

SELENIUM TEST AUTOMATION FRAMEWORK IN ON-LINE BASED APPLICATION

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ABSTRACT

Software testing is the important method to find bugs and improves the software quality. At present a lot of applications are created in web based applications that execute in a web browser. Web applications are becoming more and more complex that applications are difficult to test manually. It will increase the time and cost. Accurate results can't be provided. This can be avoided by using test automation. The objective of the paper is to make test automation for Web applications using Software testing tool, Selenium. It is a set of testing tool running with multiple browsers, operating systems and many programming languages. Selenium encloses almost all the features to automate tests and it is used to create test cases for web application.

Keywords: Test Automation, Selenium IDE, Selenium RC, Web Driver, Selenium Grid

I INTRODUCTION

Software testing is an important process of software program. It is to find an error and improve the quality. The process of testing software in a well intended and efficient way is known as software testing lifecycle (STLC). It can be divided into a number of different phases: planning, analysis, design, test execution, cycles, test closure and final test. Manual and Automation testing process is to help testing the software program application. In manual testing is tested by manually, without using any software tool. It takes more time and execution speed is slow, manual testing error can occur easily. There are distinct phases for manual testing like unit testing, integration testing, system testing and user acceptance testing. Automation testing is known as test automation. It increases the test coverage, improve accuracy and save time. Test automation is the use of testing tool and reduces the manual task. Automation testing is more reliable, faster than manual work and numbers of resources for task are reduced. It can reuse tests on different versions of an application and run more tests in less time. Many automation testing tools are available in the market. There are many things to be considered for selecting the testing tool. It is ease of integration, compatible with the design & implementation of the application, performance of tests and maintenance. These are all offered in an automation testing tool selenium. It is not a single tool but it's having set of different software tools like IDE, Remote control, web driver, grid. Selenium is tremendous software testing for web application.

1.1 Advantages

- The code for the same object can be used across different applications. At every level duplication of the work is minimized.
- The scripts will be of uniform quality since they make use of the same code.
- In automated testing, tests perform the same steps are executed at every time but in manual testing tester make many mistakes.
- Simple modifications to the application can be easily handled in the code.
- Test cases are stored and maintained, if any error occurs, we can easily check that error.

II TECHNICAL OVERVIEW

2.1 Web Testing

Web testing is completely focused on web based applications. This testing is to help reduce the efforts required to test the web applications, minimize the cost, increase software quality and used to reuse the test cases. There are different web testing are available like functional testing, compatibility testing, load testing, regression testing and performance testing.

- *Functional Testing:* It is a software testing process, which is used to test the functionality of the application. It will check the validations on all fields; verify page redirection, business logic & calculation.
- *Compatibility Testing:* Web based applications are tested on different browsers. It makes sure that the application will be reliable on all browsers. Applications are compatible with different devices like mobile, notebook etc,
- *Performance Testing:* The performances of web based applications are tested. It is the process of determining the speed of computer, software program and scalability & reliability. Load and stress tests are one of the performance test types.
- *Load Testing:* Load testing is the testing with the target of determining how well the product handles competition for system resources. It will be in the form of network traffic, CPU utilization or memory allocation. For example; multiple applications are running on a computer concurrently.
- *Stress Testing:* This test is conducted to calculate the behavior when the system is pushed away from the breaking point. It is to determine, if the system manages to recover gracefully.

2.2 Web Automation Testing

Manual testing is difficult to test the high competitive websites and web applications. It will be avoided for using web automation testing. It provides the ability to reuse, tests multiple browsers, platforms & programming languages.

Features:

- It saves time
- Minimize the cost
- Improves accuracy
- Less effort and get more results

III SELENIUM SUITE

Selenium was created by Jason Huggins working in Thought Works in 2004. He was working on a web application that required regular testing. He realized that manual testing replication was becoming more and more inefficient; he created a JavaScript program that would automatically control the browser's action. He named this program JavaScriptTestRunner. Afterward he completed this JavaScriptRunner open source which was later re-named as Selenium Core. Selenium is an open source browser automation tool, commonly used for testing the web applications. It automates the control of a web browser so that cyclic tasks can be automated. Selenium is a set of testing tools, working with multiple browsers, operating systems and writing tests in different languages like C#, java, Ruby and Python.

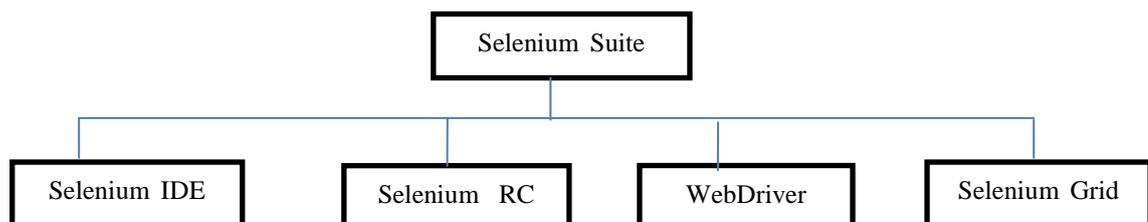


Fig 1: Selenium Suite

Selenium is a suite of four components. First is Selenium IDE, which is an extension for Firefox that allows users to record and playback tests. Second element is Selenium RC which is a server written in java. It accepts commands for the browser via HTTP. Third element is Selenium Webdriver which provides APIs in variety of languages to allow more control and the application of standard software development practices. Finally Selenium Grid, it is possible to use the Selenium APIs to control browser instances distributed over a grid of machines. It allowing more tests to run in parallel.

3.1 Selenium IDE

Selenium IDE (Integrated Development Environment) is a tool to develop Selenium test cases. Selenium IDE was originally created by Shinya Kasatani and donated to Selenium project in 2006. It is implemented as a Firefox Plug-in that allows recording, editing and debugging the selenium test cases. Selenium name comes from Selenium Recorder. On start-up of the Firefox, the recording option is automatically turned on. This option allows user to record any action done inside the web page. In Selenium IDE scripts are recorded in Selenese, a special test scripting language which is a set of Selenium commands. It is used to test web application. Actions, Accessors, Assertions are the classification of selenium.

3.1.1 Architecture of IDE

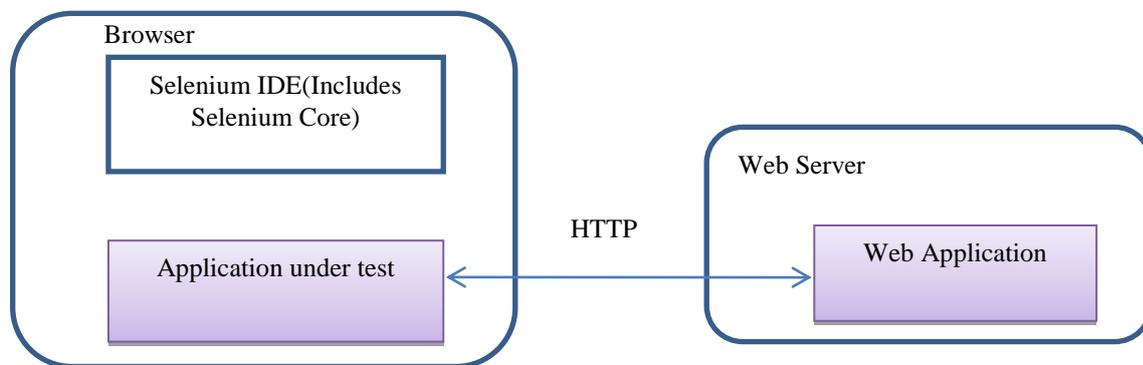


Fig 2: Architecture of IDE

3.1.2 Features

- It is simple and easy record and playback.
- Selenium Ide supports intellectual field selection options like ID's, XPath and Names.
- It saves test scripts in several formats like Selenese, Ruby etc.
- Ide allow to customization through plug-ins.
- Selenium Ide having an option for adding different asserts options in scripts.
- It allows setting breakpoints and debugging the scripts.
- It also supports auto complete commands.

3.1.3 Limitations

- Selenium IDE works only in Mozilla Firefox and it cannot be used with other browsers.
- There is no option to verify images.
- It can execute scripts created in selenese only.
- It is difficult for checking complex test cases involving dynamic contents.

3.2 Selenium RC

To overcome the Selenium IDE limitations, ThoughtWork's engineer Paul Hammant decided to create a server that will act as HTTP proxy to "trick" the browser into believing that Selenium Core and the web application being tested come from the same domain. This system known as Selenium Remote Control. It is possible to run tests inside every JavaScript compatible browser using a wide range of programming language. Selenium RC has two components

Selenium RC has two parts:

Selenium Server: It uses Selenium core and browser's built-in JavaScript interpreter to process selenium commands (such as click, type) and report back results.

Selenium Client Libraries: Client libraries are the API's for the programming languages to communicate with Selenium server.

3.2.1 Architecture of RC

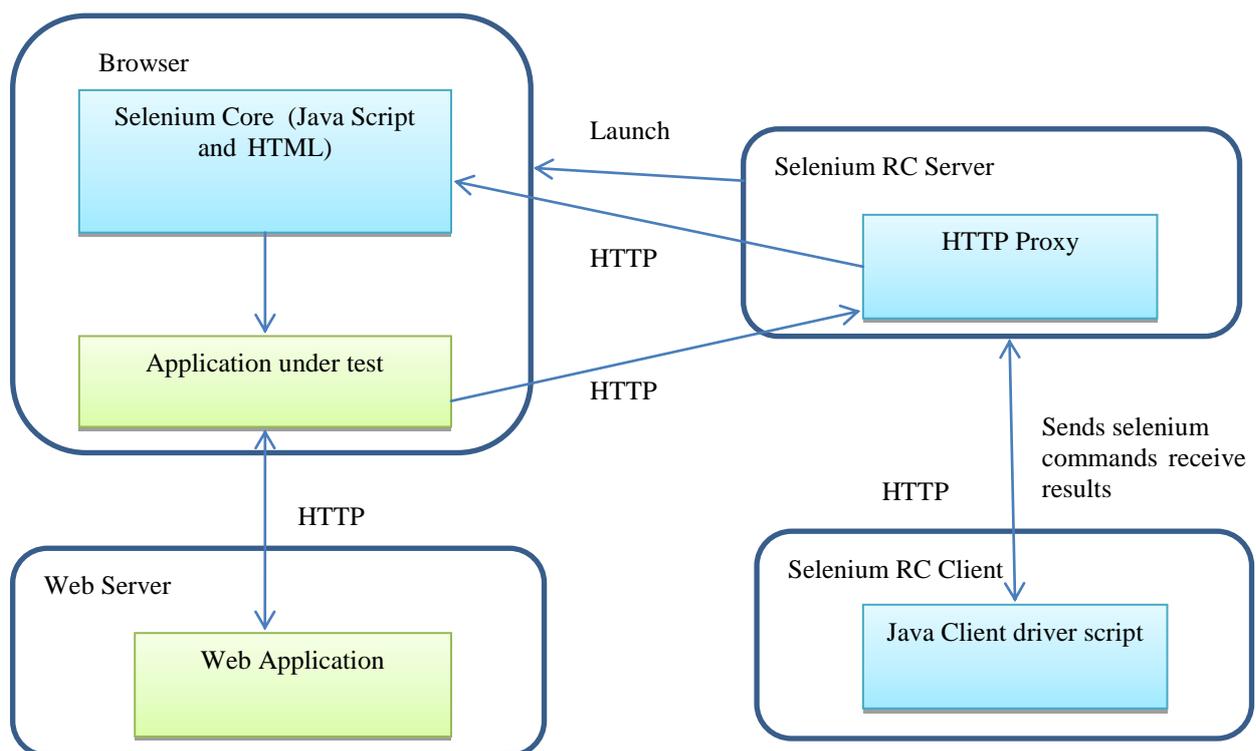


Fig 3: Architecture of RC

3.2.2 Features

- It faster execution speed than IDE.
- Cross browser and cross platform
- Have matured and complete API

- It can readily support new browsers
- Selenium can run tests automatically as many times as you want
- Selenium can support data driven testing
- It allows the user to use programming language.

3.2.3 Limitations

- Selenium RC is slow.
- It has limited features of drag and drop of objects
- It struggles when running concurrent tests.
- It does not allow simultaneously tests across different OS and browsers.

3.3 Selenium WebDriver

Simon Stewart created WebDriver 2006 when browsers and web applications were becoming more powerful and more restrictive with JavaScript programs like Selenium Core. It was the first cross platform testing framework that could control the browser. To provide a simpler, more concise programming interface. It supports dynamic web pages where elements of a page may change without the page itself being reloaded. WebDriver is the name of the key interface against which tests should be written in Java. Selenium Web Driver is the successor to Selenium RC. It does not need a special server to execute tests. It directly starts a browser instance and controls it. Selenium Grid can be used with Web Driver to execute tests on remote systems.

3.3.1 Architecture of WebDriver



Fig 4: Architecture of WebDriver

Selenium WebDriver makes directly calls to the browser using each browser's native support for automation. There are so many browsers and many programming languages there is need for common specification provided by WebDriver API. Remote Webdriver means each browser has to implement this API. Language bindings will send the commands to the common driver API, on the other end there is going to be a driver listening to those commands and they will be executed in browser using remote WebDriver and it's going to return the result/response via API to the code/Binding. WebDriver API that communicates with the use a common wire protocol which is named as JSON Wired Protocol which is a RESTFUL webservice using JSON over HTTP.

3.3.2 Features

- It allows you to execute the tests against different browsers.
- Use a programming language of your own choice for creating test scripts
- This architecture is simpler than Selenium RC's architecture.
- It directly run with the browser by using the browser's own engine to control it.
- Support the headless HtmlUnit browser.

3.3.3 Limitations

- Selenium WebDriver cannot support new browsers because it operates on the OS level and also different browsers communicate differently with the Operating System.
- Built-in commands are not available.

3.4 Selenium GRID

A test of different machines against different browsers in parallel can be run by using Selenium Grid. It runs on multiple tests at the same time against different machines running different browsers and operating systems. Selenium Grid support distributed test execution. It is a server that allows tests to use web browser instances running on remote machines. One server acts as the Hub. Tests contact the hub to obtain access to browser instances. The hub offers list of servers that provide access to browser instances, and let's tests use of these instances. The tests will run parallel on multiple machines, and to manage different browser versions. Selenium Grid has 2 versions - the older Grid 1 and the newer Grid 2.



Selenium Grid uses a hub-node concept. It only run the test on a single machine called a hub, but the execution will be done by different machines called nodes.

3.4.1 Features

- It can be extended by distributing tests on a number of machines. Executions can be done parallel.
- It manages multiple environments from a central point and make test to run easily against a huge combination of browsers as well as Operating System.
- Maintenance time will be reduced for the grid by allowing you to implement regular hooks to influence virtual infrastructure for instance.

3.4.2 Limitations

- Selenium grid by itself cannot run multiple tests in parallel, the framework like TestNG or JUnit are used to provide multiple tests to the grid

IV RELATED WORK

[2] This paper described the drawbacks in Selenium IDE tools, and find out the problems and implement them in selenium. In case testing team uses Selenium IDE only as test automation tool the functionality cannot be tested on all browsers, For that we has used Selenium IDE with Web Driver because Selenium Web Driver compatible with all browsers .So, that Integrating Selenium IDE and web driver in one single package so that recorded tests on IDE can be run as web driver tests from single UI. In this paper we had described the running and recording testing scripts in Selenium IDE with others browser like IE, Chrome and it can only possible with web driver and it's also improved functionality of browsers.

[5] In this paper we have discuss about selenium framework. Selenium is a web automation framework which uses different platform and framework according to the programming language that is used by programmer. Selenium is a set of testing tools and all have different features which are useful for developer. Selenium IDE is use for record and playback as well as for those developers who are new in developing side can also use easily for their work. Developers who are good in programming language can use selenium RC or WebDriver. To run selenium tests parallel one can use selenium grid. Choosing the proper framework one can save time as well as money and can improve software quality.

[7] This paper introduced a new automation framework integrated by selenium and Jmeter. This automation framework shares the test steps and test data which is convenient to switch in various types of testing for web application. It supports multiple browser and operating System. With use of this software framework one can efficiently improve the extensibility and reusability of automation test.

V CONCLUSION

In this paper discuss about selenium framework. The main benefit of using automated tools is to avoid manual effort. Selenium is a web based automation framework which uses different platform and programming languages. These features are record and playback and run in parallel tests. It can reduce the time and provide free software and easier for developers and programmers. Future enhancements are selenium is to test window based application. So nowadays selenium is the best available tool for web applications.

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CLUSTERING PERFORMANCE IN SENTENCE USING FUZZY RELATIONAL CLUSTERING ALGORITHM

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ABSTRACT

Data Mining is defined as extracting the information from the huge set of data. Clustering is the process of grouping or aggregating of data items. Sentence clustering mainly used in variety of applications such as classify and categorization of documents, automatic summary generation, organizing the documents. In comparison with hard clustering methods, in which a pattern belongs to a single cluster, fuzzy clustering algorithms allow patterns to belong to all clusters with differing degrees of membership. This is important in domains such as sentence clustering, since a sentence is likely to be related to more than one theme or topic present within a document or set of documents. Size of the clusters may change from one cluster to another. The traditional clustering (hard clustering) algorithms have some problems in clustering the input dataset. The problems are instability of clusters, complexity and sensitivity. To overcome the drawbacks of these clustering algorithms, this paper proposes an algorithm called Fuzzy Relational Eigenvector Centrality-based Clustering Algorithm (FRECCA) which is used for the clustering of sentences. Contents present in text documents contain hierarchical structure and there are many terms present in the documents which are related to more than one theme hence FRECCA will be useful algorithm for natural language documents.

Keywords - Data mining, FRECCA, Fuzzy clustering, Hard clustering, Sentence level clustering.

1. INTRODUCTION

Data mining is the practice of automatically searching large stores of data to discover patterns [5] and trends that go beyond simple analysis. Data mining is also known as Knowledge discovery in data. It is the extraction of hidden predictive information from large databases, is a powerful new technology with great potential to help companies focus on the most important information in their data warehouses. Data mining is accomplished by building models. A model performs some actions on data based on some algorithm. The notion of automatic discovery refers to the execution of data mining models. Data mining techniques can be divided into supervised or unsupervised. Clustering is one of the unsupervised techniques. Clustering is the process of grouping a set of objects in such a way that object in the same group are more similar to each other than those in other cluster

.Each group, called cluster, consists of objects that are similar between themselves and dissimilar to objects of other groups .Clustering has become an increasingly important topic with the explosion of information available via the Internet. It is an important tool in text mining and knowledge discovery. Representing data by fewer clusters necessarily loses certain fine details, but achieves simplification. It represents many data objects by few clusters, and hence, it models data by its clusters.

There are several algorithms available for clustering. Each algorithm will cluster or group similar data objects in a useful way. This task involves dividing the data into various groups called clusters. The application of clustering includes Bioinformatics, Business modelling, image processing etc. In general, the text mining process focuses on the statistical study of terms or phrases which helps us to understand the significance of a word within a document. Even if the two words didn't have similar meanings, clustering will takes place. Clustering can be considered the most important unsupervised learning framework, a cluster is declared as a group of data items, which are "similar" between them and are "dissimilar" to the objects belonging to other clusters. Sentence Clustering mainly used in variety of text mining applications. Output of clustering should be related to the query, which is specified by the user.

Similarity between the sentences [2] is measured in terms of some distance function; such functions are Euclidean distance or Manhattan distance. The choice of the measure is based on our requirement that induces the cluster size and formulates the success of a clustering algorithm on the specific application domain. Current sentence clustering methods usually represent sentences as a term document matrix and perform clustering algorithm on it. Although these clustering methods can group the documents satisfactorily, it is still hard for people to capture the meanings of the documents since there is no satisfactory interpretation for document cluster.

Similarity measure, which is generally defined on the attributes of a data set, has a major impact on clustering results and it must be selected according to the clustering needs. Moreover, not every similarity measure can be used with every clustering algorithm. For instance, similarity metrics that are only defined between data objects cannot be used with algorithms that define pseudo points in the data space during the clustering process, such as k-means [13]. Nowadays, large amount of data is available in the form of texts. It is very difficult for human beings to manually find out useful and significant data. This problem can be solved with the help of text summarization algorithms.

Text Summarization is the process of condensing the input text file into shorter version by preserving its overall content and meaning. This paper is about called text summarization using natural language processing. The raw, unlabeled data from the large volume of dataset can be classified initially in an unsupervised fashion by clustering the assignment of a set of observations [9] into clusters so that observations in the same cluster may be in some sense be treated similar. The outcome of the clustering process and efficiency of its domain application is generally determined by algorithms. There are different algorithms which are used to solve this problem. The proposal describes a system, which consists of two steps. In first step, they are implementing the phases of natural language processing that are splitting, tokenization, and part of speech tagging, and parsing. In

second step, they are implementing Expectation Maximization (EM) Clustering Algorithm to find out sentence similarity between the sentences. This is important in domains such as sentence clustering, since a sentence is likely to be related to more than one theme or topic present within a document or set of documents.

II BASIC CONCEPTS AND DEFINITIONS

2.1 Cluster Analysis

There are several algorithms available for clustering. Each algorithm will cluster or group similar data objects in a useful way. This task involves dividing the data into various groups called clusters. The application of clustering includes Bioinformatics, Business modeling, image processing etc. In general, the text mining process focuses on the statistical study of terms or phrases which helps us to understand the significance of a word within a document. Even if the two words didn't have similar meanings, clustering will take place. Clustering can be considered the most important unsupervised learning framework, a cluster is declared as a group of data items, which are "similar" between them and are "dissimilar" to the objects belonging to other clusters. Sentence Clustering mainly used in variety of text mining applications. Output of clustering should be related to the query, which is specified by the user.

2.2 Similarity Measure

Similarity between the sentences [7] is measured in terms of some distance function such functions are Euclidean distance or Manhattan distance. The choice of the measure is based on our requirement that induces the cluster size and formulates the success of a clustering algorithm on the specific application domain. Current sentence clustering methods usually represent sentences as a term document matrix [6] and perform clustering algorithm on it. Although these clustering methods can group the documents satisfactorily, it is still hard for people to capture the meanings of the documents since there is no satisfactory interpretation for each document cluster. Based on the similarity or dissimilarity values of clustering performance will take place.

2.3 Hierarchical clustering

Hierarchical clustering outputs a hierarchy, a structure that is more informative than the unstructured set of clusters returned by flat clustering. Hierarchical clustering does not require us to pre specify the number of clusters and most hierarchical algorithms that have been used in Information Retrieval (IR) are deterministic. These advantages of hierarchical clustering come at the cost of lower efficiency.

III RELATED WORKS AND EXISTING ALGORITHMS

3.1 K-Means Algorithm

k- Means [13] is one of the partitioning based clustering methods. The partitioning methods generally result in asset of M clusters, each object belonging to one cluster. Each cluster may be represented by a centroid or a cluster representative; this is some sort of summary description of all the objects contained in a cluster. In k-means case a cluster is represented by its centroid, which is a mean (usually weighted average) of points within a cluster. Each point is assigned to the cluster with the closest centroid Number of clusters, K, must be specified.

This obviously does not work well with a categorical attributes, it has the good geometric and statistical sense for numerical attributes. K-means [13] has problems when clusters are of differing Sizes, Densities, Non-globular shapes and K-means has problems when the data contains outliers.

3.2 K-Medoids Algorithm

When medoids [10] are selected, clusters are defined as subsets of points close to respective medoids, and the objective function is defined as the averaged distance or another dissimilarity measure between a point and its medoid. K-medoid [10] is the most appropriate data point within a cluster that represents it. Representation by k-medoids has two advantages. First, it presents no limitations on attributes types, and, second, the choice of medoids is dictated by the location of a predominant fraction of points inside a cluster and, therefore, it is lesser sensitive to the presence of outliers. Like k-Means, methods based on *k*-Medoids [10] are highly sensitive to the initial (random) selection of centroid, and in practice it is often necessary to run the algorithm several times from different initializations. To overcome these problems, the Affinity Propagation, a technique which simultaneously considers all data points as potential centroid (or exemplars). Treating each data point as a node in a network, Affinity Propagation recursively transmits real-valued messages along the edges of the network until a good set of exemplars (and corresponding clusters) emerges. These messages are then updated using simple formulas that minimize an energy function based on a probability model.

3.3 Vector Space Model

The vector space model has been successful in IR because it is able to adequately capture much of the semantic [14] content of document-level text. This is because documents that are semantically related are likely to contain many words in common, and thus are found to be similar according to popular vector space measures such as cosine similarity [7], which are based on word co-occurrence. However, while the assumption that (semantic) similarity can be measured in terms of word co-occurrence may be valid at the document level, the assumption does not hold for small-sized text fragments such as sentences, since two sentences may be semantically related despite having few, if any, words in common. To solve this problem, a number of sentence similarity measures have recently been proposed. Rather than representing sentences in a common vector space, these measures define sentence similarity as some function of inter-sentence word-to-word similarities, where these similarities are in turn usually derived either from distributional information [14] from some corpora (corpus-based measures), or semantic information represented in external sources such as Word Net (knowledge-based measures) of computing time.

3.4 Fuzzy Algorithm

The fuzzy set [15], first proposed by Zadeh in 1965, is an extension to allow $\pi(x)$ to be a function (called membership function) assuming values in the interval [0,1]. Traditional clustering [8] approaches generate partitions; in a partition, each pattern belongs to one and only one cluster. Hence, the clusters in a hard clustering are disjoint. Fuzzy clustering [15] extends this notion to associate each pattern [5] with every cluster using a membership function. The output of such algorithms is a clustering, but not a partition.

3.5 Fuzzy C Means

Ruspini [11] introduced a fuzzy c-partition $p = (p_1, p_2, \dots, p_c)$ by the extension to allow $p_i(x)$ to be functions assuming values in the interval $(0, 1)$ such that $p_1(x) + \dots + p_c(x) = 1$ since he first applied the fuzzy set in cluster. In fuzzy object data clustering, on the other hand, the problem of classifying N objects into C types is typically solved by, first, finding C prototypes, which best represent the characteristics of as many groups of objects, and then building a cluster around each such prototype, by assigning each object a membership degree that is as much higher as greater its similarity degree with the prototype is. A prototype may be either a cluster centre, or the most centrally located [12] object in a cluster, or a probability distribution, etc., depending on the type of available data and the specific algorithm adopted. It should be noted that the knowledge of prototypes, which are a condensed representation of the key characteristics of the corresponding clusters, is also an important factor. Here the distance calculations for stable clusters in the iterative process, when the number of proceeding iterations increases the cluster center number will also increases. In the FCM algorithm, a data item may belong to more than one cluster with different degrees of membership. To analyzed a several popular robust clustering methods [16] and established the connection between fuzzy set [15] theory and robust statistics. The rough based fuzzy c-means [3] algorithm to arbitrary (non-Euclidean) dissimilarity data. The fuzzy relational data clustering algorithm can handle datasets containing outliers and can deal with all kinds of relational data. Parameters such as the fuzzification degree greatly affect the performance of FCM [12].

IV PROPOSED ALGORITHM

In this work, we analyze how one can take advantage of the efficiency and stability of clusters, when the data to be clustered are available in the form of similarity [2] relationships between pairs of objects. More precisely, we propose a new fuzzy relational clustering algorithm [1], based on the existing fuzzy C-means (FCM) algorithm, which does not require any restriction on the relation matrix. FRECCA will give the output as clusters which are grouped from text data which is present in a given documents. In this FRECCA algorithm, Page Rank algorithm is used as similarity [2] measure.

4.1 Page Rank

We describe the application of the algorithm to data sets, and show that our algorithm performs better than other fuzzy clustering algorithms. In the proposed algorithm, we describe the use of Page Rank [1] and use the Gaussian mixture model approach. Page Rank is used as a graph centrality measure. Page Rank algorithm is used to determine the importance of a particular node within a graph. Importance of node is used as a measure of centrality. This algorithm assigns numerical score (from 0 to 1) to every node in graph. This score is known as Page Rank Score. Sentence is represented by node on a graph and edges are weighted with value representing similarity [4] between sentences. Page Rank can be used within the Expectation- Maximization algorithm to optimize the parameter values and to formulate the clusters. A graph representation of data objects is used in along with the Page Rank algorithm. It operates within an Expectation-Maximization; it is a framework which is a general purpose method for learning knowledge from the incomplete data. Each sentence in a document is represented by a node in the directed graph and the objects with weights indicate the object similarity [4].

4.2 EM Algorithm

It is an unsupervised method, which does not need any training phase; it tries to find the parameters of the probability distribution that has the maximum likelihood of its parameters. Its main role is to parameter estimation. It is an iterative method, which is mainly used to finding the maximum likelihood parameters of the model. The E-step involves the computation of cluster membership probabilities. The probabilities calculated from E-step are re estimated with the parameters in M-step.

4.3 Fuzzy Relational Clustering – FRECCA

A fuzzy [15] relational clustering approach is used to produce clusters with sentences, where each of them corresponds to some content. The output of clustering indicates the strength of the association among the data elements. Andrew Skabar and Khaled Abdalgader [1] proposed a novel fuzzy relational clustering algorithm called FRECCA (Fuzzy Relational Eigen Vector Centrality based Clustering Algorithm). The algorithm involves the following steps. Unlike Gaussian mixture models, which use a likelihood function parameterized by the means and covariance of the mixture components, the algorithm uses the Page Rank score of an object within a cluster as a measure of its centrality to that cluster.

- **Initialization:** cluster membership values are initialized randomly, and normalized. Mixing coefficients are initialized.
- **Expectation:** Calculates the Page Rank value for each object in each cluster.
- **Maximization:** Updating the mixing coefficients based on membership values calculated in the Expectation Step.

4.4 Performance Evaluation

The performance evaluation of the proposed FRECCA clustering algorithm is based on certain performance metrics. The performance metrics used in this paper are Partition Entropy Coefficient (PE), Purity and Entropy, V-Measure, Rand Index and F-Measure. The sentence similarity measure is based on the following metrics.

- **Purity:** The fraction of the cluster size that the largest class of objects assigned to that cluster.
- **Entropy:** It is a measure of how mixed the objects within the clusters present.
- **V -measure:** It is defined as the harmonic mean of homogeneity and completeness.
- **Rand Index and F-measure:** It based on a combinatorial approach.

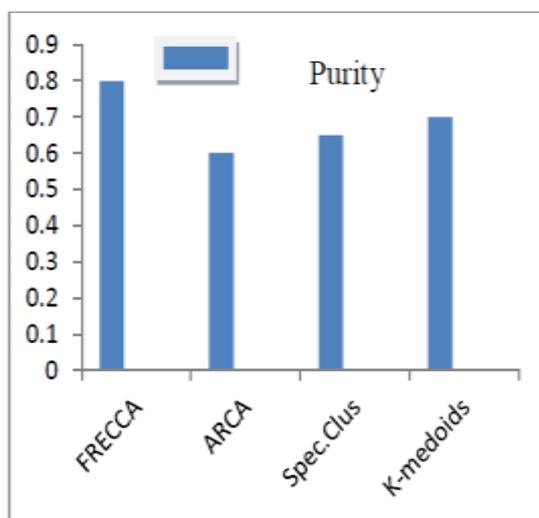
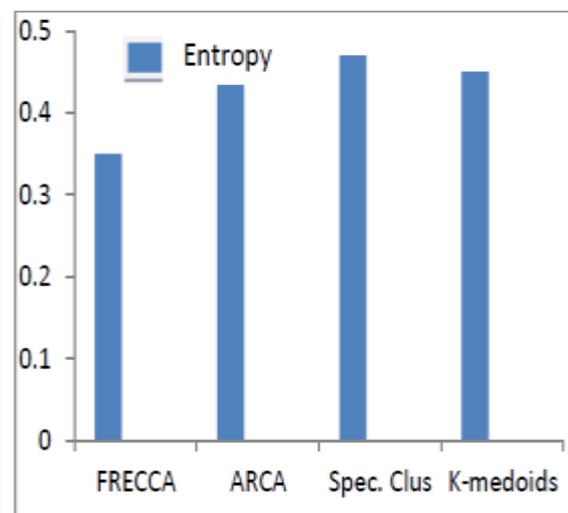
V IMPLEMENTATION AND RESULTS

In table 1, the comparison is performed out for 6 numbers of clusters. We compare the performance of FRECCA algorithm with ARCA, Spectral Clustering, and k-Medoids algorithms to the quotations data set and evaluating using the external measures. In each algorithm, the affinity matrix [6] was used and pair wise similarities also calculated for each of the method. It is to be observed that FRECCA algorithm is able to identify and avoid overlapping clusters.

Table 1: Clustering Performance

Techniques	Purity	Entropy	V-meas	Rand	F-meas
FRECCA	0.800	0.324	0.646	0.862	0.601
ARCA	0.622	0.451	0.524	0.815	0.462
Spec.Clus	0.690	0.475	0.508	0.800	0.444
Kmedoids	0.720	0.457	0.546	0.779	0.459

Figure 1 shows purity comparison and Figure 2 shows entropy comparison of various clustering algorithms.

**Fig.1: Purity Comparison****Fig.2: Entropy Comparison**

VI CONCLUSION

In this paper already reviewed numerous clustering algorithms. But it is necessary to pre assume the number of clusters for all these algorithms. Therefore, algorithm to find optimal solution is very important. By analyzing various methods it is clear that each of them have their own advantages and disadvantages. The quality of clusters depends on the particular application. When object relationship has no metric characteristics then

ARCA is a better choice. Among the different fuzzy clustering techniques FRECCA algorithm is superior to others. It is able to overcome the problems in sentence level clustering. But when time is critical factor then we cannot adopt fuzzy based approaches. A good clustering of text requires effective feature selection and a proper choice of the algorithm for the task at hand. It is observed from the above analysis that fuzzy based clustering approaches provide significant performance and better results.

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CHALLENGES OF SEDIMENTARY HAZARDS EMERGENCY RESCUE OPERATIONS UNDER EXTREME RAINFALL CONDITIONS IN MOUNTAINOUS AREAS IN TAIWAN

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ABSTRACT

A sedimentary hazard emergency rescue operation procedure in the Taihe Village Meishan Township, Chiayi County during Typhoon Morakot (August 7-9, 2009) is reviewed and studied. A questionnaire was designed and conducted to survey the firefighters who had participated in sedimentary disaster prevention education, disaster preparedness, and emergency rescue and response prior to and during Typhoon Morakot. The survey results were integrated into the case study. Results of the analysis show that problems encountered during sedimentary hazard rescues during Typhoon Morakot include: (1) the magnitude of hazard exceeded the capacity of the firefighters; (2) shortage of trained professionals; (3) shortage of rescue equipment; (4) roads destroyed in mountainous areas; (5) communications cut off during severe weather conditions; (6) recurrence of hazards; (7) difficult to rescue buried persons; (8) administrative processes were inefficient; and (9) the integration of different rescue teams was inadequate.

Keywords: *Disaster Prevention System, Typhoon Morakot, Emergency Rescue, Sedimentary Hazard.*

I. INTRODUCTION

There were 2,620 fatal landslides recorded worldwide during 2004-2010 yrs, causing a total of 32,322 recorded fatalities (Petley, 2012). Landslide has been seen as a major global hazard. Climate change increasing the potential of extreme rainfall condition may be a contribution factor to landslide (Nadim et al., 2006). In the face of multiple, compound hazards (including flood, landslides and debris flows, and breached natural dams (Chen et al., 2011)), the relief workers feel helpless. The huge landslide in Southern Leyte, Philippines in 2006 caused 139 dead with 980 missing (Orense and Sapuay, 2006; Evans et al., 2007; Catane et al. 2007; 2008; Lagmay et al., 2008). Only 20 people rescued, two eventually died, in the landslide dam breaching induced secondary hazard (Catane et al. 2007).

Taiwan is regularly struck by powerful typhoons. Since 2000, typhoons Toraji (2001), Nari (2001), Mindulle (2004), and Morakot (2009) have caused numerous sedimentary hazards such as landslides and debris flows. Between 2006 and 2010, there were 305 sedimentary hazards involving rescue operations, injuring 70 and

causing 619 deaths in Taiwan (National Fire Agency, 2014). Thirty-six of these hazards (roughly 25%), including 30 caused by Typhoon Morakot, occurred in Chiayi County in south-central Taiwan.

Typhoon Morakot made landfall on Taiwan from 7 to 9 August 2009, bringing the highest recorded rainfall in the past 50 years to southern and south-central Taiwan (Chien and Kuo, 2011). The massive rainfall caused immense damage to the natural and human landscape. A total of 9,333 landslides (2.26 km²) were interpreted from change detection analysis of satellite images (Tsai et al., 2010). Numerous sedimentary hazards occurred, resulting in injuries, road destruction, and broken bridges. At Shaolin Village in Kaohsiung County in southern Taiwan, a giant landslide dam breach caused 398 deaths and buried at least 169 buildings during Typhoon Morakot (CEOC, 2014; Tsou et al., 2011). No one was rescued in the debris masses buried area. Landslide locations and magnitudes information were urgently necessary during the rescue emergency (Zhang et al., 2010). In such large-scale landslide disaster, speed, accuracy, and the maximum appropriation resources are crucial (Lagmay et al., 2008). “A systematic and technically informed approach to search and rescue missions in large-scale landslide disaster, and the formulation of better disaster management policies are needed” (Lagmay et al., 2008).

Given the urgent need for deeper assessment of disaster procedures and processes, this study reviews the sedimentary hazard emergency rescue procedure in the Taihe area of Chiayi County in south-central Taiwan during typhoon Morakot in 2009. The purpose of this study is to learn what problems were encountered during the rescue process and to offer recommendations for ameliorating these problems. By doing so, it can make important contributions to both the literature on disaster response and to the practical needs of disaster responders.

II. SEDIMENTARY HAZARDS EMERGENCY RESCUE MEASURES

In Taiwan, the procedure for sedimentary hazard emergency rescue operations is carried out by local fire departments (Fig. 1). It includes:

1. Confirm the magnitude of sedimentary hazard and request support needed. Sedimentary hazards could be rockfalls, slips, landslides, debris flows, and riverbank erosion. Query eyewitnesses to learn how many people are buried by debris mass and their possible locations. Supporting units may include:
 - (1). Other fire departments: If the sedimentary hazard requires more manpower, firefighters and rescue equipment may be requested from other fire departments.
 - (2). Non-governmental organizations (NGO): the control center coordinates NGOs to support the rescue action.
 - (3). Military support: The Emergency Operation Center (EOC) coordinates nearby military units to support the rescue.
 - (4). Heavy machinery: The EOC requisitions private business heavy earthmoving equipment such as power shovels or bulldozers to accelerate the rescue.
 - (5). Medical staff: The EOC coordinates doctors and nurses for injuries needing emergency care.

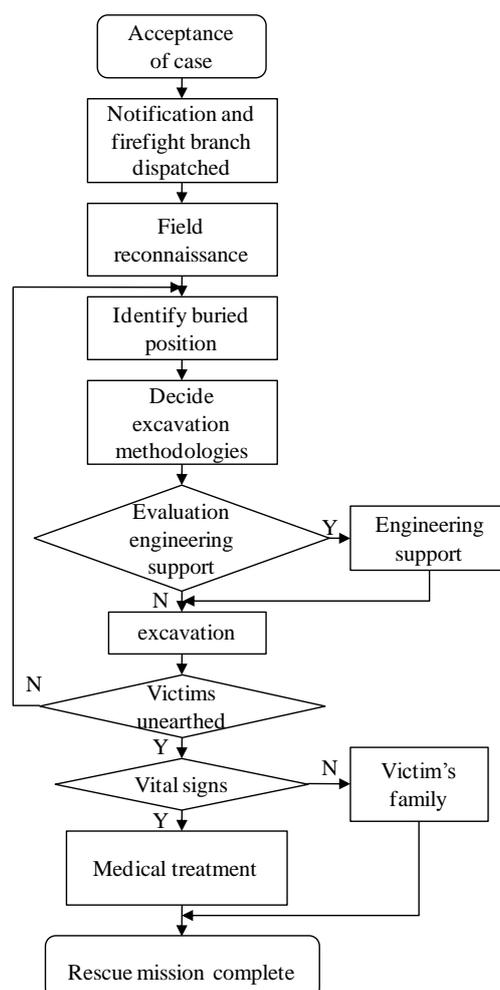


Fig. 1: Flowchart of Emergency Rescue Operation Procedure for Sedimentary Hazards (revised after Chiayi County Fire Bureau, <http://w3.cycfd.gov.tw/>)

2. Identification of possible locations of debris masses and buried people. The most direct method is by querying eyewitnesses or persons in the area. It is possible to survey locations of victims using field topography and scientific instruments.
3. Determine how to excavate. Excavation work by manual labor is required at the beginning to prevent heavy machinery from doing further injury to victims. Consent of the victim's family is necessary to permit use of heavy machinery to excavate after 72 hours have passed without manual labor resulting in rescue. Engineering support is required to prevent further collapse of debris masses. Excavation from the top of collapsed buildings downward is prohibited to prevent further hazard. The field commander is responsible for deciding on the type of excavation and for determining whether to re-survey to find the possible location of victims.
4. Emergency medical treatment: Victims will be returned to the family if they do not display vital signs. If the victims have vital signs or the family demands resuscitation attempts, the victim will be immediately taken to the hospital. The rescue action is finished at this stage.

Repeated hazards (buried building collapse or further slope slip) could occur under continued rainfall, during heavy machine excavation, or as a result of earthquake aftershocks. Firefighters are generally not professionally trained in judgment of secondary hazards and necessary engineering measures. According to the “Operating Procedures for Prevention of Repeated Debris Flow Disasters and for Recovery and Reconstruction” issued by the Soil and Water Conservation Bureau in Taiwan [15], SWCB workers and professional engineers should determine the possibility of repeated hazards at the scene. Emergency engineering measures are usually necessary to avoid repeated hazards. The procedure for the process of identification and emergency engineering is:

1. Field investigation

- (1). Hazard identification: Contact the village head to confirm the hazards and their magnitude.
- (2). Professional investigation: The SWCB is the department responsible for debris flow hazards prevention and mitigation in Taiwan. The SWCB and local government and professional engineers will investigate the hazard magnitude, the endangered area, and give professional suggestions for the safety of rescuers.
- (3). GPS orientation: using GPS to locate debris flows, landslides, and hazard spots.
- (4). Items for investigation: site location, type of disaster, affected areas, injured people, damages, magnitude (debris masses volume), estimated losses, and suggested engineering measures.

2. Emergency engineering measures and response

- (1). Emergency soil and water conservation engineering measures: SWCB and local government will perform emergency soil and water conservation engineering measures such as strengthening buildings, stabilizing slopes, and other engineering disaster prevention measures for in danger sedimentary hazard areas.
- (2). Rush to repair: Local government will make urgent repairs to blocked roads, damaged bridges, communications, and community facilities.
- (3). Temporary protection measures: Local government should perform temporary protection measures for severely damaged areas and erect warning signals.
- (4). Delineation of restrained area: local government should demarcate restricted areas to separate hazard areas and prohibit people from entering the area or ask them to leave.
- (5). Checking drainage system: SWCB and local government should check and maintain the detention, deposit, and retention ponds drainage unobstructed in the jurisdiction to prevent riverbed deposition induced floods.
- (6). Riverbed debris mass dredging: The responsible departments should dredge the debris in riverbeds to avoid further hazards.
- (7). Building reinforcement: The responsible departments should dismantle broken structures and strengthen temporary support and protection measures for damaged buildings.
- (8). Spoil and debris masses disposal: The responsible departments should establish safe deposition areas and exchange or recycling systems for landslides, road blockage, and dredged debris masses to prevent further hazards.

III. SEDIMENTARY HAZARDS EMERGENCY RESCUE PROCEDURE IN TAIHE VILLAGE

Taihe Village is located in eastern Chiayi County in south-central Taiwan (Fig. 2). From the plain to the mountainous village is two hours by car. Typhoon and torrential rainfall induced rock fall and traffic cutoff have been frequent in the area in recent years (SWCB, 2014).

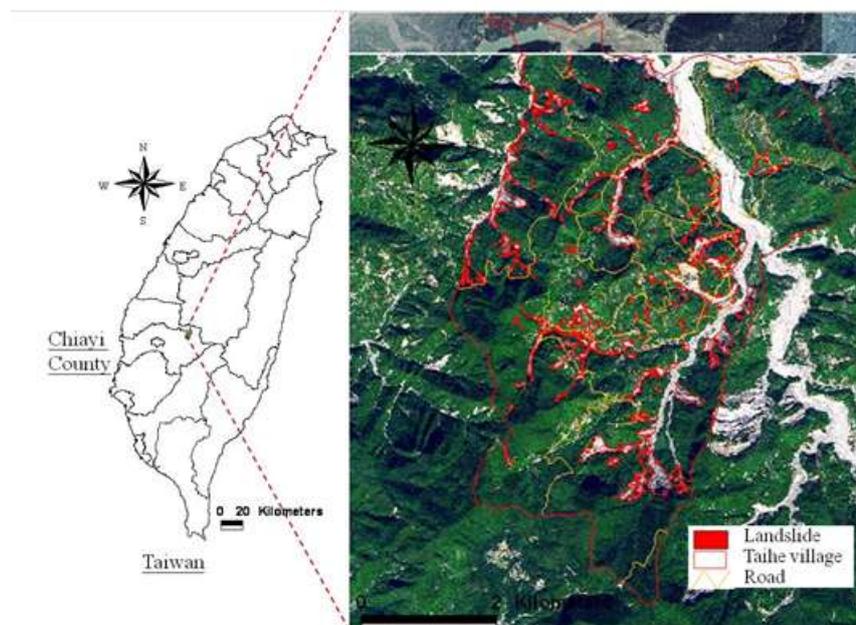


Fig. 2: Site Location and Landslides after Typhoon Morakot in the Study Area

Typhoon Morakot brought torrential rainfall of up to 1,812 mm to the Taihe area during 7-10 August 2009, equivalent to over 50% of the annual rainfall. Three potential debris flow creeks were identified by the SWCB (<http://www.swcb.gov.tw>). Morakot induced 243 landslides and debris flows with a total area of 2.75 km² interpreted from Spot 5 images in the area (Chen and Huang, 2013). Villages in the mountainous areas in Chiayi County were isolated and communications cut off by numerous landslides and debris flows caused by Morakot. Emergency rescue was initially unavailable. Finally, at 7:05 morning on 9 August the Chiayi County Fire Bureau received a report that Taihe and nearby villages' had been cut off by landslides and 4 people had been buried by debris. The Fire Bureau put together a rescue team on 9 August, first driving and then walking to the scene, but the team was unable to reach the hazard scene. Finally, the firefighters walked to the village using a historical foot track.

The severe weather also stopped helicopters bringing food and other necessities to the hazard scenes until 10 August, when three firefighters took a plane to the village. A shovel loader was hanged by the helicopter for road to rush through urgently. A rough emergency road finally enabled a team of seven firefighters, one sniffer dog and two trainees, 30 soldiers and two big excavators, to reach the area on the 26th. The excavation started in the morning of the 26th and by the following afternoon the bodies of the four victims were unearthed (Fig. 3).



Fig. 3: Sedimentary Hazards Emergency Rescue in the Taihe Village (a) Excavators Removing Debris (b) A Sniffer Dog Searching for Buried Victims (c) A Shovel Loader was Hanged by the Helicopter for Blocked Road to Rush Through Urgently (d) Relief Workers Excavate Debris Masses using Hand Tools (August of 2009, Chiayi Fire Bureau, Chiayi County)

The rescue action lasted 20 days, from 9-28 August, 2009. The Chiayi County Fire Bureau sent 223 person, 40 vehicles, and support organizations assisted with a further 189 person, 65 vehicles (Chen and Chen, 2011). In addition, there were four evacuation shelters and six public buildings available for temporary shelters in the village. Most of the shelters were damaged or cutoff by landslides (Fig. 4).





Fig. 4: Damages of the Four Temporary Shelters in the Taihe Village

IV. QUESTIONNAIRE STATISTICS ANALYSIS

A total of 255 questionnaires (overall response rate 98.5%) were returned, including 159 by leaving method (100%) and 96 by internet survey (96%). The high rate of recovery was attributed to the fact that most of the interviewees are colleagues of the author. Twelve invalid questionnaires were removed, leaving 243 effective questionnaires (effective response rate 95.3%).

The results of the descriptive statistics analysis of questionnaires were generalized into the factors of hazard prevention and mitigation, professional training, equipment related, available resources, coordination of work, and other factors. The various factors and corresponding questions were listed in [Table 1](#).

Table 1: List of Factors Affecting Firefighters on Sedimentary Hazards Emergency Rescue

Factor	Content
A. Hazard prevention and mitigation factors	<ol style="list-style-type: none"> 1. Firefighters fully understand the characteristics and dangers of sedimentary hazards. Education and emergency operations are effective. (63.8% selected agree/strongly agree) 2. The fire department should use daily education programs to strengthen resident awareness of sedimentary hazards. (75.3%) 3. Residents are not aware of sedimentary hazards. It is difficult to do disaster prevention education. (66.9% selected agree/strongly agree) 4. The fire department can go to potential sedimentary hazards to strengthen disaster prevention and mitigation after a typhoon warning is issued. (77.8% selected agree/strongly agree) 5. Firefighters should persuade and exhort residents to evacuate historical and potential sedimentary hazard areas after a typhoon warning is issued. (79.4% selected agree/strongly agree) 6. Firefighters should force local residents to evacuate high potential hazard areas to prevent life and property losses. (78.6% selected agree/strongly agree)
B. Professional training	<ol style="list-style-type: none"> 1. It is difficult to perform rescues in sedimentary hazard areas and fire departments should strengthen professional training and rescue equipment. (91.8% selected agree/strongly agree)

factor	2. The official training of firefighters is sufficient to enable them to cope with sedimentary hazards (60.5% selected disagree/strongly disagree)
C. Equipment related factor	<p>1. The vehicles and equipment of the fire department are sufficient to conduct sedimentary hazard emergency rescue action (60.9% selected disagree/strongly disagree)</p> <p>2. Firefighters can maintain vehicles, detection equipment, and stock enough fuel for emergency rescue in advance. (77.4% selected agree/strongly agree)</p> <p>3. The fire department can supply and repair vehicles, equipment, and food soon for emergency rescue. (50.7% selected disagree/strongly disagree)</p> <p>4. Emergency rescue equipment needed at the scene can be rapidly supplied. (38.3% selected disagree/strongly disagree)</p>
D. Available resources	<p>1. The fire department has established a detailed list of residents and manpower, and established emergency channels of communication. (73.3% selected agree/strongly agree)</p> <p>2. The fire department has established a detailed list of resources in the jurisdiction to requisition for emergency rescue. (83.1% selected agree/strongly agree)</p> <p>3. The fire department has established a detailed list of resources that can be contacted immediately and dispatched support for emergency rescue. (45.9% selected disagree/strongly disagree)</p> <p>4. Volunteer firefighters, volunteers, Neighborhood Rescue Team in the community, and the financial resources of the people in the jurisdiction can help in sedimentary hazards rescue. (73.3% selected agree/strongly agree)</p> <p>5. The fire department and non-governmental organizations have signed a contract to supply heavy machines for emergency rescue use. (64.2% selected agree/strongly agree)</p>
E. Coordination of work	<p>1. The fire department should cooperate with other departments to perform disaster prevention education and promotion and evacuation drills periodically. (82.7% selected agree/strongly agree)</p> <p>2. The fire departments can cooperate well with other rescue teams (military, NGOs) and coordinate the division of rescue work. (45.7% selected disagree/strongly disagree)</p> <p>3. The procedure to request support is varied and time consuming and their dispatch requires a top official to integrate. (75.3% selected agree/strongly agree)</p>
F. Other factors	<p>1. The fire department should pre-plan emergency rescue and response strategies for potential sedimentary hazards. (89.7% selected agree/strongly agree)</p> <p>2. The greater magnitude of sedimentary hazards compared to the ordinary duties of the fire department means that sedimentary hazard rescue is not mature in all aspects. (95.9% selected agree/strongly agree)</p> <p>3. The information and correction of sedimentary hazards are not clear and need verified, causing difficulties for firefighters in rescues. (89.3% selected agree/strongly agree)</p> <p>4. Firefighters' needed food and water can be supplied soon during sedimentary hazard emergency rescue. (38.3% selected agree/strongly agree)</p>

Interviewee responses were on a 1-5 scale ranging from “strongly agree” to “strongly disagree”. **Table 2** shows the aptitude trend analysis of the questionnaire. The designed middle value was 3 (no opinion) and mean values lower than 3 represent agreement with the questions while mean values greater than 3 represent disagreement.

Table 2: Statistics Analysis of Questionnaire Results from Firefighters

No. of Descriptive questions (corresponding to Table 1)	No.	Mean	Standard deviation
A1	243	2.51	1.166
A2	243	2.21	1.010
A3	242	2.33	1.073
B1	243	1.74	0.756
B2	243	3.44	1.164
E1	243	2.02	0.733
D1	243	2.25	1.024
D2	243	2.05	0.834
A4	243	2.19	0.949
A5	243	2.06	0.967
F1	243	1.91	0.647
C1	243	3.53	1.129
C2	243	2.15	0.702
C3	243	3.20	1.133
F2	243	1.62	0.654
A6	243	2.09	0.893
F3	243	1.84	0.716
E2	243	3.15	1.142
E3	243	2.08	0.892
D3	242	3.11	1.127
D4	243	2.28	0.830
D5	243	2.39	0.890
C4	240	3.09	0.972
F4	240	2.95	0.978

V. RESULTS AND SUGGESTIONS

The study reviews the emergency rescue process in Taihe Village during Typhoon Morakot using a questionnaire of firefighters. Results are summarized and listed below.

1. The magnitude of hazards exceeds the normal duties of firefighters (corresponding to F-2 in **Table 2**).

2. Lack of professional sedimentary hazard emergency rescue training (E-1)
3. Lack of sedimentary hazards emergency rescue equipment (C-1 and C-3)
4. Rescue action interrupted by communications cut off (C-1, C-3)
5. Unclear information causes rescue difficulties (F3)
5. Repeated hazards are hard to predict and increasing the risks to relief workers (A1)
6. Buried victims are hard to rescue (B1)
7. Process for requesting support is time-consuming (D5, E3)
8. Horizontal communication across different units is hard to integrate (E2)

Suggestions for resolving the aforementioned difficulties are listed below:

1. Promote professional training for relief workers

Educational units, for example, the Central Police University, the Taiwan Police College, and other practical training units should promote training in sedimentary hazard rescue. This training should include flowcharts of the rescue procedure, relief skills, information integration and transmission, equipment maintenance, coordination work with helicopters, and personnel safety.

2. Strengthen emergency rescue equipment

Rescue workers had to use hand tools to dig through the mud in order to rescue survivors. The questionnaire shows that equipment for sedimentary hazard emergency rescue are lacking. Commonly used equipment should be acquired. **Table 3** lists the suggested procurement priority.

Table 3: Suggested Equipment Acquisition Priority for Sedimentary Hazard Rescue

Types	Equipment		
	Waterproof wireless phone	Radios	3G cell phone
Rescue equipment	small shatter apparatus dynamic rope and static rope	small rock drilling machine hook and pulley sets	simple excavation tools bundle of goods or tie-downs
Power supply	small electric generators	solar battery chargers	-
Assist equipment	man-pack march tent	simple cooking equipment	-
Personal equipment	winter protection wear, hat and shoes	headlamps	waterproof gloves

3. Establishing rescue resources in potentially affected areas:

- (1). Financial resources of the people

There are three volunteer organizations under the fire department available: Volunteer Firefighters, Women's Fire Prevention Promotion Team, and Phoenix Volunteers. Other non-profit organizations, for example, Neighborhood Rescue Team, need continuous financial and training assistances.

- (2). Communication networks

Planning of available communication networks include police radio channels, satellite telephones in remote townships, and radio channels and frequencies.

(3). Relief vehicles, facilities, heavy machinery, and logistics

Periodically investigate and list other available government and non-governmental relief trucks, facilities, heavy machines, and supplies for sedimentary hazard emergency rescue.

4. Evaluation using advanced rescue equipment

It is important to plot out the landslides immediately to rescue victims urgently. Optical and microwave techniques of remote sensing were both used (Pohl and Van Genderen, 1998). Nevertheless, the severe weather in the mountainous area imposes serious technical difficulty upon remote observation at a regional scale (Zhang et al., 2010). Thermal imaging cameras and seismic listening devices were used in an attempt to locate survivors in the 1997 Thredbo landslide (Queensland Government, 2014). Ground-penetrating radar (GPR) has been used in a number of rescues in the 2006 Philippine landslide (Lagmay et al., 2008). GPR and other advanced detection equipment used in Taiwan including during Typhoon Morakot for Shaolin Village, for the No. 3 freeway 31.5k landslide on 24 April, 2010 (The Landslide Blog-AGU Blogosphere, 2014) and the Suhua Highway landslide on 23 October, 2010 (Taiwan News, 2010). The equipment was used for faster identification of the position of victims. Advanced equipment such as life detectors (Table 4) are not in common use among relief workers. Instead, their usage depends on the situation at the scene.

Table 4: Advanced Equipment for Emergency Rescue

Type	Equipment	Usage
detector	Ground-penetrating radar (GPR)	Uses reflection of radar wave to find the position of objects.
	Metal detector	Detect underground metal for possible locations of buildings, cars, or victims.
	Sonar life detector	Find the source of the victim's voice.
	Imaging devices	Flexible tube camera used in tight spaces, sonar life detector identified victim position, or boring machine drilled hole to take image of buried victims.
	Thermal imagery detector	Detect surface temperatures to find possible location of buried victims.
	Gas detector	Detect concentrations of hydrogen sulfide for indicating bodies.
	Drilling machines	Bore a hole 48-76 mm in diameter with a depth of 120 m for scene investigation.

5. Implementation of hazard inspection, reporting and notification mechanisms

Hazard notification involves firefighters, police, and non-governmental organizations. Fire departments should periodically coordinate, check connections, and update with the police and non-governmental systems. There are many police stations with radio and other wireless communications systems available in mountainous areas.

6. Establishment of disaster Incident Command System (ICS)

A standard procedure must be developed to improve how relief workers respond to natural calamities (Lagmay et al., 2008). Local government should erect a disaster ICS at the hazard scene. This command system should include a Commander, Security, Operations, Information, Communication liaisons, and Logistics officers. For large sedimentary hazards the CEOC should set up a Forward Command Center near the scene. The ICS should cooperate with the forward command center in hazard rescue.

7. Promotion of disaster response level

The National Fire Agency (<http://www.nfa.gov.tw/>) of the central government handled the CEOC emergency response, while local fire departments carried out hazard rescue during Typhoon Morakot. The multiple levels of operations led to inefficient integration and reduced efficiency during the emergency response. A professional institute for disaster prevention and mitigation and higher level control is suggested for emergency response.

8. Standardize military emergency rescue support equipment and communications

There was a limited interface between the relief workers and military during the response to the mudslide in southern Leyte in Philippines (Hall and Cular, 2010) and during the typhoon Morakot in Taiwan. Disaster prevention and emergency rescue became one of the missions of the military in Taiwan after Typhoon Morakot. The military should take the initiative in disaster rescue and pre-disposition of troops for potential affected areas according to the Disaster Prevention and Protection Act in Taiwan. Nevertheless, the training and equipment of the military are not designed for disaster prevention and rescue. An interdepartmental effort is necessary now to establish measures and procedures for future disasters.

9. Communication of sedimentary hazard emergency rescue experience

Periodic workshops for sedimentary hazard emergency rescue experience exchanges and discussions with both domestic and international rescue workers are suggested to promote emergency rescue ability.

VI. CONCLUSION

The questionnaire results show that the relief workers lack sedimentary hazard emergency rescue training and equipment. The extreme rainfall conditions in the mountainous areas interrupted rescue action by cutting off communications. Information was unclear, increasing the risks for relief workers, and the buried victims were difficult to rescue under these straitened circumstances. Requests for support from other agencies are time-consuming and horizontal communication across various units is hard to integrate during the rescue action. The proposed suggestions for solving the aforementioned difficulties include promoting professional training for relief workers, strengthening emergency rescue equipment, and establishing rescue resources prior to disasters. Evaluations using advanced equipment, implementation of hazard inspection, reporting and notification mechanisms during the rescue are also suggested. A disaster incident command system, promotion of the disaster response level of the EOC, standardized military emergency rescue equipment and communications are needed as well. Finally emergency rescue efficiency can be enhanced by workshops for sharing the sedimentary hazard emergency rescue experience.

VII. ACKNOWLEDGEMENTS

This work was supported in part by Ministry of Science and Technology in Taiwan in contract No. NSC 102-2221-E-415-008-MY3.

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DESIGN AND ANALYSIS OF I²C BASED DATA TRANSMITTER AND RECEIVER

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ABSTRACT

As technology scales, the physical size of the Integrated Circuit(IC) is reduced by means of reducing the transistor count and Input Output (I/O) pins. In order to minimize the I/O pins the interconnect delays will be reduced internally. In major applications the integrated circuits plays a major role because it control faster devices to communicate with slower devices and also allow devices to communicate with each other over a serial data bus without data loss. Hence to allow serial communication and to reduce the interconnect delays the I²C (Inter-Integrated Circuit) protocol is considered. The I²C controller provides support for a communication link between integrated circuits and memory units on a board. I²C is a two wire, bidirectional serial bus that provides effective data communication between two devices. I²C bus supports many devices and each device is recognized by its unique address. Secure Digital is the most widely used portable memory standard. Its ultra-compact and rugged architecture, simple interface, high security, low power consumption and reliable operation. This module was designed in Verilog HDL and synthesized using Xilinx ISE Design Suite 13.2.

Keywords: *Inter-Integrated Circuit, Finite State Machine, Serial Data, Serial Clock, FPGA, Verilog.*

I. INTRODUCTION

The physical size and power requirement of IC get reduce over the years. The main reason for that is more number of transistors can be integrated into smaller size and less number of interconnections wire present in between ICs can possible. The actual circuitry of the IC is much smaller than the packaging of the IC but it requires larger area to cover because of interconnection wire present in between ICs. These wire requirements can be reduce by using I²C that is Inter-Integrated circuit bus. This communication has a special protocol assigned to it which is I²C Protocol. I²C bus physically consists of two active wires and a ground connection. The two active wires namely Serial Clock(SCL) and Serial Data (SDA). These wires are bidirectional half duplex in natures which carry information between the devices connected to the bus. Each device is acknowledge by a unique address whether it is a microcontroller, LCD driver, memory or keyboard interface and can operate as either a transmitter or receiver, depending on the function of the device. In I²C bus devices can easily added or removed which is very useful for

low maintenance and control application in embedded system. There are many reasons for using serial interface design much more important application includes serial communication like sensors communication with personal computer. Many common embedded system peripherals, such as analog-to-digital and digital-to-analog convertors, LCDs, and temperature sensors, support serial interfaces. The objective of this project is to design and analyse the data transmitter and receiver by using an I²C bus protocol by using Verilog hardware description language and synthesis by the software Xilinx.

II. NEED FOR I²C BUS

The on-chip RAM (EEPROM), Oscillator (RTC), ADC and I²C Interface will be integrated for the purpose to Communicate between them. The presence of a RTC and an on-chip RAM introduces an immediate need for a data communication between the chip and a host computer to send data on the RAM. To minimize the system-level interconnect, the contents of the RAM storing the results back to a host computer via a serial bus, the I²C Interface. This greatly simplifies the system level design and in particular the design of the mother-board and associated chip-boards. Moreover, storing data in a digital format on-chip before transmittal to a host computer over the I²C Interface will result in an improved system performance since the transmission of digital data is much less susceptible to interference from environmental noise sources.

2.1. Design goals

The following goals were considered during this design:

- I²C bus speeds of 100kbits/sec and 400kbits/sec
- I²C 7-bit addressing
- Multiple I²C masters on one I²C bus
- Up to 256-byte I²C transactions
- Compatible with any number of slaves

2.2. I²C features

- Only two bus lines are required: a serial data line (SDA) and a serial clock line (SCL).
- Each device connected to the bus is software addressable by a unique address and simple master/slave relationships exist at all times masters can operate as master-transmitters or as master-receivers.
- It's a true multi-master bus including collision detection and arbitration to prevent data corruption if two or more masters simultaneously initiate data transfer.
- Serial, 8-bit oriented, bi-directional data transfers can be made at up to 100 bit/s in the Standard-mode, up to 400 kbps in the Fast-mode, or up to 3.4Mbps in the High-speed mode

III. I²C BUS PROTOCOL

The interconnect integrated circuit bus commonly known as the I²C bus which is a bi-directional, two-wire and

serial communication standard protocol. It is designed primarily for simple but efficient integrated circuit (IC) control.

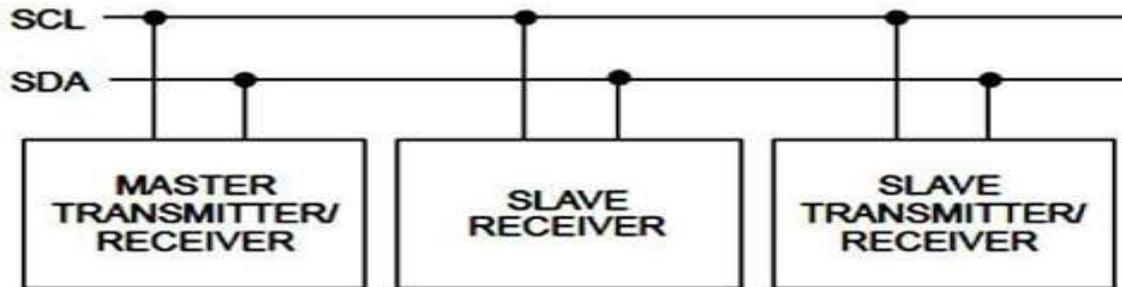


Fig. 1 I²C Bus Configuration

The system is comprised of two bus lines, SCL (Serial Clock) and SDA (Serial Data) that carry information between the ICs connected to them. Various communication configurations may be designed using this bus however this application discusses only the Master-Slave system implementation.

3.1. START CONDITION

The master initiates a data transfer by issuing a START condition, which is a high to low transition on the SDA line while the SCL line is high as shown in Figure 2. The bus is considered to be busy after the START condition. After the START condition, a slave address is sent out on the bus by the master. This address is 7 bits long followed by an eight bit which is a data direction bit (R/~W) where a '0' indicates a write from the master to the slave and a '1' indicates a read from the slave to the master.

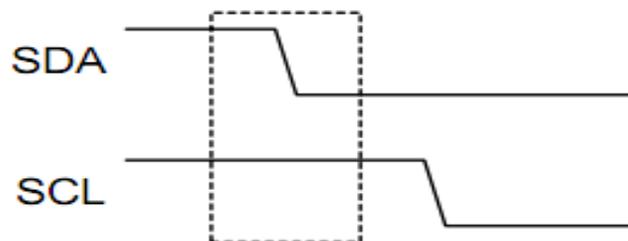


Fig. 2 START Condition

The master is controlling the SCL line, will send out the bits on the SDA line, one bit per clock cycle of the SCL line, with the most significant bit sent out first. The value on the SDA line can be changed only when the SCL line is at low.

3.2. STOP CONDITION

The START condition happens when the SDA line changes from a high to a low while the SCL line is at a high. The STOP condition happens when the SDA line changes from a low to a high while the SCL line is high. These are the

only two situations where the SDA lines can changes when SCL is at high.

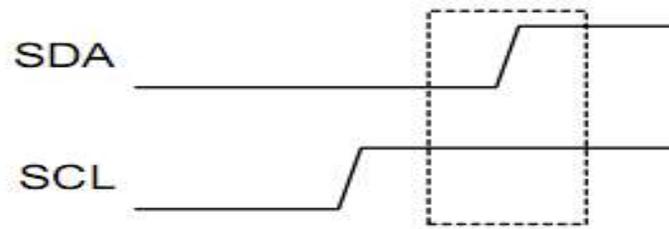


Fig. 3 START Condition

IV. I²C PROPOSED

4.1. Master Implementation

I²C Master is composed of a Slave and some additional components. The I²C Master is connected to a controller from which it receives destination address, control signals and data. A Master must have the ability to create the I²C Serial Clock, START and STOP signals. It also has to keep track of the number of transferred bytes to determine an appropriate time to stop a data transfer. Based on the above characteristics a shortcut was used to take advantage of the already created Slave. There are two types of devices on the I²C bus, Master and Slave.

A Slave cannot initiate a data transfer. It just monitors the SDA and SCL lines waiting for a START signal. After detecting a START signal, the Slave will compare its address to the address received. If the addresses match, it will perform an action requested by Master by either sending or receiving data.

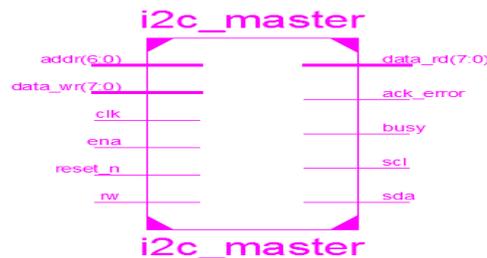


Fig. 4 Master Logic

4.1.1. Finite State Machine

The Finite State Machine (FSM) is the most important component in the design of the Master to accommodate this requirement; both Master and Slave Microcontroller are slightly changed from its original designs. In the transferring mode (Master sends data to Slave), the FSM gets number of bytes from the Microcontroller before releasing a Start condition. But in the receiving mode, the FSM gets the number of RAM locations in the first byte received from Slave. After that it holds the SCL line low to freeze the communication, sending number of locations back to controller. Controller will manipulate the number of locations to get number of bits and send it back to Master.

4.1.2. Shift Register

The Shift Register is used for parallel-to-serial and serial-to-parallel conversion. It is an 8-bit Shift Register with serial or parallel load select. In the receiving mode, the Shift Register samples data on the SDA line at the rising edge of the SCL signal and shifts the received bit to the left. After getting the whole byte, the data will be parallel loaded to the RAM. In the transmitting mode, the Shift Register is loaded with parallel data from the RAM first and then the data will be shifted to the left to transfer each bit to a receiver on the negative edge of the SCL signal.

4.1.3 Clock Generator

The I²C Master will be downloaded to a Spartan 3E board, which operates at a frequency of 50MHz. In order to create an approximately 100 KHz SCL signal, we need to divide the board clock signal by 512 times, the I²C Master only changes the SDA signal when the SCL line is low, or equivalently, the Master can change SDA line signal at negative edge of SCL signal. Hence, before negative edges of SCL, the circuit conditions, based on which the Master makes its decisions, must be stable and valid. For this reason, the signal in addition to sclout1 called sclout1_delay. This signal is used as the operating clock signal for the 32-bit counter inside the FSM. In order to create this signal, in addition to the Clock_Div_512 module, we need a Clock_Div_256 module and a 1-bit register. This clock signal is delayed for 1/4 T_{sclout1} compared to sclout1 and used as an input for the Finite State Machine.

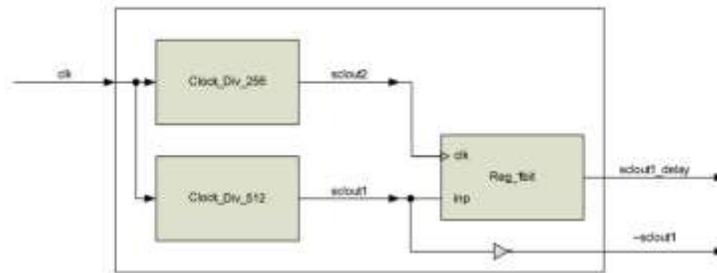


Fig. 5 Clock Generator

V. SIMULATION AND ANALYSIS

5.1. Write state



Fig.6 Simulation Result for Write State

The above simulation output gives the detail picture of data can be write in to the memory address 00010110 and after that slave responds as acknowledge that data is received.

i2c_master Project Status			
Project File:	net.xise	Parser Errors:	No Errors
Module Name:	i2c_master	Implementation State:	Synthesized
Target Device:	xc3s250e-4tq144	• Errors:	No Errors
Product Version:	ISE 13.2	• Warnings:	6 Warnings (6 new)
Design Goal:	Balanced	• Routing Results:	
Design Strategy:	Xilinx Default (unlocked)	• Timing Constraints:	
Environment:	System Settings	• Final Timing Score:	

Device Utilization Summary (estimated values)			
Logic Utilization	Used	Available	Utilization
Number of Slices	69	2448	2%
Number of Slice Flip Flops	58	4896	1%
Number of 4 input LUTs	124	4896	2%
Number of bonded IOBs	31	108	28%
Number of GCLKs	2	24	8%

Table 1 Logic utilization of proposed I²C master unit

The design summary indicated in table 1 shows that the global clock used is 8%, the number of bounded input output blocks utilization is 28%, hence the system interconnect will be minimized by reducing the flip flops.

VI. CONCLUSION

The design of I²C controller using Verilog HDL, simplifies the design process. The result shows successful storage of data transmitted by the master and the power dissipation due to leakage is 0.052w analyzed by synthesis. The result shows that minimal resources are utilized in designing the I²C master as only 2 % slices, 1% flip flops and 2% LUTs are utilized. The logic synthesis tool will optimize the circuit in area and timing for the new technology. The design of I²C master controller has immense applications in future as the number of devices connected to a system is only going to increase. So there is always a need for a system which supports multiple protocols. The drawback of designed I²C is that the bounded I/O utilization will be more when compared it with existing design. Dumping of Verilog code to FPGA to realize the exact hardware of the circuit and the verification of I²C bus using system Verilog based open verification methodology.

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TEXTURE CLASSIFICATION USING OPTIMAL LOCAL TERNARY PATTERN WITH NOISE RESISTANT LOCAL BINARY PATTERN

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ABSTRACT

Optimized local Ternary Patterns a new model for texture analysis, already many texture model has been introduce in few years, but more simple and efficient method is Local Binary Pattern (LBP). LBP has some problem like feature vector generation and to handle the challenges like gray scale variation, illumination variation, rotation variation and noise. Optimal Local Ternary Pattern(OLTP) introduce for feature vector generation. The proposed approach LTP extended from LBP. LBP and LTP still have a challenge in noise, so new method has been introduce to reduce the noise namely NRLBP and ENRLBP to capture line patterns both are more resistant to noise compared with LBP, LTP and many other variants. Already the experiment result also refered in proposed texture model improves the classification accuracy and speed the classification process.

Keywords: Center-Symmetric Local Ternary Pattern , Extended Noise-Resistant Local Binary Pattern , fuzzy Local Binary Pattern, Local Binary Pattern , Local Ternary Pattern , Noise-Resistant Local Binary Pattern and Optimal Local Ternary Pattern.

I INTRODUCTION

Image processing is used to extract the useful information from image has an input and extract useful information from the digital image. Image segmentation, Image compression, Image correspondence are some image analysis. Feature extraction is task for sub process in image analysis a feature like color texture and shape from a digital image. Textures are defined as wide variability and is structure composed of large number of more or less similar elements or patterns. Texture has different shapes and model is not adequate for a variety of texture. A texture analysis have four categories they are statistical methods and signal processing methods.

LBP operator transforms an image into an array or image interger labels for micropatterns it has been formed by pixels and immediate neighbours[2].LBP encodes the sign of pixel to pixel difference in neighbourhood to a binary code.The histogram of such code in an image block can be used in texture classification[2],dynamic texture recognition, facial analysis, human detection and many other tasks.LBP is less sensitive to illumination variation extracting histogram of micropatterns in a patch location information is preserved.

1.1 Literature Review and Related Work

Ojala and Pietikynen, et al proposed In the digital images, the spatial distributions of grey values decide the textural features and hence, statistical methods analyze the spatial distribution of pixel values in the digital image. Based on the number of pixels defining the local feature, statistical methods can be classified into first-order statistical methods, second-order statistical methods and higher-order statistical methods.

Moasheri and Azadinia et al a large number of statistical texture approaches have been proposed, ranging from first order statistics to higher order statistics. As first order statistical methods cannot model the texture perfectly, higher order statistics are widely used for texture analysis .

G Haralick et al., proposed Grey level cooccurrence matrices grey level differencesc Weszka et al., and Local Binary Patterns Ojala et al., proposed some of the popular second-order statistical texture methods for texture analysis. Galloway et al and after some years Tsatsanis and Giannakis et al have proved that at the cost of computational complexity, higher than second-order statistical methods could also be used for statistical texture analysis. Geometrical methods are based on the concept that texture could be considered as a spatial organization of texture primitives.

Fu et al proposed an idea in which the texture image is viewed as texture primitives, which are arranged according to a placement rule and texture analysis is a process of identifying those primitives or the placement rule. Matsuyama et al used Fourier spectrum of a texture image to detect texture periodicity for the texture analysis. Liu et al examined the structures of texture patterns in terms of their translation symmetries for the texture analysis.

Xia et al., proposed In model-based methods, mathematical models are used to represent the textures in an image such as fractals random field models by Zhu et al., and so on. Signal processing methods consider the frequency domain of the digital images for the texture feature extraction. Coggins and Jain et al tested multichannel filtering approach using frequency and orientation selective filters for the texture analysis. Under signal processing methods, usage of Gabor filters Daugman, et al and pyramids Heeger et al and Bergen, et al have also been successfully investigated.

II. EXISTING WORK

2.1 Local Binary Patterns (LBP)

The texture model Local Binary Patterns was first developed in [1]. For a 3×3 neighborhood around a centre pixel in an image, the LBP operator. This LBP operator considers a local neighborhood with a certain radius around every pixel in the image and all the neighboring pixels are encoded by thresholding against the centre pixel of the neighborhood by using the piecewise function $s(u)$. Then all the encoded neighboring labels are concatenated to form a binary pattern string and finally the histogram of all these binary pattern strings is used as the texture descriptor. Ojala *et al.* extended their earlier work in the name of Uniform Local Binary Patterns (ULBP) by introducing a new concept called "Uniform patterns". By considering the uniform patterns, total number of patterns in LBP is reduced from 256 to 58 and it is observed that in a texture image, for a 3×3 neighborhood, nearly 90% of encoded labels are uniform patterns only.

Even after ten years of its introduction, still there have been various extensions and modifications from the original LBP operator, because it is computationally simple and very robust in terms of rotational and gray-scale variations. Some recent developments in medical imaging [1] moving object detection [7] and facial expression recognition [8] prove that the LBP texture model is still receiving a lot of attention. However LBP texture model is considered to be sensitive to noise especially in uniform regions [9] Moreover, it supports only a binary level comparison for encoding and thereby it is inadequate to represent the local texture information.

2.2 Local Ternary Patterns (LTP)

As LBP may be sensitive to noise, a 3-valued pattern instead of a binary pattern was introduced by [1] When a 3×3 neighborhood around a [1] centre pixel in an image is considered, the LTP operator.

Although LBP has gained much popularity because of its simplicity and robustness to illumination variations, its sensitivity to noise limits its performance [2]. In [2], uniform LBP was proposed to reduce the noise in LBP histogram. The LBP codes are defined as uniform patterns if they have at most two circularly bitwise transitions from 0 to 1 or vice versa, and non-uniform patterns if otherwise. In uniform LBP mapping, one separate histogram bin is used for each uniform pattern and all non-uniform patterns are accumulated in a single bin. Most LBPs in natural images are uniform patterns [2]. Thus, uniform patterns are statistically more significant, and their occurrence probabilities can be more reliably estimated. In contrast, non-uniform patterns are statistically insignificant, and hence noise-prone and unreliable. By grouping the nonuniform patterns into one label, the noise in non-uniform patterns is suppressed. The number of patterns is reduced significantly at the same time. In [2].information in non-uniform patterns is extracted and also used for classification.

Liao et al. proposed dominant LBP patterns that consider the most frequently occurred patterns in a texture image Zhou et al. and Fathi et al. proposed to extract information from non-uniform patterns based on pattern uniformity measure and the number of ones in the LBP codes. Principal Component Analysis and random subspace approach [2]. were utilized to extract information from the whole LBP histogram including both uniform patterns and non-uniform patterns. These approaches extract some useful information from non uniform codes. However, they tend to be sensitive to noise. "Soft histogram" is another approach to improve the robustness to noise, e.g. a fuzzy LBP (FLBP) using piecewise linear fuzzy membership function [2]. and another using Gaussian-like membership function [2].

A comprehensive comparison between LBP and fuzzy LBP in classifying and segmenting textures is given in [2]. Instead of hard-coding the pixel difference, a probability measure is utilized to represent its likelihood as 0 or 1. However, the probability is closely related to the magnitude of the pixel difference. Thus, it is still sensitive to noise. Local ternary pattern (LTP) was proposed in [2] to tackle the image noise in uniform regions. Instead of binary code, the pixel difference is encoded as a 3-valued code according to a threshold t . Then, the ternary code is split into a positive LBP and a negative LBP in order to reduce the dimensionality. LTP was shown less sensitive to noise, especially in uniform regions [2]. Subsequently, many LTP variants were proposed in the literature.

Nanni et al. proposed a quinary code of five values according to two thresholds [2] and then split it into four binary codes similarly as LTP. As LTP is not invariant under scaling of intensity values, Liao et al. proposed Scale Invariant Local Ternary Pattern to deal with the gray scale intensity changes in a complex background [2]

In order to reduce the high dimensionality of LTP, Center-Symmetric LTP was proposed in [2] Instead of the pixel difference between the neighboring pixel and the central pixel, the pixel difference between diagonal neighbors is calculated. In Local Adaptive Ternary Patterns [2] and extended LTP [2] instead of using a constant threshold, the threshold is calculated for each window using some local statistics, which makes them less sensitive to illumination variations. In Local Triplet Pattern [2] the equality is modeled as a separate state, and a tri-state pattern is formulated. It can be viewed as a special case of LTP [2] LTP and its variants partially solve the noise-sensitive problem. However, they lack a mechanism to recover the corrupted image patterns. Here a Noise- Resistant LBP (NRLBP) and an Extended Noise-Resistant LBP (ENRLBP) is proposed to address this issue.

III.PROPOSED WORK

3.1 Proposed Noise-Resistant LBP

LBP is sensitive to noise. Even a small noise may change the LBP code significantly. Thus, we propose to encode the small pixel difference as an *uncertain* bit X first and then determine X based on other certain bits of the LBP code. For the pixel difference between the neighboring pixel and the central pixel, then encode it into one of the three states

States 1 and 0 represent two strong states where the pixel difference is almost definitely positive and negative, respectively. Noise can unlikely change them from 0 to 1 or from 1 to 0 . State X represents an *uncertain* state where the pixel difference is small. A small pixel difference is vulnerable to noise if we only take its sign. More specifically, noise can easily change its LBP bit from 0 to 1 or vice versa. Therefore, encode it as an *uncertain* state regardless its sign.

After derive the *uncertain* code, and determine the *uncertain* bits based on the values of the other certain bits to form one or more codes of image local structures. Uniform patterns represent local primitives, including spot, flat, edge, edge end and corner. They appear much more often than nonuniform patterns in natural images. Since uniform patterns occur more likely than non-uniform ones, we assign the values of *uncertain* bits X so as to form possible uniform LBP codes. A non-uniform pattern is generated only if no uniform pattern can be formed.

Algorithm 1 Histogram construction of the proposed NRLBP

for Every pixel in a patch **do**

1. Derive the *uncertain* code $C(X)$ as in Eqn. (5), (6).

3. Search *uncertain* bits X in the space $\{0, 1\}^n$ so that $C(X)$ forms uniform LBP codes as in Eqn. (7).

4. Construct the histogram.

if $m = 0$ **then**

Accumulate the non-uniform bin with 1.

else

Accumulate the bin of each pattern in SNRLBP with

$1/m$.

end if

end for

. **Figure (1) histogram of LBP, LTP and NRLBP**

The proposed NRLBP corrects noisy non-uniform patterns back to uniform pattern. Figure (1) shows the histogram of LBP, LTP and NRLBP. The threshold t is chosen as 10 for LTP and NRLBP. LTP histogram is the concatenation of positive LBP histogram and negative LBP histogram. The last bin of each histogram is corresponding to non-uniform patterns, and other bins are corresponding to uniform patterns. Clearly, compared with LBP histogram and LTP histogram, non-uniform patterns in NRLBP histogram are reduced significantly from about 35% to about 10% only.

The proposed NRLBP corrects a large amount of non-uniform patterns that are corrupted by the noise back to uniform patterns. The proposed NRLBP is different from LBP and LTP in many other aspects besides the capability of noise resistance and error-correction. The LBP code is one of the NRLBP code set if it is uniform. The only exception is that the LBP code is non-uniform and is corrected back to uniform code in NRLBP. Compared with LTP, the treatment of *uncertain* state is totally different for NRLBP. For LTP, all *uncertain* bits are set to 0 for positive half and 1 for negative half whereas for the proposed NRLBP, do not hurry for a decision of the *uncertain* bits.

To treat them as if they could be encoded as 1 and/or 0, and determine their values based on the other bits of the code. Mathematically, for LTP, for positive half and for negative half, value is determine for NRLBP. The number of histogram bin is also different. LTP histogram consists of 118 bins, whereas NRLBP histogram only has 59 bins. For implementation, a look-up table from the *uncertain* code to the feature vector of NRLBP histogram can be precomputed. Then, the feature vector of local image patch can be easily obtained by summing up the feature vector of each pixel in this image patch.

3.2 Proposed Extended Noise-Resistant LBP

The local primitives represented by uniform LBP mainly consists of spots, flat region, edges, edge ends and corners [1]. However, a large group of local primitives are totally discarded, e.g. lines patterns. Although those patterns may not appear as frequently as uniform patterns, they represent an important group of local primitives that may be crucial for recognition tasks. Grouping them with other non-uniform patterns into one bin may result in information lost. Therefore, we introduce an extended set of uniform patterns to preserve line patterns. Among all possible line patterns, diagonal lines appear less frequently. In order to keep the feature vector compact, we only choose nearly horizontal or vertical lines.

The proposed extended set of uniform patterns consist of 48 patterns. Including 58 uniform patterns, we derive the extended uniform patterns. Similarly as NRLBP, we can derive the extended NRLBP (ENRLBP). Instead of forming uniform patterns, we form extended uniform patterns as our ENRLBP pattern. In such a way, line patterns are preserved during the encoding process. The number of bins of ENRLBP histogram is 107, which is smaller than LTP histogram that has 118 bins.

3.3 Description of an Optimal Pattern

A uniform pattern is said to be an optimal pattern, if it satisfies the following criteria:

- The pattern string must not contain more than 3 transitions between the successive encoded values (sub patterns) in the pattern string.
- The level of optimality must be greater than or equal to 2.

3.4 Optimized Local Ternary Patterns (OLTP)

The following texture model, Optimized Local Ternary Patterns (OLTP) which is rotational invariant, gray-scale invariant, image histogram equalization invariant and noise resistant is proposed. OLTP operator uses only optimal set of patterns for describing a local image texture. This newly proposed texture model, OLTP uses a total number of 24 unique optimal patterns for texture representation. All other patterns are termed as “suboptimal” patterns and grouped under one label 25.

Therefore the dimension of pattern spectrum has been reduced from 6561 to 25, that too with optimal set of patterns. Among these 24 unique optimal patterns, 17 patterns are having a maximum of 2 transitions in their sub patterns 3 patterns are having and there are 4 patterns for some of the pattern strings with relevant details of their uniformity, level of optimality and whether they are optimal patterns or not. some selected texture images from Brodatz album and their corresponding pattern spectrum of the optimal patterns obtained through proposed OLTP texture model.

IV. CONCLUSION

This study proposed a new spatial method of texture modeling approach called Optimized Local Ternary Patterns (OLTP). This study also introduced a new concept called, “Level of Optimality”, which is very simple and computationally efficient, to select the optimal patterns among the uniform patterns. On one hand, like conventional LBP approach, the proposed method OLTP has the properties of rotation invariant and gray-scale invariant.

On the other hand, like LTP, it has the ability to with stand against the noise also. LBP is sensitive to noise. Even a small noise may change the LBP pattern significantly. LTP partially solves this problem by encoding the small pixel differences into the same state. However, both LBP and LTP treat the corrupted patterns as they are, and lack a mechanism to recover the underlining image local structures. As the small pixel difference is most vulnerable to noise, we encode it as *uncertain* bit first, and then determine its value based on the other bits of the LBP code to form a code of [2] image local structure.

The proposed approaches show stronger noise-resistance compared with other approaches. Inject Gaussian noise and uniform noise of different noise levels on the AR database for face recognition and the Outex-13 dataset for texture recognition. Compared with FLBP, the proposed approaches are much faster and achieve comparable or slightly better performance. They consistently achieve better performance than all other approaches.

Further, it was also experimentally proved that this newly proposed texture model is histogram equalization invariant. The quality of the proposed approach was validated with many numbers of experiments to prove that this OLTP is robust to grey-scale variation, rotation variation, histogram equalization and noise.

This proposed OLTP texture method on one side gives better classification accuracy than recently introduced LTP texture approach. On the other side, it uses only half the number of uniform patterns of LTP method. It was experimentally in [1] proved that the optimal patterns of the proposed texture model OLTP are the fundamental properties of textures and they are the dominant patterns in the uniform patterns of the LTP model. Since the proposed OLTP is robust in every aspect it can be a good replacement for both LBP and LTP. the future work,

the proposed texture model OLTP can be tested for image texture segmentation problems. The proposed approach can also be checked for color texture images.

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OPINION MINING OF ONLINE SHOPPING SITES THROUGH FACEBOOK PAGES USING GRAPH API AND FQL QUERY

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ABSTRACT

With the advent of social networking, especially Facebook we are busy everyday posting our details and adding and rejecting people as friends and creating so called a social virtual human network which shares ideas, feeling, status, pictures and so on. This paper presents the practical implementation of how to know the detailed status of social networking Facebook account so as to know the total number of people on our network, our friends, their numbers gender-wise, their status, their IDs, picture shared, likes unlike, different reactions of people in our network on our posts, all can be studied as a summary with the help of Analysis Software R with an additional package of Facebook R on it.

General Terms: Facebook, Social Networking Sites, R facebook packages, Rcurl, Fetching.

Keywords: Rtool, Graph API, Fqlquery, Datamining, Opinion Mining.

I INTRODUCTION

Social networking site lays a vast flask on the life of a common man and mould their life to a social man. It come forth as a paramount and provides a effectual means for people to get linked so as to use them effectively. It provides a platform for sharing views,interest,real life connections etc coalesce into communities. These sites are chunk of everyday life and consort insurgent changes in communications among various age groups people especially Facebook. Facebook is one of the social networking sites which refer to online community and began as a craze. It contains wide variety of data, which makes it a time consuming process for analysis. To overcome this, we use R language tool which is a open source software for the computation of statistics and graphics, along with the help of FQL query (Queries for Facebook data) and Graph API. The R language is widely used among the data miners for data analysis, thereby converting raw data into useful information. Opinion mining also plays a very important part in the data extraction as it gives us the full review of various sites prevailing on Facebook and also help us to elaborate the overall numeric rating of sites. It aids us in making decisions about the sites whether they are good or bad and gives us an opportunity to tell our opinions about the sites i.e. what

are the improvements need to be done so that it can be proved fruitful and easily admired by the people.

II PROBLEMSTATEMENT

Everything in this world has two sides like a coin. One positive and another negative. Similarly face book which we use in our day to day life has adverse backlash on the life of people due to the vast data present or shared by the people; it takes lot of time to access. For instance, if a user wants to see all the existing pages of any site, he has to search it on the search engine of the face book individually rather than retrieve all the pages simultaneously. Asides these, if u want to chart the difference between two sites by simple Facebooklogin, then it becomes a time consuming process.This all can be resolved by queries which helps us to find things easily and timesaving.

III FETCHING DATA FROM FACEBOOK

For fetching data from facebook,first login your facebook account page and open a new tab next to that facebook page and paste following link

(<https://developers.facebook.com/tools/explorer?method=GET&path=me%3Ffields%3Dname%2Cfriends&version=v2.1> on tab. Click gets access token to obtain token.

After this we need to select either FQL query or Graph API to insert the query which enables the user to fetch the data in few seconds. In this way you can achieve the information of your friends.

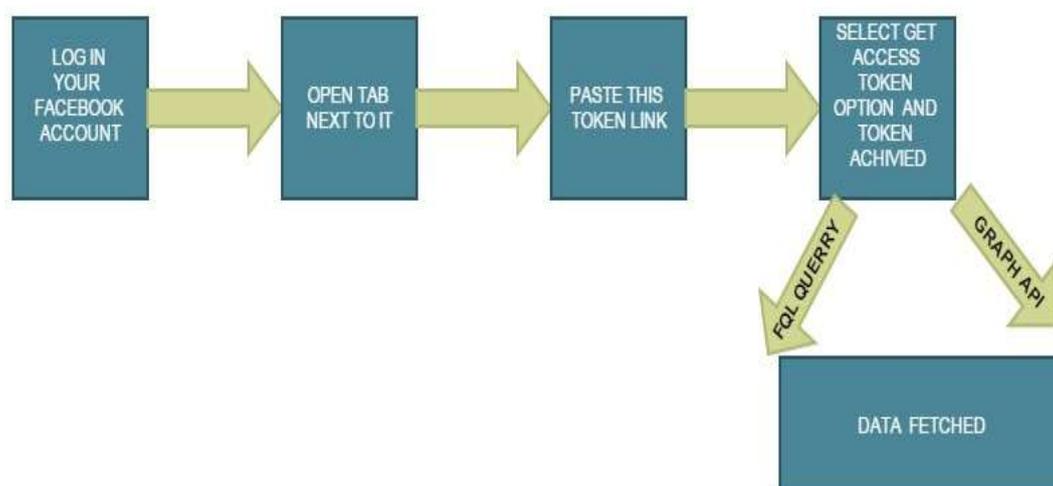


Fig. 1: Block Diagram Which Illustrates How Token Is Achieved

IV IMPLEMENTATION

Name of sites	Like_Count	No. of Pages
Flipkart	4000346	28
Amazon	25690818	30
Snapdeal	2708634	16
Myntra	2582581	16
Jabong	3247554	22

Table1: shows name of sites along with like_count and no of pages.

With the help of this table, we plot two graphs to chart the distinction between various online shopping sites by using FQL queries.

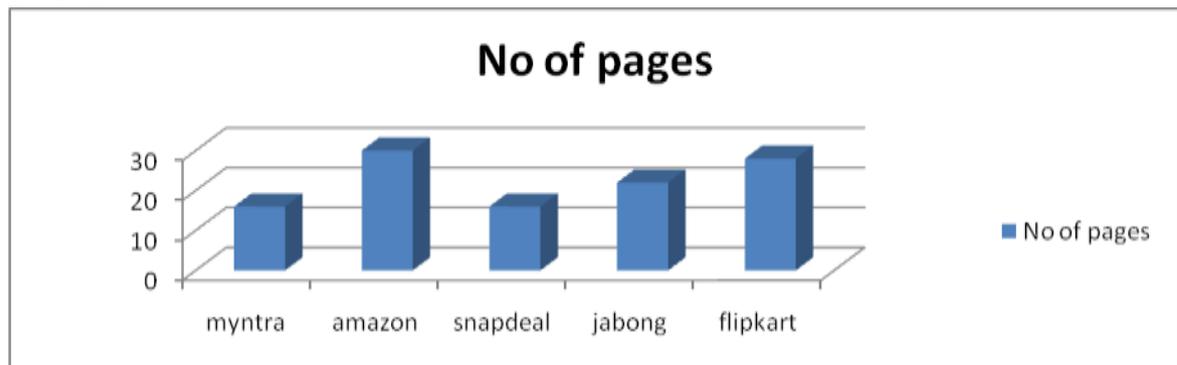


Fig. 2: Distinction between various sites on the basis of pages

The above illustrated graph represents the gathered information of various sites like myntra, amazon, snapdeal, jabong and flipkart along with the number of pages onfacebook account. In this graphical analysis this observation tells us that an amazon is most famous facebook page.

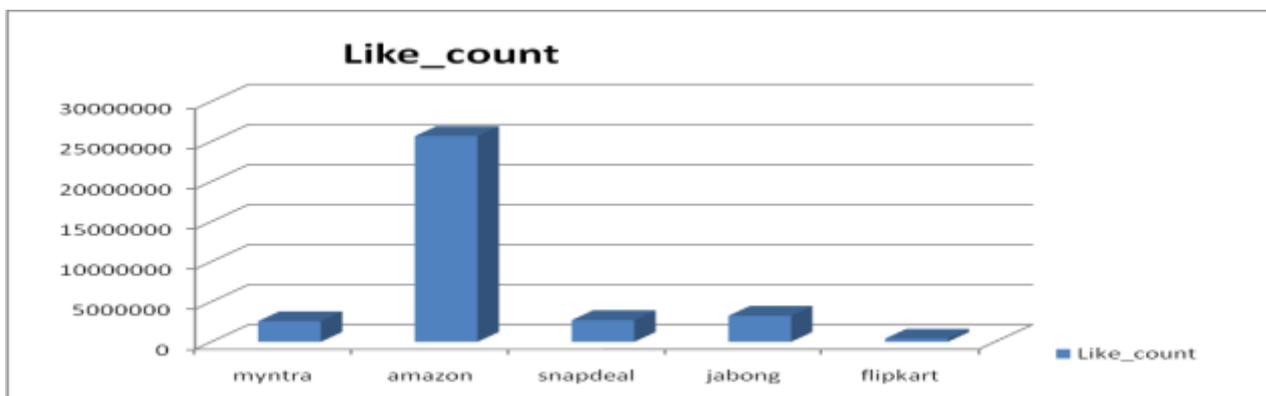


Fig . 3: Shows name of various sites on the basis of like count.

And, the above illustrated graph depicts the site name along with the like count. This observation tells us that amazon is most admired Facebook page and flipkart is least admired page on Facebook.

The goal is to emphasize the understanding of how R works. R is a free programming language tool. The R language is widely used among data miners to provide us a statistical view of various things. Here, we use it for analyzing the data tool includes two packages R face book and R Curl tool.

i) The RCurl package provides HTTP facilities, allowing us to download files from Web servers, post forms, upload files, use binary content, handle redirects, password authentication, etc.

ii) R Facebook package is used for providing the information of graph API along with FQL Query within R language. It includes a series of functions that allow R users to extract their private information, search for public Facebook pages and capture data, and update their comments regarding that site.

V EXAMPLES OF FETCHING DATA FROM FACEBOOK USING FQL QUERIES /GRAPH API

With the help of R language tool, we can find out various information of friends including their names, their profile pictures, birthdays, location, hometown, relationship status, gender, status, likes, dislikes, etc. It also evaluates exact count of friends a user have. Besides this, it can also calculate total pages of sites such as myntra.com, flipkart etc. Along with it, calculates the total number of total pages a site so as to make a difference between two sites. Also, elaborates the photos, cover photos, uploads, any album the user has made etc. By this just one query, we are able to see all the pictures which are loading in his Facebook account rather than opening them individually which results in wasting of time.

Not only has it told us about the status of sites i.e. how many people share, like, comment, total count, comment-on-count, click-count etc.. But also, helps the user to determine whether this site is useful or not. It enables user to give their suggestions about that site and what improvements have to be done resulting a good platform for users and help in determining the mood or nature of the person. The liking, sharing or commenting of pictures decide what kind of person the user is and what is his mental state.

VI CONCLUSION

The aim of this project is classification of various Facebook pages. Now a days, people are increasingly on facebook as it provides them a user friendly platform to express their opinions about various sites and what are the changes need to be done. So, it is essential to device some tool to retrieve the data more effectively. In this paper, for correctly analyzing the popularity of sites, emotions of people, friend counts etc we use a approach that combine together the use of various tools including R tool, Graph API, FQL Query.. This approach can be used together with the concept of opinion or data mining to validate result. Our bag of opinions was a result of a deep analysis of various Facebook sites, likes and number of pages. This work can further be strengthened with the use of Facebook query analyzer which is the future scope of this work and can add further results to our objective.

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GAMES FOR ELDERLY: THE DESIGN ISSUES

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ABSTRACT

Elder Games provides an environment for coming together, leisure, work out and refreshing the lives of the elderly population. Designing and developing precise computer games applications for elderly population could assist them to get happiness and at the same time to be engaged in training or exercising, without getting bothered or bored. However, the development of Games for Elderly requires the implementation of a thoughtful design approach to make games useful for Elderly. Therefore, the significant issues related to design and development of Games for Elderly are studied and presented in this paper.

Keywords : *Elderly Games, Persuasive Design*

I INTRODUCTION

Researchers in [1], who conducted several focus groups with elderly people, found that more than 50% of problems reported by participants in using technological tools related to usability, and could be solved by improving the design (25%) or by providing training (28%). Input and output devices are particularly delicate, because they involve an interaction with the sensory or perceptual system of the user, which undergoes several changes with age that can hamper usability.

II USABILITY CHARACTERISTICS

The researchers in [1] considered usability as the possibility to have access to a product, and define utility as the capability to provide the functionality the product possesses. They also identify five characteristics related to usability, which are particularly important when speaking about older adults:

Learn ability: how difficult it is to learn to use a device, to understand and to integrate functioning instruction. Time needed to complete a task correctly and results obtained in a certain amount of time are possible measures of learn ability.

Efficiency: the extent to which technological applications satisfy users' needs, avoiding loss of time, frustration and dissatisfaction. It can be measured by an experienced user's performance on a specific task;

Memorability: elderly users' memorability of a device's functioning is very important in order to avoid frustration and loss of time. A simple measure of this characteristic can be obtained by considering the time needed to perform a previously experienced task.

Errors: how easily a product can induce errors for elderly users and how easily it recovers from them.

Satisfaction: Users' attitude and adoption of technological applications could be influenced by the pleasure derived from their usage.

The above mentioned points are to be considered essentially while designing the games for elders.

III GUIDELINES FOR A UNIVERSAL DESIGN

The intention of the principles in a universal design is to ensure that a product suits all ages, different body sizes and functional abilities. Whenever a product is designed, the guidelines for a universal design should be considered to fit different users' needs.

IV DESIGN TO EVERYONE

In addition to the universal design principles, seven principles of "design to everyone" have been developed by North Carolina State University [2]. It includes:

Principle 1: Equitable use

Principle 2: Flexibility in use

Principle 3: Simple and intuitive use

Principle 4: Perceivable information

Principle 5: Tolerance for error

Principle 6: Low physical effort

Principle 7: Size and space for approach and use

A game designed for elderly has to ensure that the safety and security is taken care of whenever interacting with it. The designed product should not decrease the user's ability to get in social contact, but rather increase it.

The design should be developed to be adjustable to the elderly users. This is an important principle. Elderly people and those suffering with dementia are a mixed group with different mental and physical capabilities, and their functional abilities are in constant change as well.

Regardless of the users' expertise, skills or the comprehension of language or concentration, the usability should be simple and easy to understand. To people with reduced cognitive functions the product should be used with a minimal or absent learning time. The user group should rather feel familiar to the product, to avoid confusion and stress, and consequently feel motivated. [2]

All the important information should be placed within the field of vision to the user, using words that are understandable and simple. It is important to catch the elderly user's attention. This could be done by a combination of several elements. One example is the combination of proper/suitable images, sounds and colors to help the elderly user complete a given task.

The design should ensure error reduction, quick usage and reliability. Even if errors should occur, the product should be designed to give positive feedback to the user, not warnings.

The product should not demand a high physical effort in order to use it effectively and comfortably. It should be usable in any natural occupied positions. This is considered an important principle, as elderly people experience difficulties coordinating their movements along with their reduced physical strength.

It is recommended that the designed product has an appropriate size and space to suit both an approach and usage regardless of the user's mobility, body size or posture. Different hand sizes, their handgrip abilities and whether or not they're confined to their beds, sit or even stand upraised. These issues should always be important considering usability [3].

V PERSUASIVE TECHNOLOGY DESIGN

Persuasive technology can be defined as a set of technologies that attempts to change attitudes and behavior of people through persuasion and social influence, but without making use of coercion and deception [4]. Those changes should be voluntarily accepted by subjects. Persuasive technology has a great potential to motivate and encourage old-aged people to change his sedentary lifestyle and become more physically active. Nevertheless, to make them change is a complex process. Appropriate persuasive methods should be used at the right time to persuade them to adopt healthier behaviors.

VI IMPLEMENTATION OF PERSUASIVE STRATEGIES [5] IN GAME DESIGNS

Display information to encourage people to be more active.

Do not show detailed information about users collected from sensors such as lung capacity or the number of steps they did. They may not understand it at all. In the project Fish 'n' Steps [6], the size of the virtual fishes represents user's progression. As users walk, fishes become larger and healthier to indicate that they are exercising instead of displaying only the number of steps they did.

Record and display the user's past behavior.

Showing historical information related to their physical activity can help to establish new changes and attitudes. It can also be used to set new personal goals. In the project Flowie, a virtual coach [7], the system stores the number of steps the user did to show him/her a chart with his/her progression. In this manner, users can know if they are exercising enough a particular week or they can try to get better step accounts.

Use positive reinforcements to improve behaviors.

Feedback should be immediately delivered as players achieve their goals. Do not punish them for not performing an activity nor accomplish a goal. In the project UbiFit Garden [8], if the user exercises, the garden will become more beautiful and pleasant with different flowers and butterflies appearing. But, if he/she does not exercise, nothing will happen. He/she will only see the green grass and blue sky of the garden. This way the users never get negative feedback.

Make an attractive and friendly user interface.

This helps to motivate users to spend more time performing an activity. In addition, it will be easier to engage them in the game if it is easy to play. In the project Flowie, a virtual coach [7], the system registers the walking distance of the users by using a pedometer and sending the information via wireless networks to the application automatically so the players do not have to register their activities manually. Thus, users can focus only on exercising.

Provide information at opportune moments. Do not disturb users with annoying messages at inappropriate times. In the project UP Health (Ubiquitously Persuasive Health Promotion) [9], the authors designed a notification system focused on minimizing the possibility of interrupting users.

Use social influence.

There are several types of social influence that can promote behavior changes.

Social facilitation suggests that people get more involved while performing an activity when other people are participating too or if they are being observed [10]. For example, some studies show that people exercise more effectively when they do it with others [11]. In the project Jogging over a distance [12], jogging partners who are not in the same location use an audio system to be in contact in order to socialize and to motivate each other. Social Comparison is a theory that explains how individuals evaluate their own opinions and behaviors by comparing themselves to other people [13].

VII DESIGN GUIDELINES FOR ELDERLY GAMES

Based on these findings of the research [14] the following conclusions were posited. There exists a potential market for elderly use of video games. Games developers should take into account a strong preference for familiar content, distaste for violent content, and preference for educational or historical information. In order to better target this population, a high degree of instructional support must also be provided.

As per another study [15], it was stated that although seniors are quite diverse in abilities and experience, older age is generally associated with a number of well documented changes in sensory-perceptual processes, motor abilities, response speed and cognitive processes, all of which impose requirements on interfaces that are to be pleasurable used by the growing elderly population.

The game should be easier to use, with possibility to adjust the game's controls, features, and communication.

There are many commonalities that can be incorporated as design implications for future elderly games.

VIII TECHNOLOGICAL REQUIREMENTS

It is well known that older people have difficulty coping with new technology such as computers, internet, touch screen, modern interface and advanced mobile functions. Senior people are often reluctant to learn new piece of technology. Therefore, it is quite logical to use rather known devices or tools such as television, remote control, computer for some of them and so forth[16]. Today with the advance of innovative such as Kinect, a whole range of possibilities are offered for the creation of game. The main advantages of Kinect technologies are to allow senior people to use their body movements to navigate through a selection of menu for instance.

IX CUSTOMIZABILITY OF A GAME

The customizability of a game depending on the user group is important [17]. A simple game may be constructed on themes based on the player groups. For example, for kids it can be a fairy tale based on cartoon characters and for the older adults it can be a city excursion. According to [18], elderly woman like to socialize

while men still like competing with others or with themselves. Thus, it is important to implement score function for competition.

X CONTROL AND ADJUSTMENT

[15] Allowing the user easy control of font, color and contrast setting, as well as window resizing, scroll rate and zooming, is generally recommended. These adjustments should not exceed appropriate boundaries for the playability of a game on a system, e.g., a 200 point-size font on a portable game device will not increase readability. At any moment in time, the user should be able to directly undo the adjustments by means of a single click.

[19] For elderly it may become a challenge to be steady with the mouse, or any other control device. Small targets and moving interface elements are known to be difficult for older people, and should best be avoided. In a related research it was found that pen input is accessible, even for seniors who lack computer experience [20]. Furthermore, in another research [21] based on CogStim Game, the researchers stated that an 85-year-old study participant expressed that it was fun to draw using a stylus on a Tablet PC, and that drawing with a stylus on a smooth tablet was much easier than drawing with a pencil on a piece of paper. Some participants wanted to finger paint. Therefore, they designed interaction methods using touch or pen input for the CogStim Game.

XI RULES OF THE GAMES

The rules of any game influence the level of social involvement of its players.

Social Interaction is deeply related with game rules and players are expected to interact as much as the rules allow for. Therefore, while designing social games, elements within game rules must be designed with scrutiny which can maximize social interaction of all players. Examples of such elements could be guessing, uncertainty of the game situation, incorporating cooperation and competition, etc. [17]

XII UNCERTAINTY IN THE GAME ENVIRONMENT

Hidden resources and resources that would appear only after prior ones were successfully conquered, meant that new challenges were introduced at an appropriate pace, an important game design technique also advocated in [22].

XIII TAKING CARE OF SHORT- TERM MEMORY

The older adult during the play might easily forget instructions and information. Therefore, there is a need to recall the game situation and eventually repeat the information [23]. In addition, it is important to provide information about the game in a slow manner with option to restart easily if the loss memory has occurred. Messages should short and concise and displayed on the screen. One interesting feature of the game would be that the system is able to detect the loss memory of the player by for instance the player's position / posture so that it can trigger a break in the game play and allow a restart of the movement.

XIV VISUAL REQUIREMENTS

[23] People might experience some difficulties to read or interpret the body language. Therefore, as a requirement, the screen should be large enough and clear and should be positioned at readable distance. Additional, visual messages such as icons and illustrations must be simple and easily interpretable.

Researchers in [24] proposed 9 design criteria within a human-factor perspective in order to compensate for age-related deficits in the visual system:

- increasing the illumination of environment or task context;
- increasing the levels of luminance contrast;
- minimizing the need to use a device excessively close to the eyes;
- adapting the font size;
- minimizing glare;
- minimizing the use of peripheral vision;
- adopting marking strategies to enhance motion perception;
- using great color contrast;
- optimizing the legibility of spatial forms using computer capabilities

XV MOTION REQUIREMENT

[16]Seniors often experience joint pain, problems with mobility, and a lack of general flexibility. Therefore, it is important to understand their possible physical limitation in order to avoid injuries. Hence, the game should be designed with in mind several level of difficulties. Very basic and simple steps of the dance are possible. According to the confidence of the player, there is a possibility to increase the number of steps, or the speed. It is crucial that the patient feel that it is quite safe to play. Other external parameter should be taken into account such as enough light in the room, environment setting and so forth.

XVI HEARING

The anatomical changes in the ear with age affect absolute sensitivity, frequency and intensity discrimination, sound localization and speech recognition. For instance, [25] observed that computer-generated speech, which does not match the rhythm properties of natural verbal production, can be problematic for elderly drivers.

In [24] the researcher proposed 9 design criteria:

- increasing stimulus intensity,
- controlling background noise,
- avoiding the need to detect/identify high-frequency stimuli,
- avoiding long-term exposure to high levels of noise,
- avoiding signal locations with low frequency sound sources,
- using redundant and semantically well-structured speech materials,
- adapting the rate of words per minute,

- asking for feedback from users to calibrate the devices,
- using the Web to provide verbal communication channels for assistance

XVII MOTIVATION

In [26], the researchers investigated ways to incorporate reward schemes to increase motivation and encourage game participation. For example, a personally motivating reward could be an automatic direct dial to a grandchild if they complete the daily game session. Another example would be putting an algorithm into the game so that if a user completes a certain session, their family members will then be notified by an instant short message or an email. The reward structure could also be accumulating points to exchange for coupons or gift cards that could be redeemed at participating local businesses.

[16] In order to insure the success of the senior game dance or sport, it is crucial to make sure that people are enough motivated to play it again and again. One aspect to consider is related to the perceived success that the player could feel. Studies highlight if senior felt that they will not be able to complete the game, they will feel unmotivated. Thus, it is important that the game offer levels that they can reach easily. In addition, the game should not expose openly their failure to others residents. In addition, staff should offer praise and encourage people to use the game as a social tool connecting the community. In addition, game system can be used as a tool in distraction therapy for pain and anxiety [27].

XVIII CONCLUSION

Game systems for Elders help to reduce isolation, and increase the life expectancy. Games are also found to help old people better age in place by providing ways to help them form, keep and implement social relationships and also take care of their wellbeing. While designing a game for Elderly the issues and problems of Elderly should be taken care of. This paper has given the study related to such design issues for developing games for Elderly.

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A NOVEL DESIGN OF COUNTER USING TSPC D FLIP-FLOP FOR HIGH PERFORMANCE AND LOW POWER VLSI DESIGN APPLICATIONS USING 45NM CMOS TECHNOLOGY

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ABSTRACT

The design of high-performance and low-power clocked storage elements is essential and critical to achieving maximum levels of performance and reliability in modern VLSI systems such as Systems o Chips (SoCs). TSPC D flip flop offers advantages in terms of speed and power over normal D Flip Flop design. As chip manufacturing technology is suddenly on the threshold of major evaluation, which shrinks chip in size and performance is implemented in layout level which develops the low power consumption chip, using recent CMOS, micron layout tools. This paper compares 2 architecture of 3 bit counter using normal Flip flop design and TSPC D flip flop design in terms of speed, power consumption and CMOS layout using 45 nm CMOS technology. Micro wind CMOS layout design tool allows the designer to design and simulate an integrated circuit at physical description level.

Index Terms: Microwind, Micron Technology, Layout, Asynchronous Counter.

I. INTRODUCTION

Counters are sequential circuits that keep track of the number of pulses applied on their inputs. They occur frequently in real-world, practical digital systems, with applications in computer systems, communication equipments, scientific instruments, and industrial control, to name a few. Many counter designs have been proposed in literature, patents, and/or used in practice. Counters are usually classified into synchronous counters, such as ring counters and twisted counters, and asynchronous counters, such as ripple counter. In CPUs, microcontrollers, DSPs and many other digital designs which include a program counter, and a timer counter, synchronous counters are usually preferred. Counters are often clocked at a very high rate, usually with an activity factor of 1. In a good design however, the activity factor can be substantially less than 1 and data-dependent leading to lower power consumption.

A counter is a logic circuit that counts the number of occurrence of an input. Each count, a binary number is

called the state of the counter. Hence a counter counting in term of n bits has 2^n different states. The number of different states of the counter is known as modulus of the counter. Thus, an n bit counter is a module 2^n counter. This type of asynchronous counter is also known as serial or ripples counter. The name asynchronous comes from the fact that's this counters flip flop are not being clocked at the same time. The clock input is applied only the first flip flop also called input flip flop in a cascaded arrangement. The purpose of this thesis is to design with Micro wind a 3-bit asynchronous counter with reset function. This counter will raise the output at a falling edge of the clock. The 3-stage asynchronous counter displays number from 0 to 9, using a chain of four D-register cells. The D register design has been implemented using two D and with CMOS inverters.

A digital asynchronous counter is a semiconductor device that is used for counting the number of time that a digital event has occurred. The term ripple counter comes from the mode in which the clock information ripples through the counter. For designing of 4 bit asynchronous counter we need to cascade 4 D register, the clock signal of the each stage is simply carried out by the previous stage to have an asynchronous counter. With this configuration counter will raise the output at a falling edge of the clock. The counters output is indexed by one LSB every time the counter is clocked. The 4-stage ripple counter displays number from 0 to 15, using a chain of four D-register cell. In a counter like this after the occurrence of each clock input, the count has to wait for a time period equal to sum of all propagation delay of all flip flop before the next clock pulse can be applied .The propagation delay of each flip flop, of course , will depend upon the logic family to which it belong.

II. DESIGN APPROACH OF ASYNCHRONOUS COUNTER

Simply, to operate on n -bit values, we can connect n 1-bit Counters. 3-bit Counter is constructed using four 1-bit register as in our case.

2.1 Efficient architecture of D flip flop

One very compact implementation of the edge-triggered Dreg is reported below.

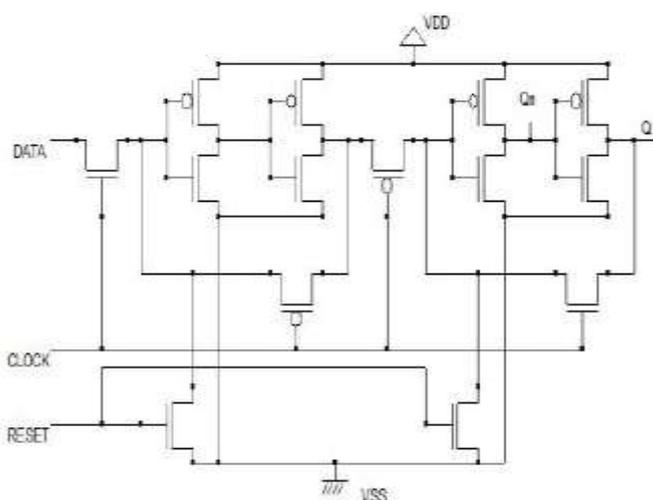


Fig 1: An implementation of a master–slave D flip-flop that using cmos logic gates and pass transistors with Reset facility

The architecture is based on inverters and pass-transistors. It is constructed from two memory loop circuits in series. The cell structure includes a master memory cell (left) and slave memory cell (right). In following figure, *clock* is high; the master latch is updated to a new value of the input *D*. The slave latch produces the previous value of *D* on the output *Q*. When *clock* goes down, the master latch turns to memory state. The slave circuit is updated. The change of the clock from 1 to 0 is the active edge of the clock. This type of latch is a negative edge flip flop. The reset function is obtained by a direct ground connection of the master and slave memories, using nMOS devices. This added circuit is equivalent to an asynchronous Reset, which means that *Q* will be reset to 0 when *Reset* is set to 1, without waiting for an active edge of the clock.

2.2 TSPC D Flip flop

Conventional latches require both true and complementary clock signals. The True Single-Phase-Clock (TSPC) circuit technique uses only one clock signal that is never inverted and fits both static and dynamic CMOS circuits. Edge-triggered D flip-flops are often implemented in integrated high-speed operations using dynamic logic. This means that the digital output is stored on parasitic device capacitance while the device is not transitioning. This design of dynamic flip flops also enables simple resetting since the reset operation can be performed by simply discharging one or more internal nodes. A common dynamic flip-flop variety is the true single-phase clock (TSPC) type which performs the flip-flop operation with little power and at high speeds. However, dynamic flip-flops will typically not work at static or low clock speeds: given enough time, leakage paths may discharge the parasitic capacitance enough to cause the flip-flop to enter invalid states.

There are four basic stages in TSPC D Flip Flop: precharged p- an n- stages and non precharged (static) p- and n- stages, named precharged N (PN), precharged P (PP), Non-precharged N (SN) and Non-precharged P (SP). The following figure gives the architecture of falling edge triggered true single phase (TSPC) flip flop. This architecture includes the reset facility by adding pmos pass transistor and inverter at last stages to invert the \bar{D} logic into *D* i.e *Q*.

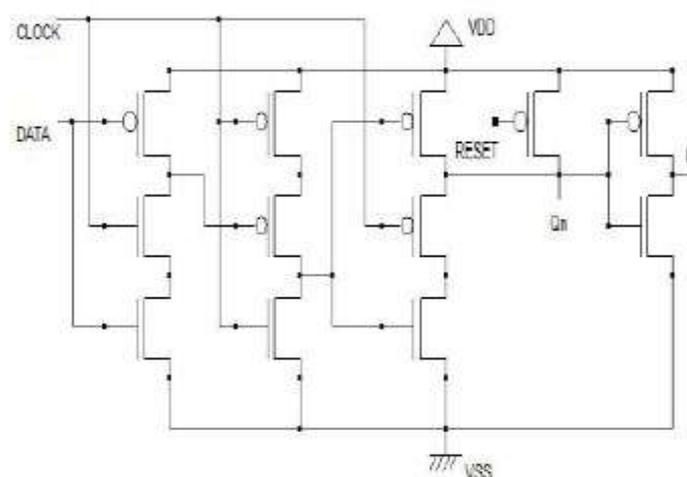


Fig 2 : An implementation of TSPC D flip flop with reset is triggered on negative edge of clock

III. THREE BIT COUNTER DESIGN USING MASTER SLAVE D FLIP FLOP AND TSPC D FLIP FLOP

The following is a 3-bit asynchronous binary counter. It has 8 states due to the three flip flop. This counter is display 000 to 111 binary number. This counter is constructed by using D flip flop as master slave arrangement. This D master slave flip flop is called D register. This counter is made by three D register. Only one flip flop is connected to clock and other flip flops are clocked by previous flip flop's output. Reset is connected to all the flip flops. When least significant bit makes a transition then information is ripple through all the states of flip flops. The clock input is applied to subsequent flip flop comes from the output of its immediately preceding flip flop. For instance the output of the first register acts as the clock input to the second register, the output of the second register feeds the clock input of third register. As a natural consequence of this all 4 register do not change state at the same time .The second register can change state only after the output of first register can change its state. That is the second fact that it gets its own clock input from the output of the first and not from the input clock

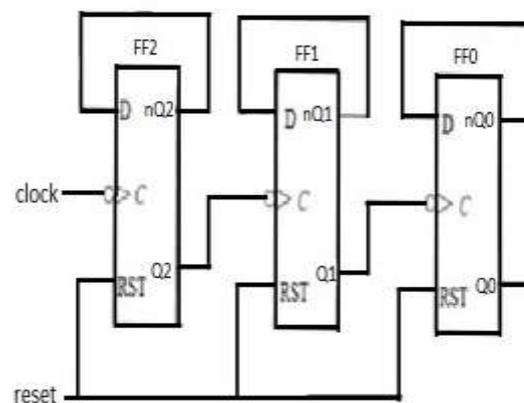


Fig 3: A general structure of 3 bit counter using D Flip Flop

The counter's output is indexed by one LSB every time the counter is clocked. The 3-stage ripple counter displays number from 0 to 7, using a chain of three D-register cell. The Q0, Q1 and Q2 are the three states of output of the counter.

IV- OPERATION OF COUNTER WITH SIMULATION RESULT

Now, as we have designed all the components of the counter, we can design it according to the schematic diagram that we have seen in the introduction. The first stage receives the clock signal. For the reset, we use the reset of our D registers and we connect them together. However, we need to change the position of the NMOS of the reset of each D register, in order to optimize our layout. Thus, we have not problems with the Q outputs of the counter when we use the reset. Firstly counter is designed by using 90Nm and normal and TSPC D FF and this compare with 45Nm counter, simulate with microwind tools. Design Counter as shown in figure. And possible combination as shown below

Clock	Q0	Q1	Q2
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

Table : Truth Table of 3 bit counter operation output

Finally, the structure of counter is designed using two different structures of Flip Flop discussed above i.e one is normal D Flip Flop with master-slave arrangement and TSPC D Flip Flop. The performance is observed by drawing cmos layout and their simulation on 90nm and 45nm CMOS technology in Microwind software.

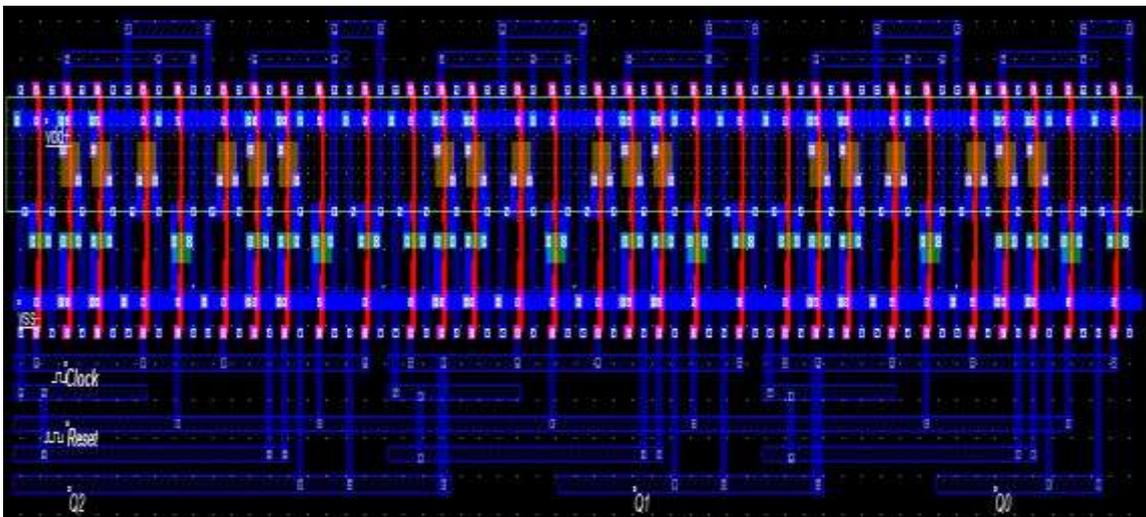


Fig 4 : CMOS layout of 3 bit counter based on D Flip Flop using 90nm Technology

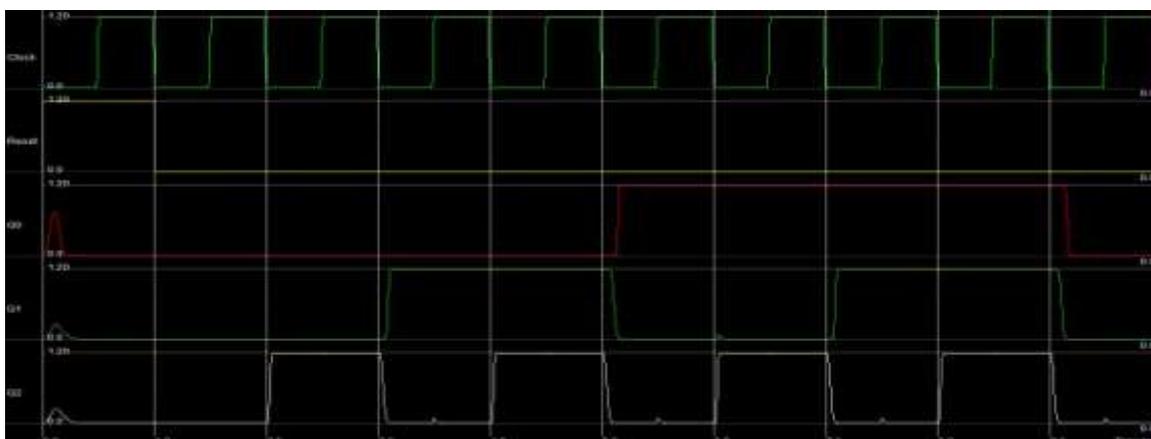


Fig 5: Simulation of 3 bit Counter using D Flip Flop using 90nm Technology

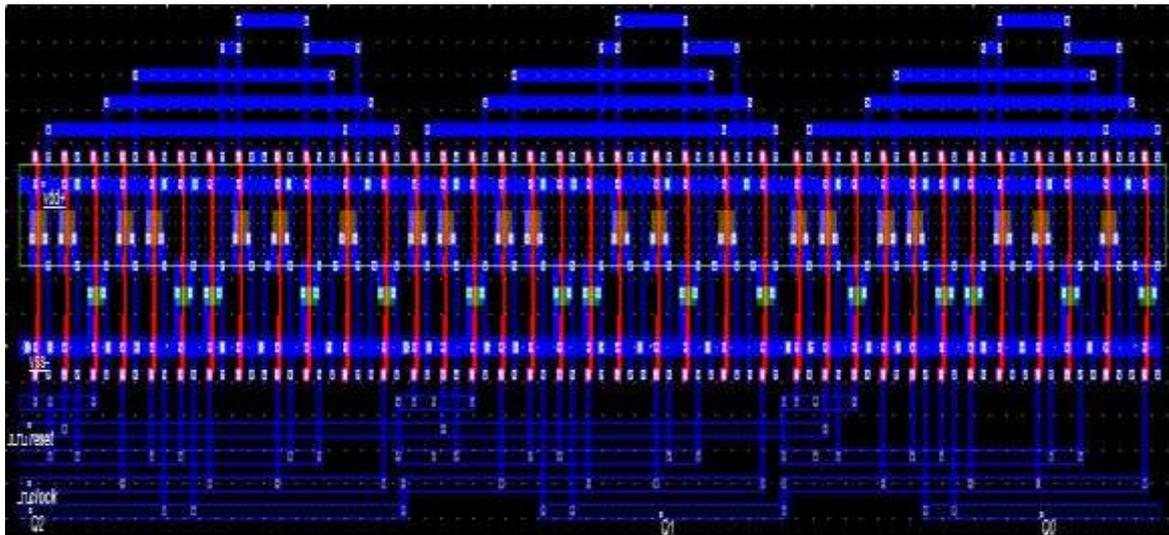


Fig 6 :CMOS layout of 3 bit counter based on TSPC D Flip Flop using 90nm Technology

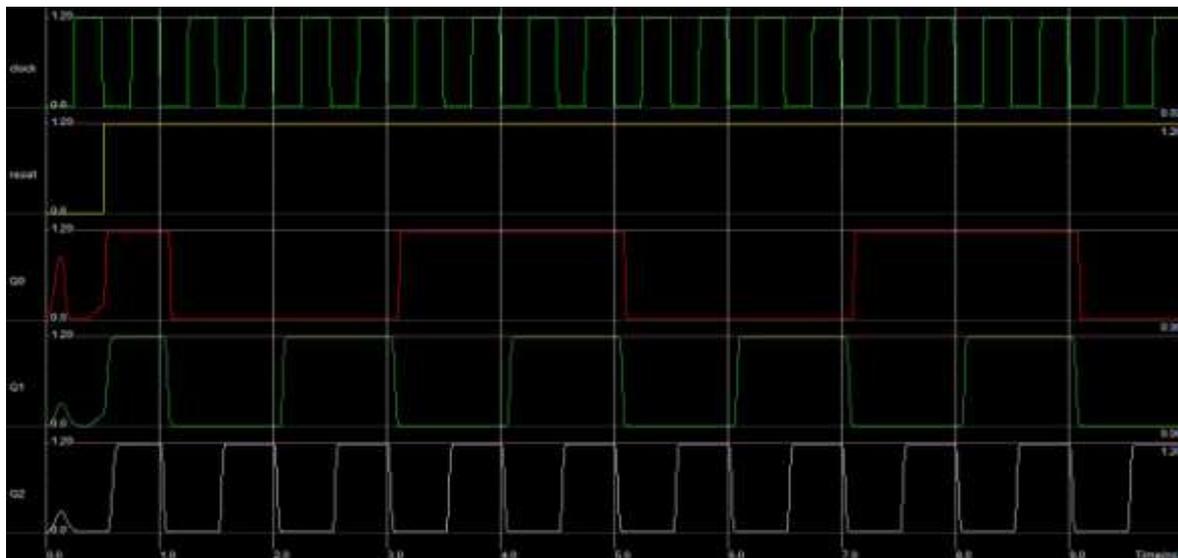


Fig 7: Simulation of 3 bit Counter using TSPC D Flip Flop using 90nm Technology

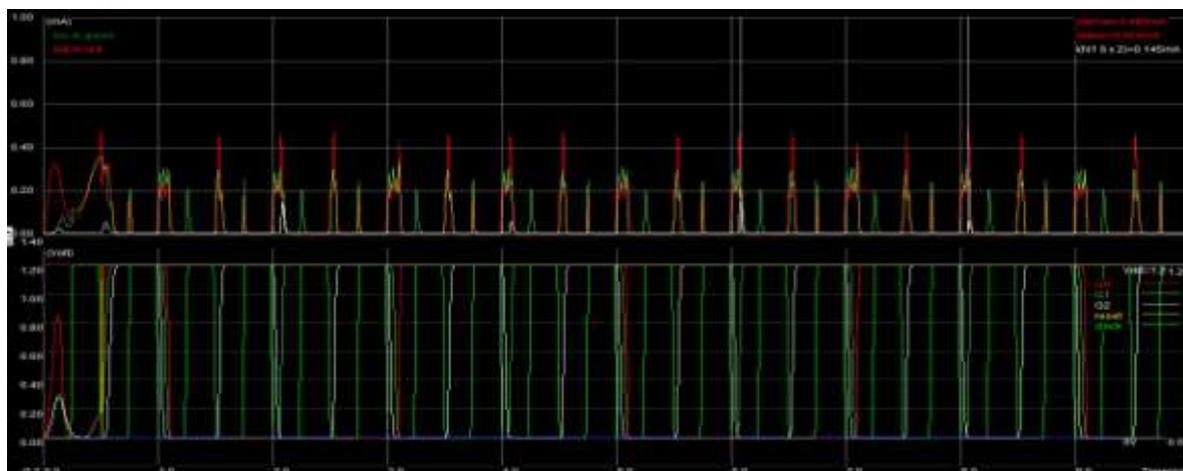


Fig 8: Voltage, Current vs Time simulation of 3 bit Counter using 90nm Technology

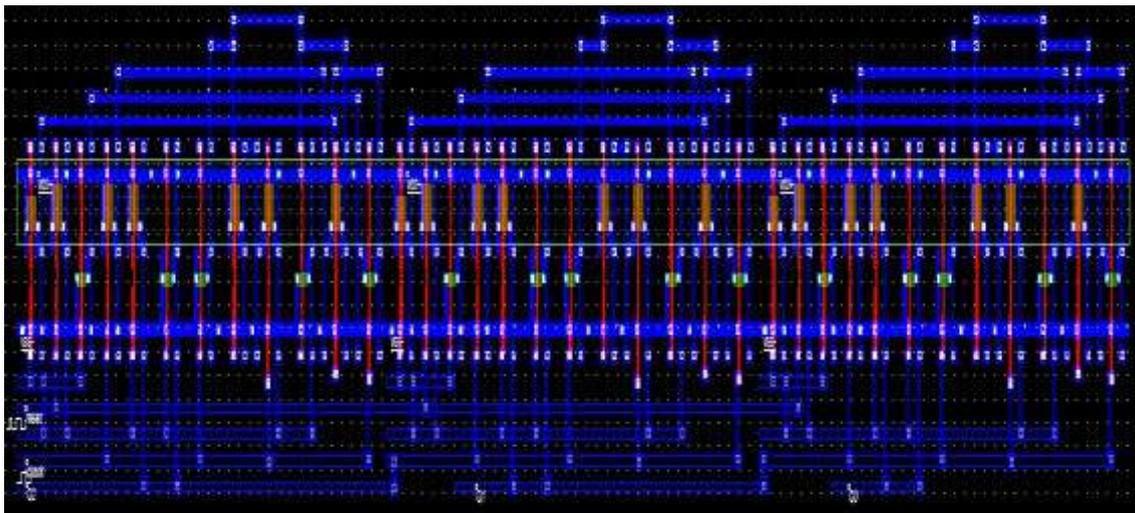


Fig 9 CMOS layout of 3 bit counter based on TSPC D Flip Flop using 45nm Technology

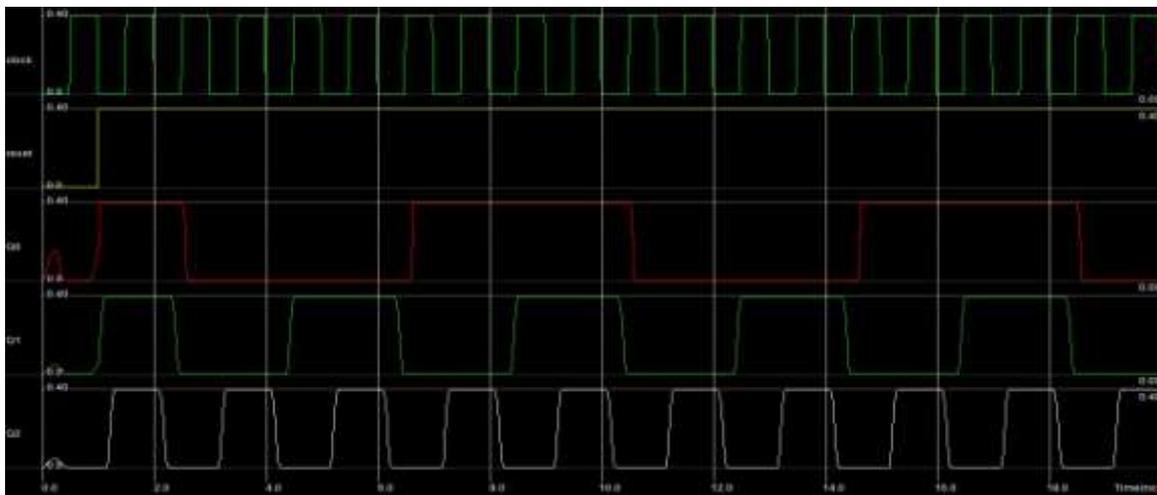


Fig 10 : Simulation of 3 bit Counter using TSPC D Flip Flop using 45nm Technology

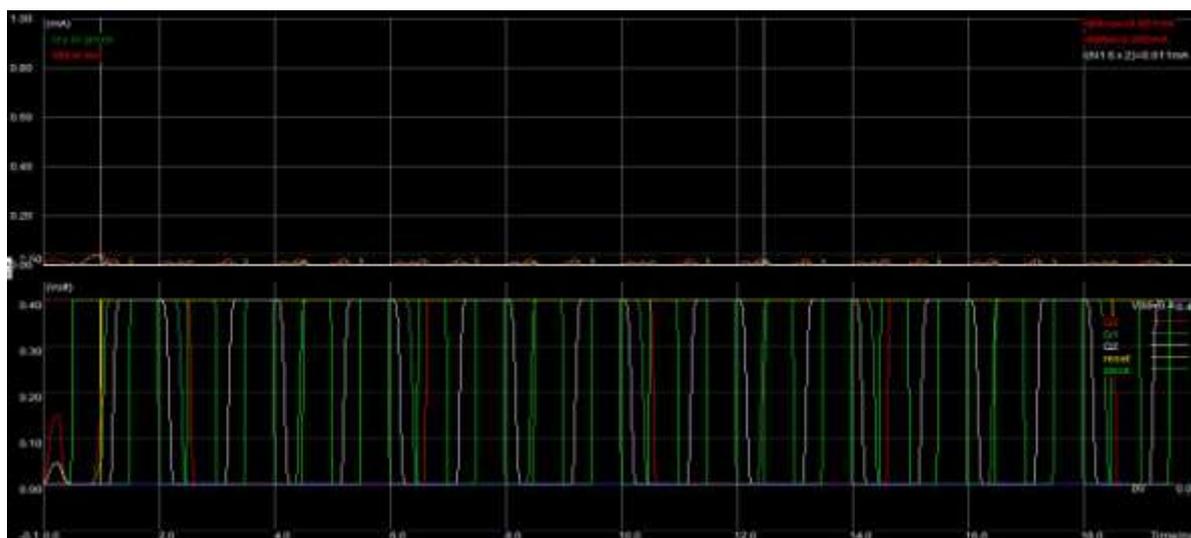


Fig 11: Voltage, Current vs Time simulation of 3 bit Counter using 45nm Technology

V CONCLUSION

This paper gives the comparison in between two design technology such as 45 Nm and 90Nm. 3-bit asynchronous counter is design by using simple D FF and TSPC D FF on 90Nm technology and results shown in following table.

Parameters	3 bit Counter using D Flip	3 bit Counter using TSPC D
CMOS Technology	90 nm	90 nm
VDD Supply Voltage	1.2 V	1.2 V
No. of transistors	56	36
Layout Area	189.44 μm^2	171.99 μm^2
Propagation Delay	149 ps	101 ps
Power Dissipation	0.108 mW	64.212 μW

Table : Comparison between 3 bit counter design using D Flip Flop and TSPC D Flip Flop using 90nm cmos Technology

TSPC based counter gives the best results as compare to the D FF based counter. It has less transistors are required due to this it gives less time for execution. Less layout area is required for designing the any circuit. Similarly counter is design using two different technology is compare on following factors.

Parameters	3 bit Counter using TSPC D	
	D Flip Flop	45 nm
CMOS Technology	90 nm	45 nm
VDD Supply Voltage	1.2 V	0.4 V
No. of transistors	36	36
Layout Area	171.99 μm^2	101.79 μm^2
Propagation Delay	101 ps	77 ps
Power Dissipation	64.212 μW	2.133 μW

The above table gives the comparison in 45Nm and 90 Nm technology, this results show 45Nm design technology required less supply voltage to operate any circuit, due to compact design it have less layout area and low power consumption as compare to the 90Nm design technology. Due to this factor 45Nm design technology is used for low power consumption circuits.

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DESIGN AND DEVELOPMENT OF DATA RECOVERY SYSTEM FOR FADED WIRELESS COMMUNICATION CHANNEL

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ABSTRACT

Wireless communication channel is being used as primary means of communication nowadays. Data is DPSK modulated and hamming encoded before being given as input to the Rayleigh Faded Wireless Communication channel. This paper mainly focuses on the data re-generation techniques from phase modulated data at the source side. The generated data is made to pass through the channel by undergoing various transmission impairments. To accurately regenerate the data at the receiver side equalizers are recommended for usage. Decision feedback equalizer is one such equalizer that reproduces the data accurately. It takes care of all types of the noise components and suppresses the AWGN also. It counters the Doppler Effect and ISI most accurately.

Keywords: Feedback Equalizer, Doppler correction, I channel and Q channel.

I DATA GENERATION

The input to the system is the message of 'L' number of characters. The model converts the given text into ASCII code and supplies the bit stream to DPSK encoder[3].

The general representation for a set of M-ary phase signaling waveform is[6][3]

$$S(t) = \{U(t) \exp j (2\Pi f_c t + 2\Pi (m-1) / M + \theta)\}$$

$$0 \leq t \leq T,$$

$$m = 1,2,3,4$$

$$\theta = \text{initial phase.}$$

Where U(t) is a rectangular pulse with amplitude 'A'

$$S(t) = A \cos [2\Pi f_c t + 2\Pi (m-1) / M + \theta]$$

$$= A_{\text{Channel Simulation}} \cos [2\Pi f_c t] - A_{\text{em}} \sin [2\Pi f_c t]$$

Where $A_{\text{Channel Simulation}} = \cos [2\Pi (m-1) / M + \theta]$

$$A_{\text{em}} = \sin [2\Pi (m-1) / M + \theta]$$

If $\theta = \Pi/4$ and $M = 4$, then $A_{\text{Channel Simulation}} = A_{\text{em}} = \pm A/2$.

The mapping or assignment of information bits to the M possible phases more commonly done using the logic described here under as shown in Fig (1).

In a four phase PSK, sets of two successive bits are mapped on to the four possible phases. When a pair of bits is encoded, say 0 1, the phase corresponding to this combination i.e., $5\pi/4$, added to the phase shift corresponding to the previous bit interval, say $7\pi/4$, to give the phase shift the present interval[6].

Thus while in the previous bit interval a sinusoid of signaling frequency f_c with phase shift $7\pi/4$ was transmitted, in the present interval the sinusoid is transmitted with a phase shift of $7\pi/4 + 5\pi/4 = \pi$.

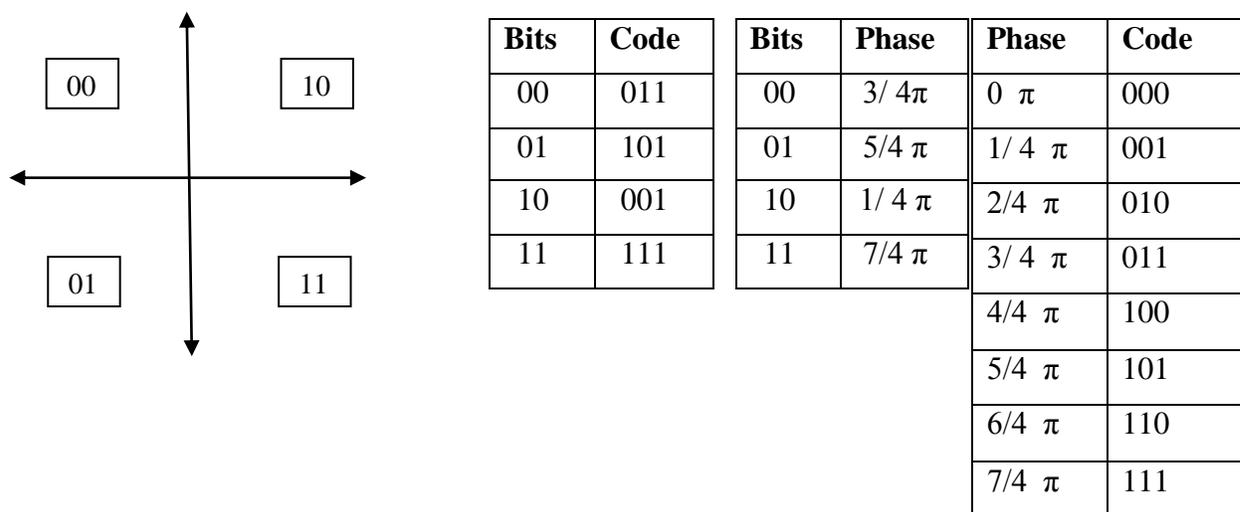


Fig (1) Signal Constellation for 4 ary PSK

When $\theta > 0$ is used, the signaling phase is shifted in every signaling interval, even when a long string of zeroes occur in the information. This results in a signal spectrum with a width that approximately equal to $1/T$. (T is the signaling interval). The spectral components above and below the carrier are used in maintaining synchronization at the receiver. Hence their presence in the received signal is important. Thus a non zero value of ' θ ' ($\theta = \pi/4$) is used in such a case. With equal to four and θ equal to $\pi/4$, eight possible phase shifts exist.

The sequence of pulses $\{\sum_k a_k\}$ or $\sum_i S_i \delta(t - iT)$ from DPSK is fed to the radio equipment transmitter filter 'G'. It has an impulse response of $g(t)$ and a transfer function of $G(f)$. The output this filter is real-valued and is given by

$$\begin{aligned}
 S(t) &= R [\sum_i S_i \delta(t - iT)] * g(t) \quad (* \text{ represents Convolution}) \\
 &= \sum_i S_i \delta(t - iT) * g(t) + \sum_i S_i^* \delta(t - iT) * g(t) \\
 &= \sum_i S_i g(t - iT) + \sum_i S_i^* g(t - iT)
 \end{aligned}$$

II DATA TRANSMISSION

When $S(t)$ is fed into a single Rayleigh fading HF channel the output would be [3][7][4]

$$-x(t) = S'(t)q_1(t) + S^{\wedge}(t)q_2(t)$$

where $q_1(t)$ and $q_2(t)$ are random process.

The random processes have been generated by filtering the zero mean white Gaussian noise signal through a Bessel filter. The frequency and impulse response of Bessel filter approach Gaussian when the order of the filter is sufficiently large. For the three sky waves, the model has, which requires six random processes $q_1(t)$ to $q_6(t)$. The variance of all six variables is equal to 0.167. It ensures that the total variance of the three sky wave channel is unity. Each of the values of $q_i(t)$ generated from an independent source so that they will be uncorrelated [4].

$$S^{\wedge}(t) = S'(t) * f(t)$$

Where $f(t)$ is the impulse response of a Hilbert Transform filter whose Fourier transform given by [5]

$$\begin{aligned} F(f) &= j & f < 0 \\ &= 0 & f = 0 \\ &= -j & f > 0 \end{aligned}$$

$$\begin{aligned} S^{\wedge}(T) &= \{ \sum_i S_i g(t - iT) + \sum_i S_i^* g(t - iT) \} * f(t) \\ &= \sum_i S_i (g(t - iT) * f(t)) + \sum_i S_i^* (g(t - iT) * f(t)) \end{aligned}$$

Where S_i^* is complex conjugate of S_i

Let us consider that the modeled channel has three independent Rayleigh-fading sky waves. The relative delay of the two sky waves from direct path be ' τ ' seconds and ' τ_l ' seconds respectively. The output from the channel is given by [8]:

$$\begin{aligned} x(t) &= [S'(t) q_1(t) + S^{\wedge}(t) q_2(t)] + [S'(t - \tau) q_3(t) + S'(t - \tau) q_4(t)] \\ &\quad + [S'(t - \tau_l) q_5(t) + S'(t - \tau_l) q_6(t)] \end{aligned}$$

While passing through the channel, the signal is modified as a result of random noise $n(t)$ added to it. The noisy signal $x'(t)$ is then passed through receiver filter $C(t)$. The receiver filter output is given by

$$y(t) = x(t) * C(t) + n(t) * C(t)$$

The output of the matched filter $d(t)$ is given to the demodulator where the signal splits into inphase (I) and quadrature (Q) channels.

I channel input is given by

$$\begin{aligned} y'(t) &= \{ [x(t) * C(t) * d(t)] \exp(-j2\Pi f_c t) \} \\ &\quad + \{ [n(t) * C(t) * d(t)] \exp(-j2\Pi f_c t) \} \end{aligned}$$

Where $n(t)$ = noise produced at the output of receiver filter due to additive noise AWGN at the receiver input.

This can be written as

$$y'(t) = \{ \mu \sum_1 a_i p(t - kT) n(t) \} \exp(-j2\Pi f_c t)$$

Where μ = Scaling factor,

$p(t)$ = Defined pulse,

$p(0) = 1$,

$\mu p(t) = x(t) * C(t) * d(t);$

∞

$$y'(t_i) = \mu a_i + \mu \sum_{k \neq i} a_k p[(i-k)T] + n(t_i)$$

$k = -\infty$

Where 1st term = Contribution of the Ith transmitted bit,

2nd term = Residual effect of all other transmitted bits on the Ith bit,

3rd term = Noise sample at t.

The residual effect due to occurrence of pulses before and after the sampling instant t_i called ISI. In the absence of ISI and noise,

$$y(t_i) = \mu a_i$$

III DATA RECOVERY

In the absence of noise, in the ith signaling interval, the received signal can be simply represented as [9]

$$R_i(t) = \sin(2 \Pi f_c t + \theta + \phi_t)$$

Where f_c = Carrier frequency having a phase shift of (θ + φ_t)

φ_t = Information bearing

θ = Unknown phase shift which represents the path delay and relative phase difference between transmitter and receiver oscillators.

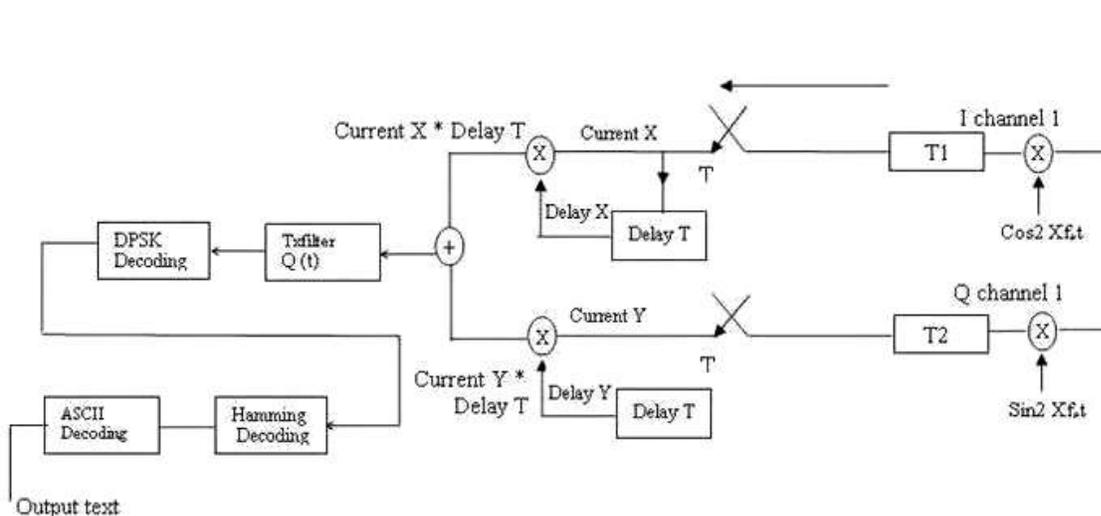


Fig (2) Model of Data Receiving System over Radio Link

The in-phase (I) channel of demodulator gives

$$X_c = \int_{T_1}^{T_2} S_i(t) \cos(2\Pi f_c t) dt$$

$$= \int 1/2 (\sin (4\Pi f_c t + \theta + \phi_i) + \sin (\theta + \phi_i)) dt$$

$$= 1/2 \sin(\theta + \phi_i)$$

Where $T_1 - T_2$ corresponds to a time period in which f_c has an integral number of cycles.

$$X_p = X_{i-1} = X_c \text{ in the previous signaling interval.}$$

$$= 1/2 \sin (\theta + \phi_{i-1})$$

assuming path delay is constant for two Successive signaling intervals.

Similarly the quadrature phase (Q) channel of demodulator will give

$$Y_c = \int_{T_1}^{T_2} S_i(t) \sin (2\Pi f_c t) dt$$

$$= \int 1/2 (\cos (\theta + \phi_i) - \cos (4\Pi f_c t + \theta + \phi_i)) dt$$

$$= 1/2 \cos(\theta + \phi_i)$$

$$Y_p = Y_{i-1} = Y_c \text{ in the previous signaling interval.}$$

$$= 1/2 \cos (\theta + \phi_{i-1})$$

The final outputs of the system are R and Q signals.

$$R = X_c * X_p + Y_c * Y_p$$

$$= k \sin(\theta + \phi_i) \sin (\theta + \phi_{i-1})$$

$$+ k \cos (\theta + \phi_i) \cos (\theta + \phi_{i-1})$$

and

$$Q = X_c * Y_p - Y_c * X_p$$

$$= k \sin(\theta + \phi_i) \cos (\theta + \phi_{i-1})$$

$$- k \cos (\theta + \phi_i) \cos (\theta + \phi_{i-1})$$

The decision is now made on the basis of the signs of 'R' and 'Q' signals as given under.

$$R < 0 \ \& \ Q < 0 \quad 01 ; \quad R < 0 \ \& \ Q > 0 \quad 00 ;$$

$$R > 0 \ \& \ Q < 0 \quad 11 ; \quad R > 0 \ \& \ Q > 0 \quad 10 ;$$

The period of integration $T_2 - T_1$ makes it possible to avoid the use of band-pass filter separate out noise (if any) from received signal.

During data demodulation, the carrier f_c generated at receiver should not run freely. It must be locked to a fixed phase at the beginning of every signaling interval. This is necessary to avoid a differential phase shift in the locally generated carrier, multiplying the incoming phase in successive signaling intervals. This differential phase shift would otherwise add to the information bearing phase shift ($\phi_i - \phi_{i-1}$) and cause erroneous decisions to be taken at the demodulator.

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DUAL TREE COMPLEX WAVELET TRANSFORM AND SHRINKAGE BASED NOISE REDUCTION

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Abstract

The main aim of this paper is to reduce noise introduced by image enhancement methods based on the random spray sampling technique. Based on nature of sprays, output images of spray-based methods shows noise with unknown statistical distribution. The non-enhanced image is nothing but either free of noise or affected by noise of non-perceivable levels. The dual-tree complex wavelet transform (CWT) is a relatively recent enhancement to the discrete wavelet transform (DWT), with important additional properties: It is nearly shift invariant and directionally selective in two and higher dimensions. Across the six orientations of the DTWCT the standard deviation of non-enhanced image coefficients can be computed, and then it normalized for each level of the transform. The result is a map of the directional structures present in the non-enhanced image. Then Said map is used to shrink the coefficients of the enhanced image. According to data directionality the shrunk coefficients and the coefficients of the non-enhanced image are mixed. Finally, the enhanced image can be computed by doing the inverse transforms. The theoretical analyses of new algorithm are well verified via computer simulations.

Keywords: *Dual-Tree Complex Wavelet Transforms (DTWCT), Noise Reduction, Image Enhancement, Random Sprays and Shrinkage.*

I INTRODUCTION

The dual-tree complex wavelet transform (CWT) is a relatively recent enhancement to the discrete wavelet transform (DWT), with important additional properties: It is nearly shift invariant and directionally selective in two and higher dimensions. If we use image enhancement algorithms based on random spray sampling a specific image quality problems are raised to remove that this Paper introduces a novel multi-resolution denoising method. We can apply this proposed approach for other image enhancement methods that either introduce or exacerbate noise. This work builds and expands based on a previous article by Fierro et al. [1]. Random sprays are a two-dimensional collection of points with a given spatial distribution around the origin. Sprays can be used to sample an image support in place of other techniques, and have been previously used in works such as Provenzi et al. [2], [3] and Kolås et al. [4]. Random sprays have been partly inspired by the

Human Visual System (HVS). In particular, a random spray is not dissimilar from the distribution of photo receptors in the retina, although the underlying mechanisms are vastly different. Due to the peaked nature of sprays, a common side effect of image enhancement methods that utilize spray sampling is the introduction of undesired noise in the output images. Magnitude and statistical characteristics of said noise are not known exactly because they depend on several factors such as image content, spray properties and algorithm parameters. Some of the most commonly used transforms for shrinkage-based noise reduction are the Wavelet Transform (WT) [5]–[7], the Steerable Pyramid Transform [8]–[10], the Contourlet Transform [11]–[13] and the Shearlet Transform [14]–[16]. With the exception of the WT, all other transforms lead to over-complete data representations. Over-completeness is an important characteristic, as it is usually associated with the ability to distinguish data directionality in the transform space. We Independently of the specific transform used, the general assumption in multi-resolution shrinkage is that image data gives rise to sparse coefficients in the transform space. Thus, denoising can be achieved by shrinking those coefficients that compromise data sparsely. Such process is usually improved by an elaborate statistical analysis of the dependencies between coefficients at different scales. Yet, while effective, traditional multi-resolution methods are designed to only remove one particular type of noise (e.g. Gaussian noise). Furthermore, only the input image is assumed to be given. Due to the unknown statistical properties of the noise introduced by the use of sprays, traditional Approaches do not find the expected conditions, and thus their action becomes much less effective. The proposed approach still performs noise reduction via coefficient shrinkage, yet an element of novelty is introduced in the form of partial reference images.

II DUAL TREE COMPLEX WAVELET TRANSFORM

The Discrete Wavelet Transform (DWT) is important one for all applications of digital image processing: from denoising of the images to pattern recognition, passing through image encoding and more. The Discrete Wavelet Transform which does not gives the analysis of data orientation because it has a phenomenon known as “checker board” pattern, and the DWT is not shift-invariant because of that reason it less useful for methods based on the computation of invariant features. To overcome the problems affected by the DWT concept of Steerable filters was introduced by Freeman and Adel son [18], this Steerable filters can be used to decompose an image into a Steerable Pyramid, SPT is the shift-invariant and as well as it has the ability to appropriately distinguish data orientations. But the SPT has the problems: the filter design can be difficult, perfect reconstruction is not possible and computational efficiency can be a concern. After that the SPT was developed by involving the use of a Hilbert pair of filters to compute the energy response, has been accomplished with the Complex Wavelet Transform Similarly to the SPT, this CWT is also efficient, since it can be computed through separable filters, but it still lacks the Perfect Reconstruction property. Therefore, Kingsbury also introduced the Dual-tree Complex Wavelet Transform (DTCWT), it has the additional characteristic of Perfect Reconstruction at the cost of approximate shift-invariance [17]. The 2D Dual Tree Complex Wavelet Transform can be implemented using two distinct sets of separable 2D wavelet bases, the dual-tree complex wavelet transform (CWT) is a recent enhancement of the discrete wavelet transform. (DWT), with important properties like it is nearly shift invariant and directionally selective in two and higher

dimensions. It achieves with a redundancy factor of only $2d$ for d -dimensional signals, which is substantially lower than the un-decimated DWT. The multidimensional (M-D) dual-tree CWT is non separable but is based on a computationally efficient, separable filter bank (FB). We use the complex number symbol C in CWT to avoid confusion with the often-used acronym CWT for the (different) continuous wavelet transform.

III PROPOSED METHODOLOGY

The proposed method circulates around the shrinkage, based on data directionality, of the wavelet coefficients generated by the Dual Tree Complex Wavelet Transform. The DTCWT has useful properties: it's capable to distinguish the data orientation in transform space and DTWCT is relatively simple. The human visual system (HVS) is more sensitive to changes in the achromatic plane (brightness), than chromatic ones [19]. Hence, the proposed algorithm first converts the image in a space where the chrome is separated from the luma (such as YCbCr), and operates on the wavelet space of the luma channel. The choice to use only the luma channel does not lead to any visible color artifact. Finally the input image is considered to be either free of noise, or contaminated by non-perceivable noise. If such an assumption holds, the input image contains the information needed for successful noise reduction.

3.1 Wavelet Coefficients Shrinkage

Assuming level j of the wavelet pyramid, one can compute the energy for each direction of the non-enhanced image $k \in \{1, 2, \dots, 6\}$ as the sum of squares of the real coefficients $m_{j,k}^i$ and the complex ones $n_{j,k}^i$

$$e_{j,k} = (m_{j,k}^i)^2 + (n_{j,k}^i)^2$$

Coefficients associated with non-directional data will have similar energy in all directions. On the other hand, directional data will give rise to high energy in one or two directions, according to its orientation. The standard deviation of energy across the six directions $k = 1, 2, \dots, 6$ is hence computed as a measure of directionality.

$$e_j = \text{stddev}_k(e_{j,k})$$

Since the input coefficients are not normalized it naturally follows that the standard deviation is also non-normalized. The Michaelis-Menten function [20] is thus applied to normalize data range. Such function is sigmoid-like and it has been used to model the cones responses of many species. The equation is as follows

$$\text{mm}(x, \mu, \gamma) = \frac{x^\gamma}{x^\gamma + \mu^\gamma}$$

where x is the quantity to be compressed, γ a real-valued exponent and μ the data expected value or its estimate. Hence, a normalized map of directionally sensitive weights for a given level j can be obtained as

$$w_j = \text{mm}(e_j, \text{median}_k(e_{j,k}), \gamma_j)$$

where the choice of γ depends on j as explained later on. A shrunk version of the enhanced image's coefficients, according to data directionality, is then computed as

$$\tilde{b}_{j,k}^E = w_j \cdot b_{j,k}^E + (1 - w_j) \cdot b_{j,k}^I$$

$$\tilde{c}_{j,k}^E = w_j \cdot c_{j,k}^E + (1 - w_j) \cdot c_{j,k}^I$$

Since the main interest is retaining directional information, we obtain a rank for each of the non-enhanced coefficients as

$$i_{j,k}^l = \text{ord}(b_{j,k}^l), \in \{1, 2, \dots, 6\}$$

where ord is the function that returns the rank according to natural ordering. The output coefficients are then computed as follows

$$b_{j,k}^o = \begin{cases} \bar{b}_{j,k}^E, & \text{if } i_{j,k}^l \in \{1, 2\} \\ b_{j,k}^l, & \text{if } i_{j,k}^l \in \{3, 4, 5, 6\} \end{cases}$$

$$c_{j,k}^o = \begin{cases} \bar{c}_{j,k}^E, & \text{if } i_{j,k}^l \in \{1, 2\} \\ c_{j,k}^l, & \text{if } i_{j,k}^l \in \{3, 4, 5, 6\} \end{cases}$$

Where ord is the function that returns the index of a coefficient in $m = 1, 2, \dots, 6$ when the set is sorted in a descending order. The meaning of the whole sequence can be roughly expressed as follows: where the enhanced image shows directional content, shrink the two most significant coefficients and replace the four less significant ones with those from the non-enhanced image. The reason why only the two most significant coefficients are taken from the shrunk ones of the enhanced image is to be found in the nature of “directional content”. For a content of an image to be directional, the responses across the six orientations of the DTCWT need to be highly skewed. In particular, any data orientation can be represented by a strong response on two adjacent orientations, while the remaining coefficients will be near zero. This will make it so that the two significant coefficients are carried over almost un-shrunk.

IV RESULTS

Original image

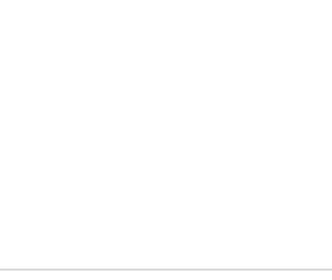


Enhanced Image

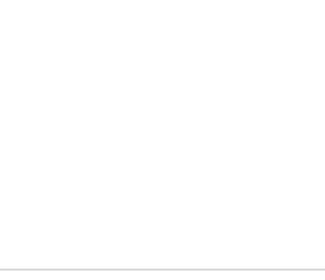


4.1 Histogram Method

Original Image



Enhanced Image





4.2 Ace Enhanced Method

Noise image



Original Image



4.3 Perform Method

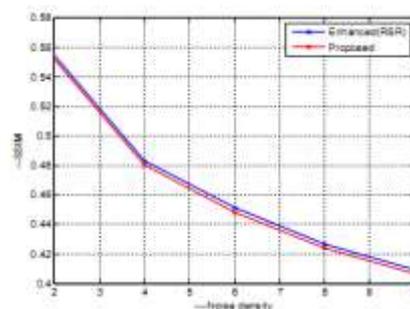
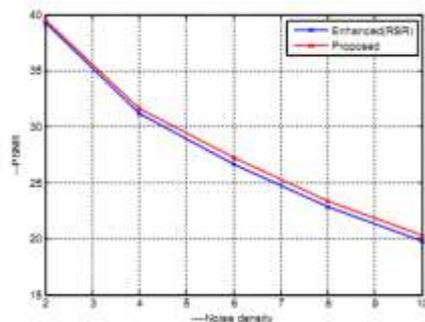


Fig: PSNR vs NOISE DENSITY

V CONCLUSION

This paper presents a noise reduction method based on Dual Tree Complex Wavelet Transform coefficients shrinkage. The main point of novelty is represented by its application in post-processing on the output of an image enhancement method (both the non-enhanced image and the enhanced one are required) and the lack of assumption on the statistical distribution of noise. On the other hand the non-enhanced image is nothing but noise free. Or affected by non-perceivable noise. The images are first converted to a color space with distinct chromatic and achromatic axes based on properties of the Human Visual System but only the achromatic part becomes object of the noise reduction process. To achieve perfect denoising, the proposed method exploits the data orientation discriminating power of the Dual Tree Complex Wavelet Transform to shrink coefficients from the enhanced, noisy image. Always according to data directionality, the shrunk coefficients are mixed with those

from the non-enhanced, noise-free image. The output image is then computed by inverting the Dual Tree Complex Wavelet Transform and the color transform. Since at the time of writing no directly comparable method was known to the authors, performance was tested in a number of ways, both subjective and objective, both quantitative and qualitative. Subjective tests include a user panel test, and close inspection of image details. Objective tests include scan line analysis for images without a known prior, and computation of PSNR and SSIM on images with a full reference. The proposed algorithm produces good quality output by removing noise without altering the underlying directional structures in the image. Also, although designed to tackle a quality problem specific to spray-based image enhancement methods, the proposed approach also proved effective on compression and latent noise brought to the surface by histogram equalization. It requires two input images (one non-enhanced and one enhanced) and its iterative nature, which expands computation time considerably with respect to one-pass algorithms these are the main limitations of proposed method.

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