

# TO CONTROL THE CHARACTERISTICS OF AC MOTOR USING FUZZY LOGIC CONTROLLER

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## ABSTRACT

*This paper presents a hybrid Fuzzy Logic Controller (FLC) with vector-control method for induction motors. The vector-control method has been improved by using FLC instead of a simple PD controller. In this hybrid controller high quality regulation is achieved through utilization of the FLC, while stability of the system during transient and around wide range of operating points are assured through application of the vector-control. The hybrid controller has been validated by applying it to a nonlinear model of the motor.*

**Keywords:** *Fuzzy Logic, Vector-Control, Speed Control, Torque Control, Induction Motor*

## I INTRODUCTION

The induction motor is an important class of electric machines which finds wide applicability in industry and in its single phase form in several domestic applications. More than 85% of industrial motors in use today are in fact induction motors that is basically a constant speed motor with a shunt characteristic [1,2]. Various methods have been developed for this purpose including direct torque control, PD/vector control, etc. But due to their peculiar limitations none of them has been found failure-proof [3,4]. Here speed of induction motor is successfully controlled over a wide range of operating points with improved accuracy using Fuzzy Logic Controller (FLC) as a block of vector-control method. In the last few years, fuzzy logic has attracted a growing interest in many motor control applications due to its abilities to handle non-linearity's and its independency of the plant's model. The FLC operates in a knowledge-based manner, and its knowledge relies on a set of linguistic if-then rules, similar to a human operator. This paper will focus on a hybrid FLC based vector-control and study its effect on the performance of the overall controller.

## II DESIGN OF THE FLC

In recent years, Fuzzy Logic Control (FLC) techniques have also been applied to the control of motor drives. The mathematical tool for the FLC is the fuzzy set theory introduced by Dr. Zadeh. In FLC, the linguistic description of human expertise in controlling a process is represented as fuzzy rules or relations. This knowledge base is used by

an inference mechanism, in conjunction with some knowledge of the states of the process (say, of measured response variables) in order to determine control actions [5]. The main advantages of FLC are: (a) There is no need for an exact mathematical model of the system, (b) It can handle nonlinearities of arbitrary complexity, and (c) It is based on linguistic rules with an IF-THEN general structure, which is the basis of human logic. However, standard FLC can not react to changes in operating conditions. The FLCs need more information to compensate nonlinearities when the operation conditions change. When the number of the fuzzy logic inputs is increased, the dimension of the rule base increases as well, thus, maintenance of the rule base becomes more time-consuming. Another disadvantage of the FLCs is the lack of systematic, effective and useful design methods and adequate analysis, which can use a priori knowledge of the plant dynamics. Moreover, the application of FLC has faced some disadvantages during hardware and software implementation due to its high-computational burden.

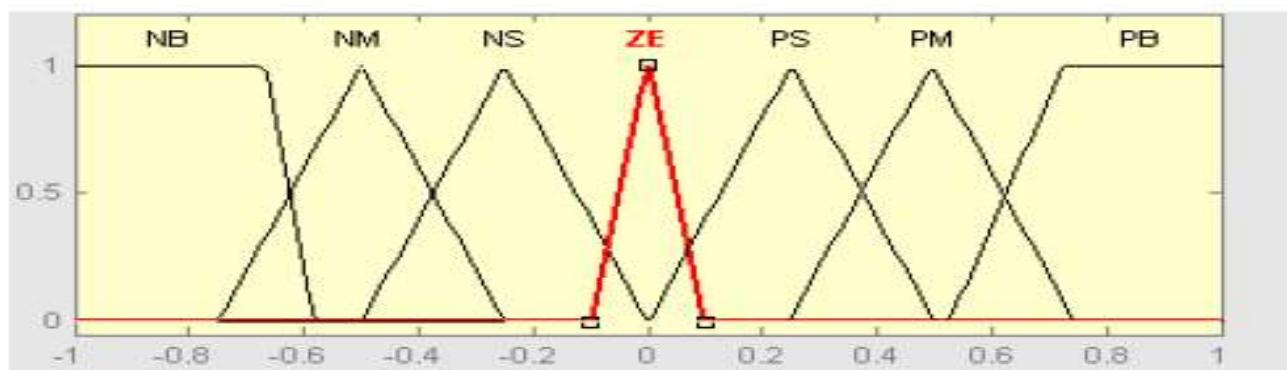
### III ARCHITECTURE

The controller architecture includes some rules which describe the causal relationship between the two normalized input voltages and an output.

These are: -Error ( $e$ ), that is the rotor angular velocity error, -Change-of-error ( $e \Delta$ ), that is the derivative of  $e$ , and – Output rotor angular velocity ( $\omega \Delta$ ). These error inputs are processed by linguistic variables, which require to be defined by membership functions. The FLC includes four major blocks: a fuzzification block, a Rule Base, an inference mechanism, and the last step is defuzzification [6].

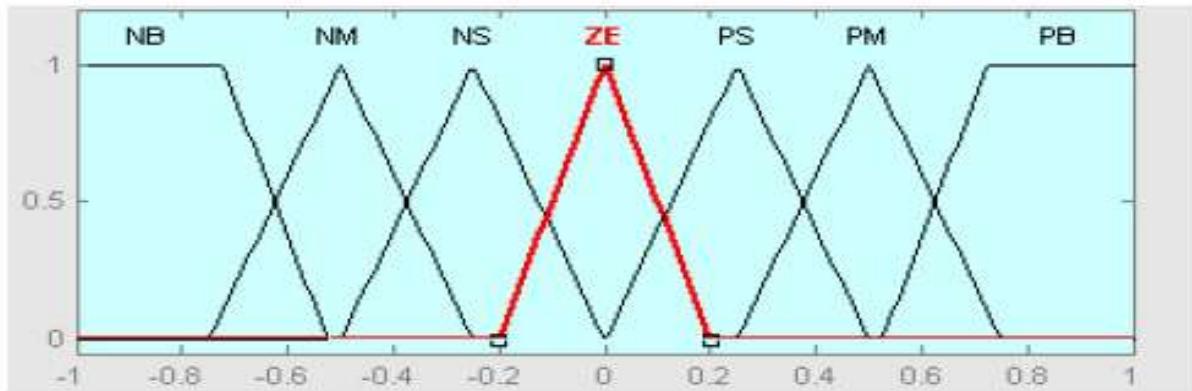
### IV PROPOSED KNOWLEDGE BASE

Fig.1 and Fig.2 shows the triangular-shaped membership functions of error ( $e$ ) and change-of-error ( $e \Delta$ ). The fuzzy sets are designated by the labels: NL (negative large), NM (negative medium), NS (negative small), ZE (zero), PS (positive small), PM (positive medium), PL (positive large)



**Fig.1 Input Error( $e$ )**

Fig.3 show the proposed member-ship functions for output variable and the control rules. The inference strategy used in this system is the Mamdani algorithm, and the center -of-area/gravity method is used as the defuzzification method.



**Fig.2 Input Error (De)**

According to the equation giving a PD-like fuzzy knowledge based controller (FKBC) is

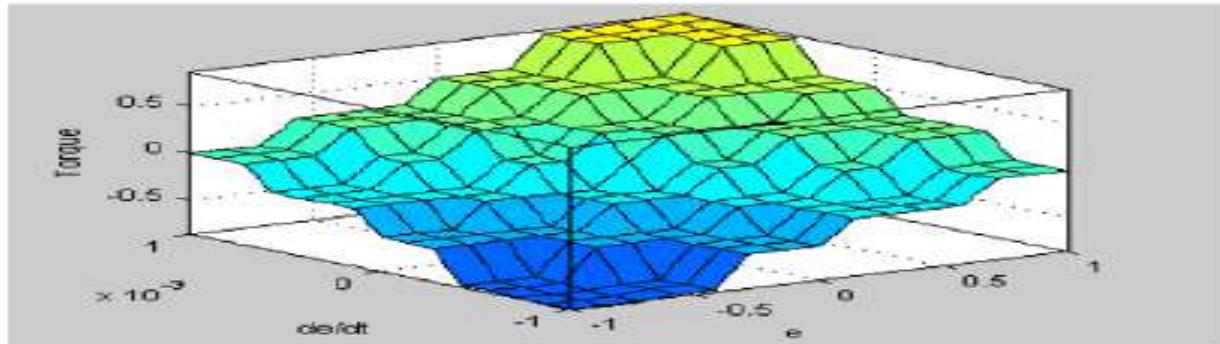
e	NB	NM	NS	ZE	PS	PM	PB
de	NB	NB	NM	NM	NS	NS	ZE
NB	NB	NM	NM	NS	NS	ZE	PS
NM	NB	NM	NM	NS	NS	ZE	PS
NS	NM	NM	NS	NS	ZE	PS	PS
ZE	NM	NS	NS	ZE	PS	PS	PM
PS	NS	NS	ZE	PS	PS	PM	PM
PM	NS	ZE	PS	PS	PM	PM	PB
PB	ZE	PS	PS	PM	PM	PB	PB

**Fig.3 Rule base**

The fuzzy if-then statements are symbolically expressed with the form If  $e$  is ( $e$ ) and  $e \Delta$  is ( $de$ ) then  $\omega \Delta$  is ( $e+de$ ). The command signal is obtained from fourty-nine rules witch all have the same weight. To tune the FLC, it is possible to change the two values pk and D k . Fig.4 shows the control surface of our FLC. The surface can take any shape based on our design of membership functions and rules that eventually this nonlinear surface can cope with nonlinearities of the system.

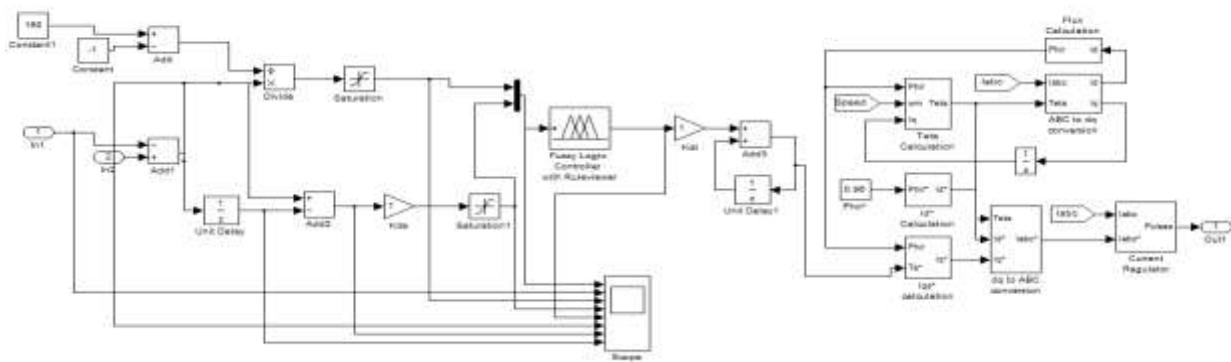
## V SIMULATION RESULTS

The response of the controller will be investigated with the Matlab/Simulink simulation program, the FLC, and Sim Power Systems (SPS) tool-boxes. The induction motor is fed by a current-controlled IGBT inverter which is built using a Universal Bridge block as presented in Fig.5.



**Fig 4 Rule Base Surface**

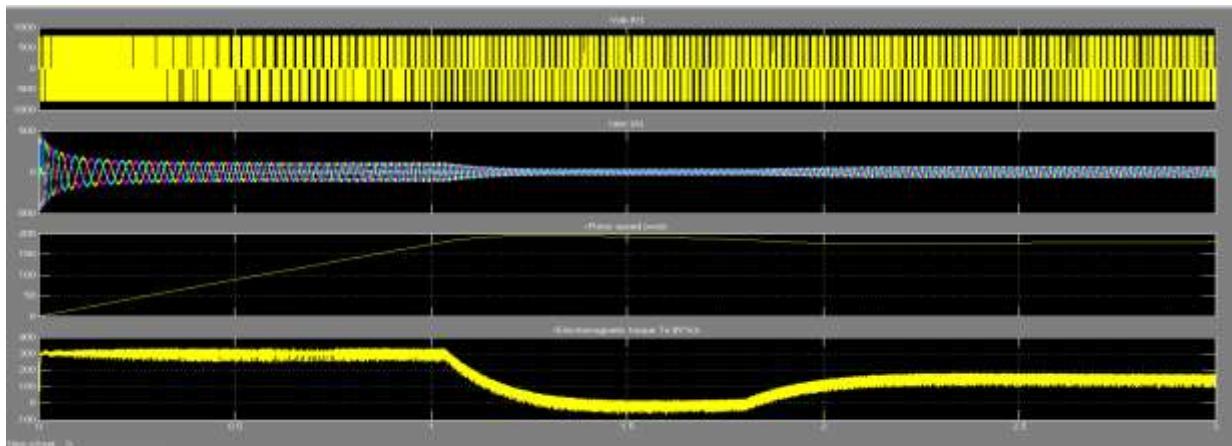
Several tests were performed to evaluate the performance of the proposed FLC based vector-control of the IM drive system in MATLAB/SIMULINK. The speed-control loop of the drive was also designed and simulated with the PD controller in order to compare the performances to those obtained from the respective FLC based vector-control. The speed responses are observed under different operating conditions such as a sudden change in command speed, step change in load etc. some sample results are presented in following section [7].



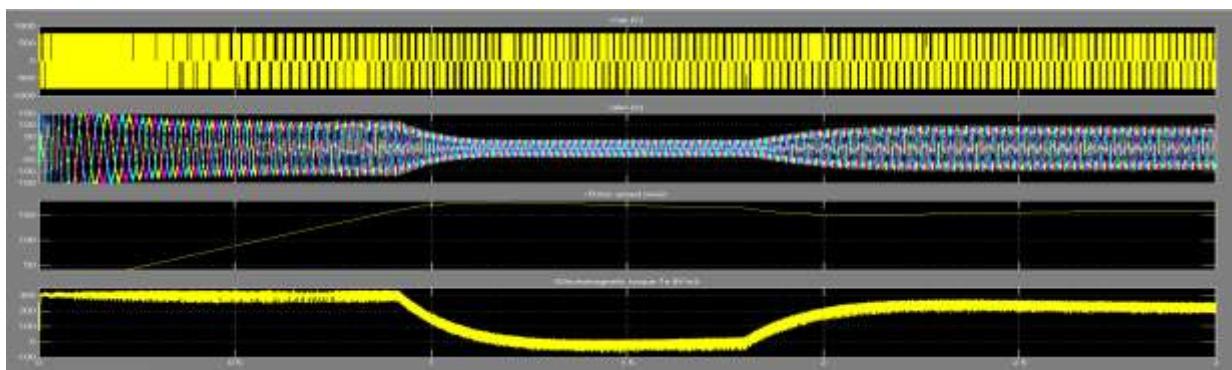
**Fig.5 Fuzzy Logic Controller**

In this work, we proposed a hybrid FLC based vector-control in order to overcome the disadvantages of PI in vector-control. Fig.5 shows a circuit diagram for this hybrid controller. Furthermore, compared with the experimental

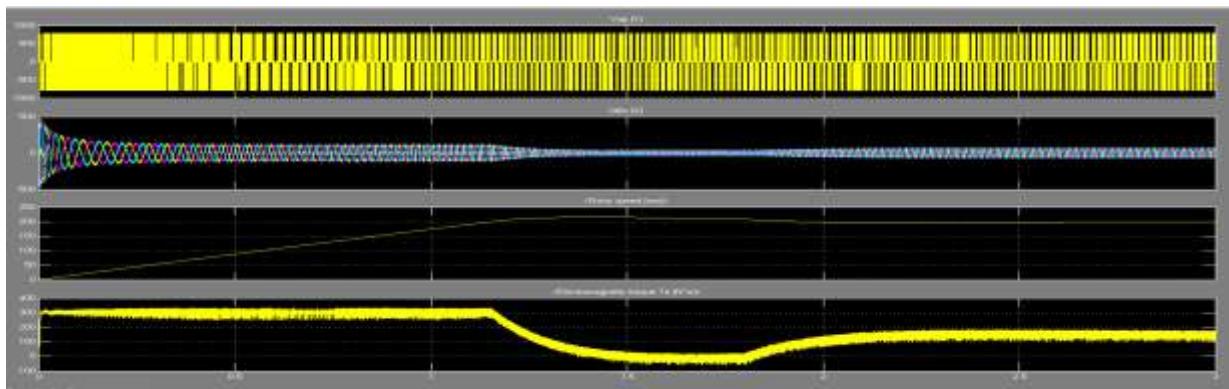
results of the PD with fixed parameters control system shown in Fig.6, Fig.7 and Fig.8 the responses are improved using the proposed FLC based vector-control.



**Fig.6 Result Iab, Vabc, Speed, Torque**



**Fig.7 Result Iab, Vabc, Speed, Torque**



**Fig.8 Result Iab,Vabc,speed,Torque**

The motor speed follows its reference with zero steady-state error. On the other hand, the PD/vector-control shows steady-state error with a high starting current. It is to be noted that the speed response is affected by the load conditions. This is the drawback of a PD/vector-control with varying operating conditions. The FLC based vector-control gives better responses in terms of over-shoot, steady-state error, and fast response. These results also show that the FLC based Vector-control can handle the sudden increase in command speed quickly without overshoot, under-shoot, and steady-state error, whereas the PD/ vector-control has steady-state error, Thus, the proposed FLC-based drive has found superior to the conventional PD/vector-control.

## VI CONCLUSION

The results section show that the performance of FLC based vector-control is superior to that with PD/vector-control. Thus, by using FLC the transient and steady state response of the induction motor has been improved noticeably. The robustness of the response is evident from the results. Since exact system parameters are not required in the implementation of the proposed controller, the performance of the drive system could be claimed to be robust, stable, and insensitive to parameters and operating condition variations. The performance has been investigated at different dynamic operating conditions. It is there for concluded that the proposed FLC based vector-control has shown better performance over the PD/vector-control.

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# **PCR FOR DETECTION OF ISOLATED *PSEUDOMONAS AERUGINOSA* AND *SALMONELLA TYPHI* BY AMPLIFICATION OF ETA GENE AND INVA GENE FROM DIFFERENT WATER SAMPLES**

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Mashu Trivedi<sup>4</sup>, Deepesh Kumar<sup>5</sup>**

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## **ABSTRACT**

*Pseudomonas aeruginosa* and *Salmonella typhi* are bacterium, water borne pathogens. *P. aeruginosa* causes critical insinuation in animals as well as humans especially in children and immune-compromised patients and *Salmonella typhi* causes diseases in humans and higher primates, it is dispatched through water and urine of infected humans, mammals and bird. Five water samples were collected from picnic spots in Agra —TAJ MAHAL, AGRA FORT and FATEHPUR SIKRI and all were positive for ETA gene and InvA gene using specific primers and showed 396-bp and 373-bp fragments respectively on 1.6% agarose gel electrophoresis. The identity of the amplified 396-bp and 373-bp fragments were confirmed by sequencing. Specific primers amplified the ETA and InvA positive *P. aeruginosa* and *Salmonella typhi* genomic DNAs. Whereas other species of *Pseudomonas* and *Salmonella* bacteria did not yield any 396-bp and 373-bp fragment. The findings suggest that water from these sites poses a health risk to communities that rely as primary sources for domestic, pet and subsistence irrigation use. Regular monitoring of the water microbiological quality and public health education to avoid consumption of untreated water are vital to ensure the reduced waterborne diseases in low-income countries.

**Keywords:** Density gradient Centrifuge, *P. aeruginosa*, PCR based detection, *Salmonella typhi*, Water borne diseases.

## I INTRODUCTION

Waterborne pathogens present a greater health risk to people using river water for drinking, bathing, irrigation of crops eaten raw, fishing, and recreational activities (Liu et al., 2006; Hellweger and Masopust, 2008). Epidemiologic reports show a correlation between use of river water contaminated with pathogenic bacteria and disease outbreaks (Nyogi, 2005; Hammer et al., 2006; Abraham et al., 2007). *Pseudomonas aeruginosa* is an opportunistic pathogen competent of infecting both humans and animals. Van der Waaij (1982) observed that 10 to 100 cells of *P. aeruginosa* can lead to gut colonization in patients who are in intensive care units and immunosuppressed. Ohman et al. (1980) and Hazlett et al. (1978) have report that 104 cells of *P. aeruginosa* per ml can lead to ocular infection in mice.

*P. aeruginosa* producing relatively hefty quantity of exotoxin A (ETA) and proteases at the level of 107 cells per ml in drinking water of mice can cause endogenous bacteremia in few days (Furuya, N., Y. et al., 1993; Hirarkata, Y. et al., 1991). *P. aeruginosa* produces two different ADP-ribosyltransferase toxins: ETA and exoenzyme S (Bever, R A. et al., 1988; Bodey, G. P. et al., 1983; Iglewski, B. H. et al., 1975; Liu, P. V. 1974; Woods, D. E., et al., 1983). The highly toxic ETA is produced by the majority of *P. aeruginosa* strains and can inhibit eukaryotic protein biosynthesis at the level of polypeptide chain elongation factor 2, (Woods, D. E., et al., 1983). Gray et al. (1984) have cloned and sequenced the ETA structural gene from a *P. aeruginosa* strain overexpressing ETA.

Although traditional microbiological methods for identifying *P. aeruginosa* from environmental samples are reliable, but they are tedious and time consuming. PCR has the uniqueness for identifying microbial species rapidly by amplification of gene sequences unique to a particular organism (Saiki, R. K. et al., 1988), and several PCR-based, DNA probe methods have been developed to detect various pathogens from clinical, water, and food samples (Bej, A. K. et al., 1991; Fields, P. I., T et al., 1992; Hill, W. E., et al., 1991). However, the prospective application of PCR for environmental monitoring of pathogenic *Pseudomonas* strains has not been reported. In this paper, we report molecular identification of *P. aeruginosa* contamination of water samples at public place using rapid PCR procedure to specifically detect *P. aeruginosa* strains in environmental samples by amplifying the ETA structural gene (Ashraf A. Khan et al., 1994).

Food industries and Poultry products have been involved as a source of *Salmonella* infection in human(Amavisit et al. 2001). To found principles method to detect and identify salmonella are time taking and include selective enrichment and plating followed by biochemical tests (Bennasar et. al, 2000,Burtcher et. al, 1999; Chiu and Jonathan, 1996).

## II MATERIALS AND METHODS

**Sample collection & Isolation:** Five samples were aseptically collected from three different sites, namely river, pond & tap, from picnic spots in Agra —TAJ MAHAL, AGRA FORT and FATEHPUR SIKRI. 10 ml water sample

was collected from each site. The isolation was performed following serial dilution and then plating on cetrimide agar and incubated at 42 °C for 48 h. Colony was picked and LB broth culture was grown for 24 h at 37°C.

**DNA isolation:** Bacterial pellet was obtained from 1 ml broth culture. And the DNA was extracted with minor modification. Bacterial pellet was washed in 1 ml of 0.1 M NaCl, again centrifuged and washed in 1ml of a TE buffer (50mM Tris-HCl [pH 8.0], 50mM EDTA), centrifuged at 15000\*g, and again resuspended in 1.0 ml TE buffer. 200µg of lysozyme (Sigma) was added, and the mixture was incubated at 37°C for 30 min. 30 µl of 20% Sodium dodecyl sulphate was added, and incubated at 65°C for 10 min. 60 ul of proteinase K (10mg/ml) (Sigma) was added and incubated at 37°C for 1 h to complete the lysis. Extraction was done twice with 1ml of phenol-chloroform solution. DNA was precipitated from aqueous phase with 0.5 M ammonium acetate and 2.5 volumes of chilled ethanol for 2h at -20°C. The precipitated DNA was then dissolved in a TE buffer. The integrity of the extracted DNA was assessed by electrophoresis in a 1.6% agarose gel and finally used for PCR.

**PCR amplification:** PCR was performed in DNA thermal cycler (Perkin Elmer) using extracted DNA & *P. aeruginosa* specific structural Exotoxin A gene primers and *Salmonella typhi* specific *InvA* gene primers. PCR reaction mixture (25ul total volume) consist of 1X PCR buffer (10mM Tris-HCl [pH 8.3]), 50mM KCl, 1.5mM MgCl<sub>2</sub>, 0.1% triton X-100, dNTP mix 200 uM each, 10 picomoles of each primer (Ashraf A. Khan et al., 1994) (forward 5'-GACAACGCCCTCAGCATCACCAGC-3'; reverse 5'-CGCTGGCCATTGCTCCAGCGCT-3'), taq DNA polymerase 0.5U, DH2O make upto 25 ul, 1.0 ul template DNA (~30ng). The reaction mixture was cycled 35 times as follows: initial denaturation at 94°C for 5min, 35 cycles of 1 min denaturation at 94°C, 1 min annealing at 68°C and 1 min extension at 72°C and then lastly final extension at 72°C for 7 min and hold at 4°C. 8 ul of PCR product was mixed with 2 ul loading buffer & electrophoresed on 1.6% agarose gel and visualized using UV trans-illuminator (312 nm wavelength) similarly above procedure repeated for *Salmonella typhi*. The PCR product was finally sent to Bioserve Pvt. Ltd, Bangalore for sequencing, for confirmation and further analysis.

### III RESULT AND DISCUSSION

**Bacterial isolation and culture:** The isolation was done following serial dilution and then plated on cetrimide agar and incubated at 42°C for 48 h then single colony isolation respectively in fig 1b,c and d. *P. aeruginosa* typical light green colony appeared (figure 1a). Colony was picked and LB broth culture was grown for 24 h at 37°C.

**DNA isolation:** Genomics DNA was isolated using modified method. The integrity of the extracted DNA was assessed by electrophoresis in a 1% agarose gel (figure 2).

**PCR amplification & identification:** *P. aeruginosa* and *Salmonella typhi* contamination in collected water samples were identified using PCR amplification for *P. aeruginosa* specific structural Exotoxin A gene primers (forward 5'-GACAACGCCCTCAGCATCACCAGC-3'; reverse 5'-CGCTGGCCATTGCTCCAGCGCT-3') and *Salmonella*

*typhi* specific *InvA* gene primers (forward 5'-tgtccgctgtctgaagtc-3', reverse 5'-atctcaggcaaactcacaaggg-3'). All the five water samples were positive for *P. aeruginosa* and *Salmonella typhi* contamination and showed up 396 bp and 373 bp PCR amplification for *P. aeruginosa* specific structural Exotoxin A gene and *Salmonella typhi* specific *InvA* gene respectively on 1.6% agarose gel electrophoresis. The PCR product were sent for sequencing (Bioserve Bangalore). 396 bp 373 bp sequence confirmed the *P. aeruginosa* specific structural Exotoxin A gene sequence and *Salmonella typhi* specific *InvA* gene sequence (fig-3).

#### IV CONCLUSION

The microbiological contamination of water samples from Picnic spots *in Agra —TAJ MAHAL, AGRA FORT and FATEHPUR SIKRI* were unacceptable for drinking water and agricultural use. The findings advocate that water from these sites is not potable, and poses a health risk to population that rely on it as primary sources of conjugal and subsistence irrigation or animal use. These findings in water scarce region of the world underline the challenges a number of developing countries are facing currently and in long-term into the future. Lessons learnt in this study would recommend suitable measures to control water pollution to ensure availability of clean water supplies to large public places. Regular monitoring of the water microbiological quality, and public health education to avoid utilization of untreated water from these public places, are vital to ensure the reduced waterborne disease burden in low-income countries.

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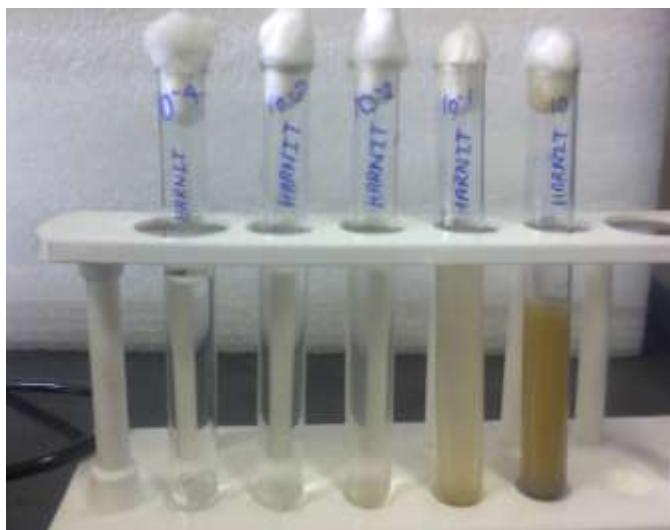
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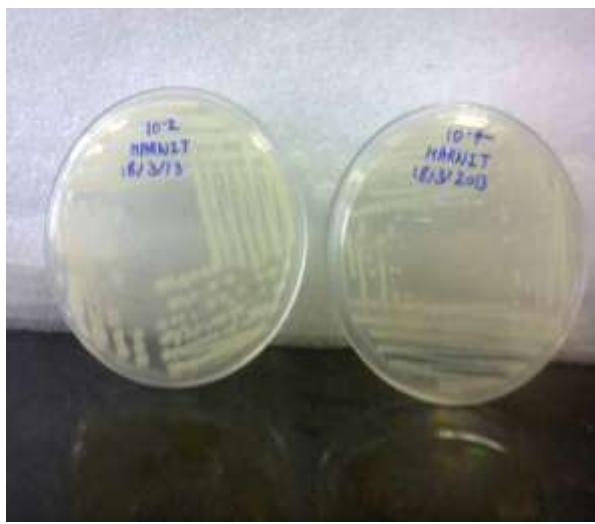
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**Fig-1a:-Serial dilution of water samples    Fig-1b:- Plate culture of *Pseudomonas aeruginosa* on cetrimide agar**

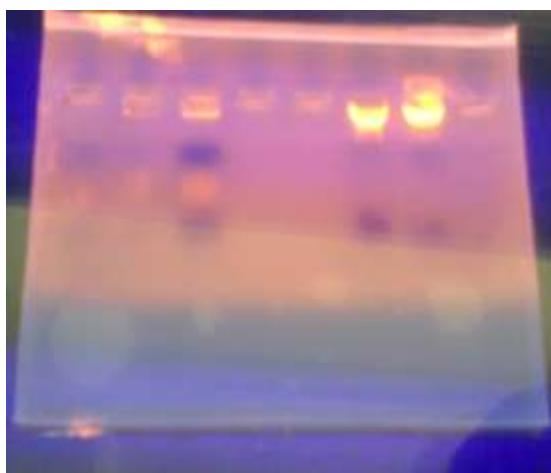




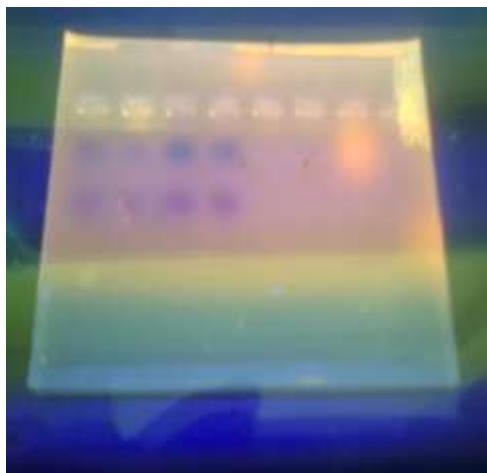
**Fig-1c:-Steak culture of *Salmonella typhi***



**Fig-1d:-Steak culture of *Pseudomonas aeruginosa***



**Fig-2:- Genomic DNA band**



**Fig-3:- Amplification of a single product of 396 bp and 373 bp**

atcggtctgaccaccgaaaggcgctgttgccgcgcctcggtggcaggcgcatggcagatcgacggtaccgctggc  
tttgcacccgcgttcaggttacgtttgcgtggggaaaggccccatatttagggcatccatgccaggcgtaacgaacgtatcg  
ggcggttggctgcattgtcgccagtccggagacttaggtcagactggcaagccacggccatcaccgagggtgctgaag  
ccaggaccggcaggacggcaatgcgtcgatggcattgtcgatggcataagtattggcagccctgatcgccgcttg  
cgctgcggcggtggcgaccggcattggcgtggcataagtattggcagccctgatcgccgcttg

**Fig 4. The 5'-3' nucleotide sequence of the 396 bp fragment amplified of ETA gene of *Pseudomonas aeruginosa***

# OBJECT ORIENTED MODELING OF ELGAMAL DIGITAL SIGNATURE FOR AUTHENTICATION OF STUDY MATERIAL IN E-LEARNING SYSTEM

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## ABSTRACT

*E-learning is now-a-days playing a vital role in our learning process. One of the most challenging things for developers in e-learning system is to secure data transmission. Being a fully online system, during transmission of study materials from developer to student, hacker can change or destroy those. At a student's point of view, non-repudiation is also an important issue in e-learning system. In this paper, we have only consider transmission of the study materials from developer to student, where verification of digital signature will check the hacking and the developer can't deny from sending the material. To provide authenticity and strong non-repudiation, we wrapped the ElGamal Digital Signature in object oriented models to get the also the benefits of the object oriented approach.*

**Keywords:** *ElGamal Digital Signature, E-learning, Activity diagram, Use case model, Sequence diagram, Class diagram, Collaboration Diagram*

## I INTRODUCTION

An e-learning system is totally a network-based and computerized online transaction system. Security issues of an e-learning system is Privacy, Integrity, Availability and Non-repudiation<sup>[8]</sup>. Here secrecy means only the authorized persons can access the information. Integrity means only the authorized persons can change or modify data. Availability means that if the network is too slow, then the student will face difficulty while giving exam or downloading study materials. Non-repudiation means no one can deny after sending any online documents. Let us consider a situation of an e-learning system, where the institute sends an incorrect result to a student. Now when the student will call the administrator about the result, he/she can deny about the sending of the result. This kind of situation can be handled using digital signature. In this paper we use object oriented models of ElGamal Digital Signature Algorithm<sup>[9,10]</sup> for authentication of study material. The discrete logarithm problem required for ElGamal Digital Signature is quite tedious and it is not so easy to calculate sender's (here developer) private key from the digital signature. The hardness of solving the logarithm problem in any cyclic group makes this algorithm better than RSA. In the ElGamal Digital Signature, we have to consider two universally known data: generator and modulus and one hash function. Developer selects a private key, an

ephemeral secret key, calculates a public key, an ephemeral public key, receives the study material from the teacher, and generates a hash value and digital signature. Then the developer sends the two public keys, study material and the signature to the student. Now the student will reuse the signature for authentication. If the signature authentic, then the student will accept the study material, otherwise, they will reject the study material and request developer for sending the material again. In the meantime, the hacking is also checked out. During the sending of study material from developer to student, hackers can change or damage the material<sup>[4]</sup>, which make a bad impression for the institution. In this competitive market<sup>[6]</sup>, the developer should pay a great attention to save their study materials from hacking. The ElGamal Digital Signature also help the student to check whether the study material is manipulated or not during transmission. This makes a good image for the institution in students' mind.

In this paper, we present, the object oriented models<sup>[5,7]</sup> with the help of activity diagram, sequence diagram, use case model, collaboration diagram and class diagram of ElGamal Digital Signature. With the use of object oriented design<sup>[1]</sup>, we can improve signature by eliminating redundant code, extending the use of existing classes or reusing the codes, which is the recent trend of software engineering. Using data hiding properties, we can also hide the data from the outside world, which is also a benefit of using object oriented programming.

In section II, we have design the object oriented models like, activity diagram, use case diagram, sequence diagram and collaboration diagram. In sections III we have discussed about the class diagram of the proposed e-learning system. Finally, we have concluded in section IV by highlighting some future scopes.

## **II OBJECT ORIENTED ANALYSIS AND DESIGN**

### **2.1 Activity Diagram**

Activity diagram is a tool of UML, showing relationship between the activities of the different components of a system for better understanding<sup>[12]</sup>. Here we use the activity diagram to show the links between the activities of the two main components of the e-learning system: Developer and Student. Activity diagram is mainly used during the initial stages of requirement analysis and specification<sup>[7]</sup>. The activity diagram of the Elgemal algorithm to create a Digital Signature, related with e-learning system, is shown in the fig.1 in the annexure.

### **2.2 Use Case Diagram**

In this Use case diagram, shown in fig.2 and fig.3, in the annexure, we use two objects: Developer and Student. First of all, two universally known numbers, a generator and a modulus, and a universally known hash function are selected. From these two numbers, the developer calculates an ephemeral public key and a static public key. Then the developer receives the study material from the teacher and uses the hash function combined with the ephemeral public key. After that, the developer creates the ElGamal signature and sends the static public key, ephemeral public key, study material and signature to student. These all things are shown in the fig.2. In the fig.3, we have discussed about the ElGamal signature verification. Signature verification occurs at the student end. After receiving all the public keys and signature and study material, student first compute the hash function and then verify the signature for the authentication. If the received signature is authentic, then the study material is accepted otherwise it is rejected.

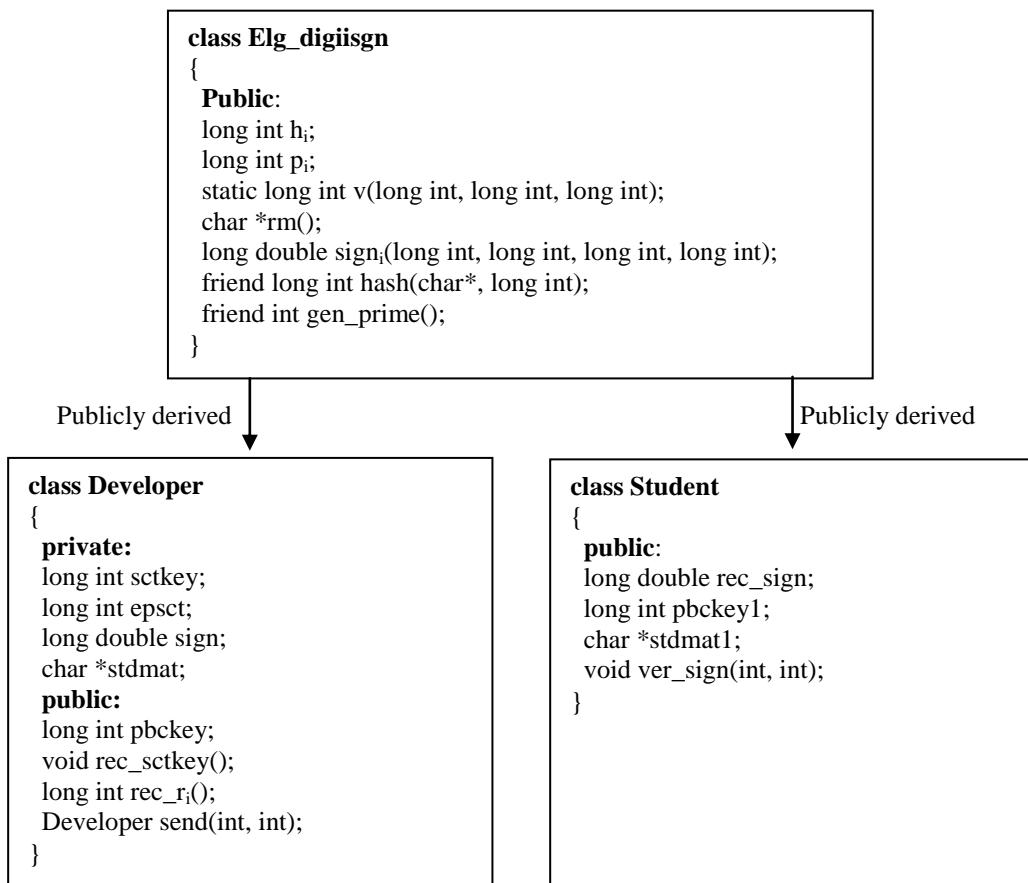
### 2.3 Sequence Diagram

A sequence diagram<sup>[2,7]</sup> shows the interaction among objects as a two dimensional chart. The chart is read from top to bottom. The sequence diagram is shown in fig.5, in annexure, where developer sends the study material along with the digital signature, which is generated using ElGamal Digital Signature Algorithm, to the student and the student, before accepting the study material, verifying the signature for authentication. In an e-learning system, when developer sends the study material to the student, he/she also sends the static public key, ephemeral public key and digital signature. After receiving all of these from the developer, students calculate the hash value and verify the signature.

### 2.4 Collaboration Diagram

Collaboration diagram<sup>[7]</sup> is one kind of UML interaction diagram. The purpose of this diagram is to emphasize on the structural organization of the objects that sends and receive messages<sup>[11]</sup>. Here we use the collaboration diagram in fig.6, to show the structural behavior and message flow between the objects in an e-learning system, and it also describes the structural organization and interaction among the objects of the same system.

## III CLASS DIAGRAM



**Fig.4: Class Diagram of ElGamal Digital Signature for signature creation and verification**

### **3.1 Analysis of class diagram**

The inheritance diagram<sup>[1,3]</sup> of ElGamal Digital Signature is shown in the above fig.4. This diagram includes three classes: Elg\_digiisgn, Developer and Student. The individual classes are discussed below:

#### **Class Elg\_digiisgn**

This is the base class which does not contain any object. The main aim to use this class is for the inheritance. It has two data members and five member functions which is inherited publicly by two other classes: Developer and Student. The functions of the data members and member functions are discussed below.

#### **Public members**

```
long int h; //It is used to store the hash value
long int p; //It is used to store value of the ephemeral public key
static long int v(long int, long int, long int); //this function is used to calculate the public key
char *rm(); //this function is used to read the study metrial and returns it to the calling function
long double signi(long int, long int, long int, long int); //this function is used to generate a signature of the
input study material
friend long int hash(char*, long int); //this is a friend function of this class and used to calculate the hash of the
study material
friend int gen_prime(); //this is also a friend function of this class and used to generate prime number and
return the prime number to the calling functions.
```

#### **Class Developer**

This class is publicly derived from the base class Elg\_digiisgn. This class contains four private data members and one public data member and three public member functions. The private data member can be accessed by only the class Developer and the public data members are accessible by class Developer and also by the member functions of other classes. All of these members are discussed below:

```
long int sctkey; //it is the secret key of the developer
long int epsct; //it is the ephemeral secret key of the developer
long double sign; //it is the sign of the study material
char *stdmat; //it is the study material received by the developer from the teacher
```

#### **Public members**

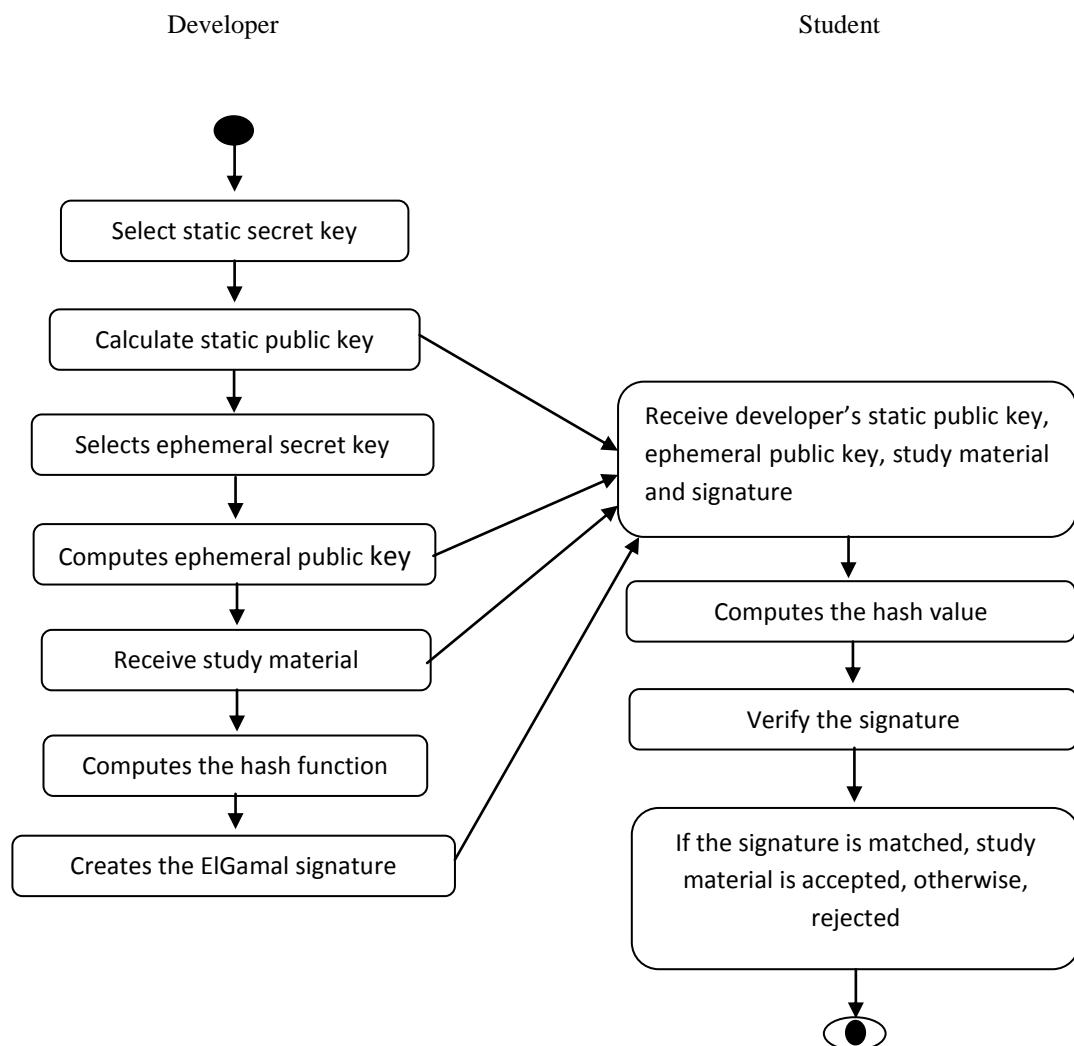
```
long int pbckey; //it is the public key of developer
void rec_sctkey(); //it is used to get the secret key
long int rec_ri(); //it is used to get the ephemeral key and return to the calling function
Developer send(int, int); //it is used to send the signature, public key and the study material to student.
```

**Class Student**

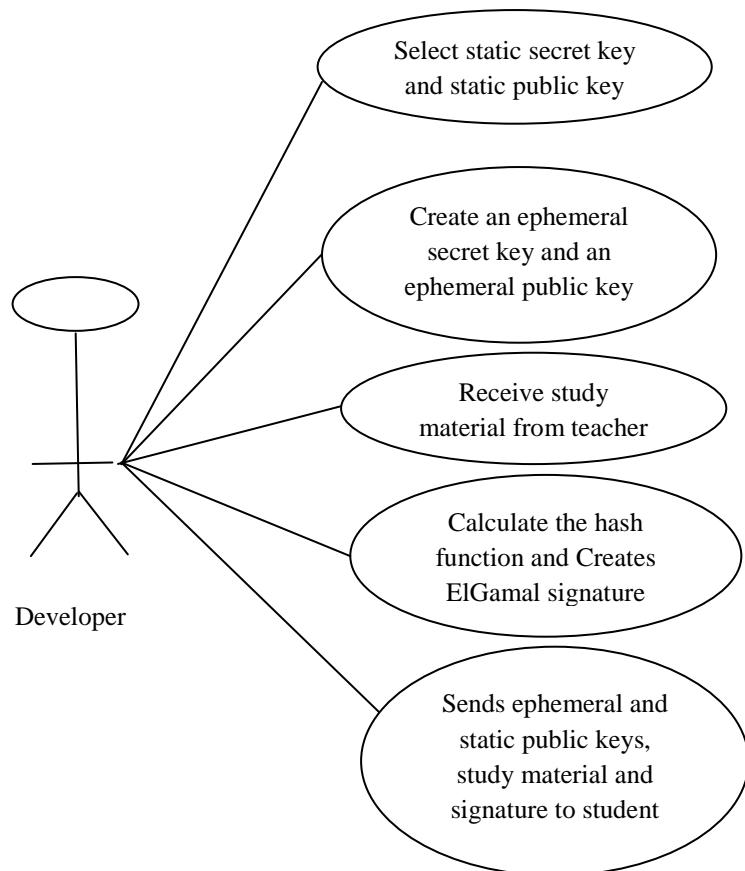
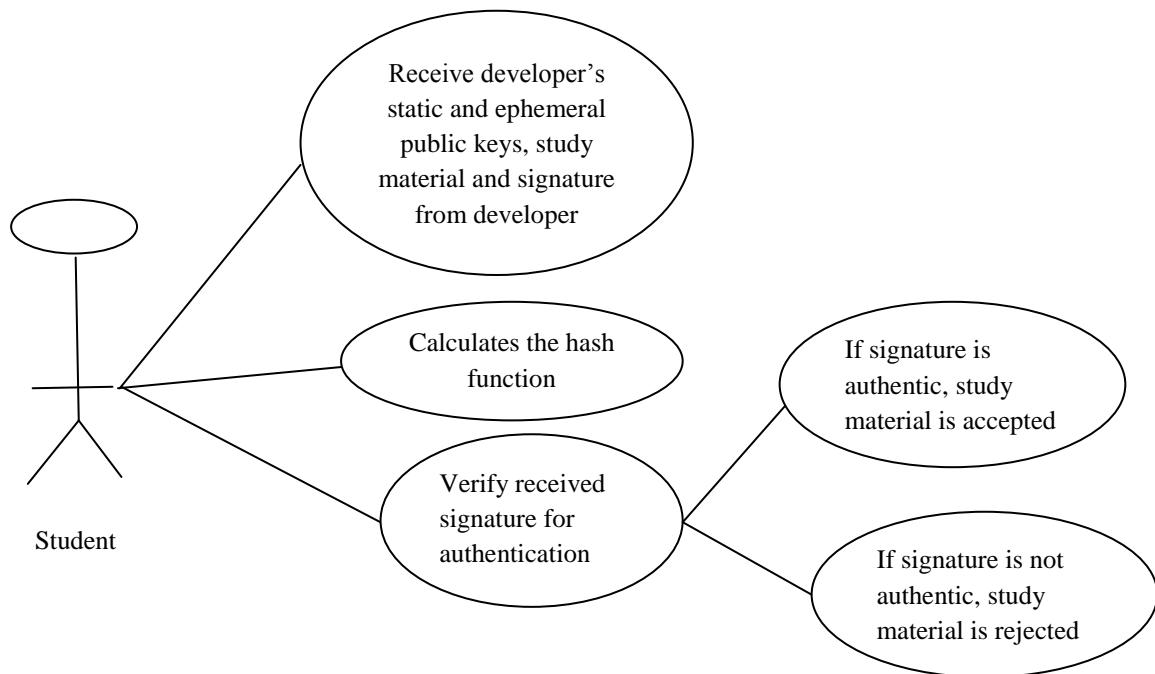
This class is publicly derived from the base class Elg\_digiisgn. It contains three data members and one member function. The functions of these members are discussed below:

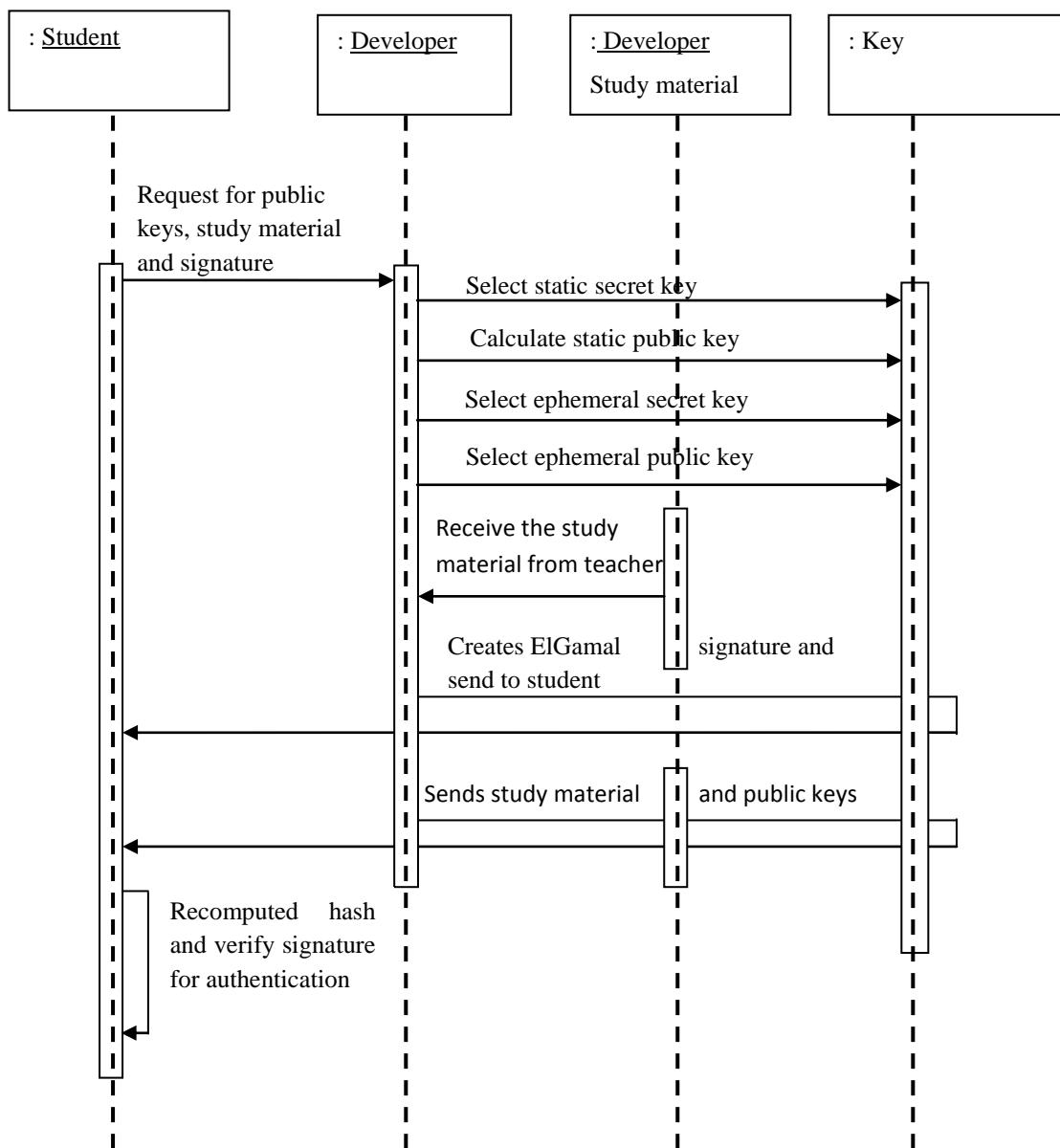
**Public members:**

```
long double rec_sign; //it is used to receive the signature from the developer
long int pbckey1; //it is used to receive the public key from the developer
char *stdmat1; //it is used to receive the study material from the developer
void ver_sign(int, int); //this function is used to verify the signature
```

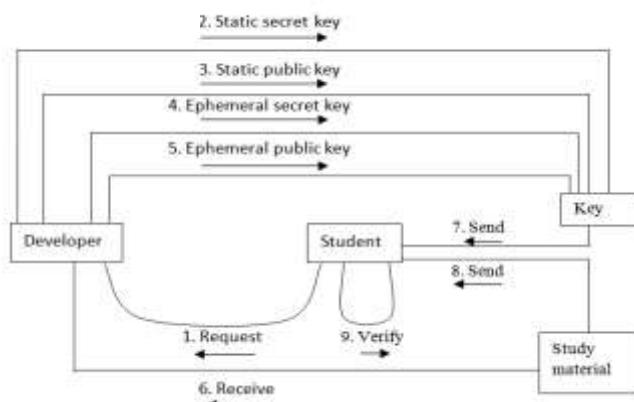
**ANNEXURE**

**Fig.1: Activity diagram for sending study material from developer to student using ElGamal Digital Signature**

**Fig.2: Use case diagram for ElGamal signature generation****Fig.3: Use case diagram of ElGamal signature verification**



**Fig.5:** Sequence diagram for ElGamal Digital Signature based on e-learning system



**Fig.6:** Collaboration Diagram for sending study material using ElGamal Digital Signature in e-learning system

#### IV CONCLUSION

The proposed models, we use in this paper, are utilizing the benefits of Object Oriented Programming. This object oriented approach of ElGamal Digital Signature Algorithm can be used for other types of transmissions in e-learning system, like transmission of registration certificate, admit card, score card etc. This approach is also applicable for secure transmission in other online systems, like e-banking, e-commerce, e-governance etc.

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- [12] [http://www.tutorialspoint.com/uml/uml\\_activity\\_diagram.htm](http://www.tutorialspoint.com/uml/uml_activity_diagram.htm)

# ERROR COVARIANCE ESTIMATION IN OBJECT TRACKING SCENARIOS USING KALMAN FILTER

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## ABSTRACT

*Detection and Tracking is considered as the primary step in the computer vision applications such as video surveillance, target tracking applications in defense, optimization of traffic control and in human interaction. Especially in object tracking scenarios there will be an uncertainty in finding the exact location of the target object or objects. In order to measure the uncertainty, error covariance estimation is considered. However a best estimate is made by combining the knowledge of prediction and correction mechanism which were incorporated as part of Kalman filter design. The tracking results obtained are presented for discussion.*

**Keywords:** *Computer Vision, Error Covariance, Frame Differencing, Gaussian Noise, Kalman Gain, Kalman Filter.*

## I INTRODUCTION

Computer vision applications are primarily concerned with scene analysis. The scene analysis is about recognizing the activities in a scene and assimilating the information from the sequences of images as a whole. There are two types of scene analysis [1] one is static and the other is dynamic. Static scene analysis is about recognizing and understanding the activities of static objects from a stationary camera. However there is a little scope of its application in current day applications. Whenever we observe a scene from a video, activities in scene despite being static keep on changing or moving rapidly within a snapshot of time. The change in the scene may be due to motion of camera or object. However system should be able to detect the changes that are going on rapidly over stationary or non stationary background. The dynamic scene analysis can be done in three ways i.e. stationary camera among moving objects (SCMO), moving camera among stationary objects (MCSO) and moving camera among moving objects (MCMO). As the researcher goal is to identify the objects of interest, track the motion and compute the characteristics of the motion, SCMO gained much attention in this regard. However an active research has been going progressively in this field over a few decades and as a result, several algorithms have been evolved. Nevertheless a robust, accurate and high performance approach is still a great challenge today in this regard. Most challenges arise from the image variability of video because video objects generally are moving objects. As an object moves through the field of view of a camera, the images of the object may change dramatically. This variability comes from three principle sources: variation in target pose or target

deformations, variation in illumination, and partial or full occlusion of the target. In our paper the discussion is about determining the motion characteristics of moving object when encountered with occlusions. For critical evaluation frame differencing algorithm are chosen for object detection and kalman filter is chosen for object tracking. Kalman filter algorithm is used for tracking single object from a stationary camera under two cases. One is the target object moving with constant velocity without occlusions and the other is with occlusions. In each case tracking efficiency is determined with error covariance estimation.

## II PRESENT WORK

To start with, the experiment is conducted on single object moving with a variable and constant speed without any occlusions. In this perspective a video is captured by Canon 550D camera with lens of 18.55mm and is used for motion analysis. For target identification frame differencing technique is applied .In this frame differencing technique [2] a current frame is always subtracted from its previous frame by using image subtraction operator. The resulting differenced image is transformed to binary image by applying grey thresolding. For the removal of blur [3] (considered as gaussain noise) in differenced image due to linear motion or unfocussed optics, filtering operation is applied. As it is known that Wiener filter is suitable for reconstruction of signal from the noisy image, it is chosen for image filtering operation. Finally morphological operations are applied for removal of image imperfections. For each of the moving object that is identified in the preprocessed image, the centroid is computed. This centroid represents the moving object in each of the differenced images [4].The whole process is summarized as follows:

### 2.1 Algorithm

1. Read the video file
2. Starting from the 2<sup>nd</sup> frame find the difference between two successive frames using image subtraction operator.
3. Calculate the threshold (T) value for the differenced image by applying grey thresolding technique.
4. Apply the threshold to each of the differenced frame and convert to binary image.
5. For each of the differenced frame containing binary image apply, image filtering techniques for noise removal and morphological operations for image perfection
6. store the centroid values for all the differenced frames
7. Generate the trajectory for the detected locations (centroids).

It is found that previous observations that tracking results are not precise, as it is encountered with false detections and also estimated path of the moving object is distracted. In order to make good estimate, prediction and correction mechanisms are implemented as part of Kalman filter Design. In this regard frame differencing algorithm is chosen for object detection but the motion of each track is estimated by Kalman filter. As point representations are more suitable [5] for representing objects occupying small regions in a space, an object is represented as centroid for motion analysis and is used as image measurement for tracking. In the first step [6] state of an object is predicted with a dynamic model and error covariance is estimated and is corrected with the

observation model so that error covariance is minimized. The procedure is repeated for successive iterations till the end of the frame

## 2.2 Mathematical Model

Dynamic model describes [7] the transformation of state vector over time.

$$\dot{x}(t) = \frac{d}{dt} x(t) = f(x(t), m(t)) \dots \dots \dots (1)$$

Where  $\dot{x}(t) = dx/dt$ ;

$m(t)$  represents white noise

$x(t)$  represents the state vector of an object.

In the experiment we have chosen position, distance and velocity as the parameters of state vector.

Where  $s(t)$  represents distance

$v(t)$  represents velocity

$A$  is a Transformation matrix which is treated as a constant.

The observation model represents the relationship between the state and measurements

Where  $H$  is the observation matrix and is constant,  $w(t)$  is the measurement noise with covariance matrix  $R(t)$ .

The predicted state ( $\hat{x}(t)$ ) is calculated by neglecting the dynamic noise and solving differential equation

The state vector at time  $t$  can be expressed by a Taylor series with respect to the approximate state  $\bar{x}(t_0)$ .

$$x^-(t) = x^-(t_0) + \dot{x}^-(t_0)(t-t_0) + \frac{1}{2} \ddot{x}^-(t_0)(t-t_0)^2 + \dots \quad (6)$$

By using equation (4) this can be rewritten as

$$x^-(t) = x^-(t_0) + A \cdot x^-(t_0)(t-t_0) + \frac{1}{2} A^2 x^-(t_0)(t-t_0)^2 + \dots \quad (7)$$

In other words the actual state is expressed as linear combination of the initial state  $\psi(t_0)$ .

$$\dot{x}(t) = \dot{\phi}_0^t \cdot x(t_0) \dots \dots \dots \quad (8)$$

$\Phi_0^t$  Is called the state transition matrix, which transforms any initial state  $x(t_0)$  to its corresponding state  $x(t)$  at time t.

By Substituting eq (7) and (8) in eq (5), we get

$$x^-(t) = A \cdot x^-(t_0) + \phi_0^t \cdot x^-(t_0). \dots \dots \dots \quad (9)$$

Substitute eq(9) in eq(1)

$$\dot{x}^-(t) = \frac{d}{dt} x^-(t) = \frac{d}{dt} [\phi_0^t \cdot x^-(t_0)] = \left[ \frac{d}{dt} \phi_0^t \right] \cdot x^-(t_0) \dots \dots \dots \quad (10)$$

By comparing eq (9) and (10)

With the initial matrix  $\phi_0^0 = I$ , because  $x^{-}(t_0) = I$ .  $x^{-}(t_0)$

The covariance matrix  $P^-(t_i)$  of the predicted state vector is obtained by the law of error propagation and is given as

## Q-system noise

Error propagation is the problem of finding the distribution of a function of random variables.

As covariance matrix of the **noise**  $\mathbf{Q}(t)$  is a function of time eq(12) is rewritten as

**In the correction step the predicted state vector  $\hat{x}^-(t_i)$**  is improved with observations made at the time  $t_i$ , the corrected state has the form

With the covariance matrix

Where  $\Delta P(t_i) = E[\Delta \mathbf{x}(t_i) \Delta \mathbf{x}(t_i)^T]$

This condition is compiled with

$$\Delta \textcolor{blue}{x}(t_i) = P^{-} H^T (H P^{-} H^T + R(t_i))^{-1} \cdot (l(t_i) - H \textcolor{blue}{x}^{-}(t_i))$$

$R(t)$  – measurement noise

With

$$\mathbf{K}(t) = \mathbf{P}^{-1} \mathbf{H}^T (\mathbf{H} \mathbf{P}^{-1} \mathbf{H}^T + \mathbf{R}(t,:))^{-1}$$

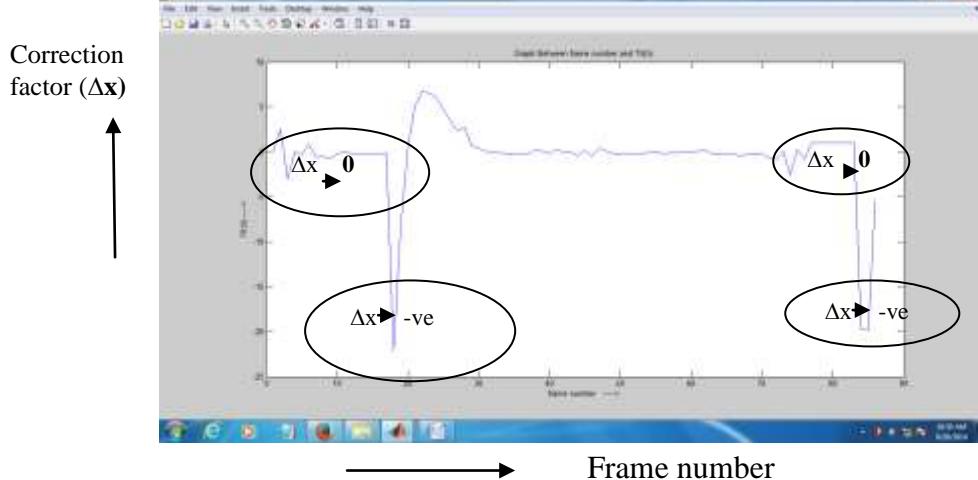
Where  $K$  is called Kalman Gain matrix used for minimizing the variance of estimator. The difference  $(l(t_i) - \hat{l}^-(t_i))$  is called the measurement residual. It reflects the discrepancy between the predicted measurement and the actual measurement  $l(t_i)$ .

Finally the corrected state is obtained by

### **K( $t_i$ )-kalman gain**

Where  $\Delta \text{x}(t_i) = \text{K}(t_i) \cdot (l(t_i) - \bar{l}(t_i))$

### III RESULTS AND OBSERVATIONS



**Fig. 1(a):** The above graph is plotted with correction factor  $\Delta \dot{x}$  to the predicted state vector  $\dot{x}(t_i)$  on Y axis and frame number on X axis

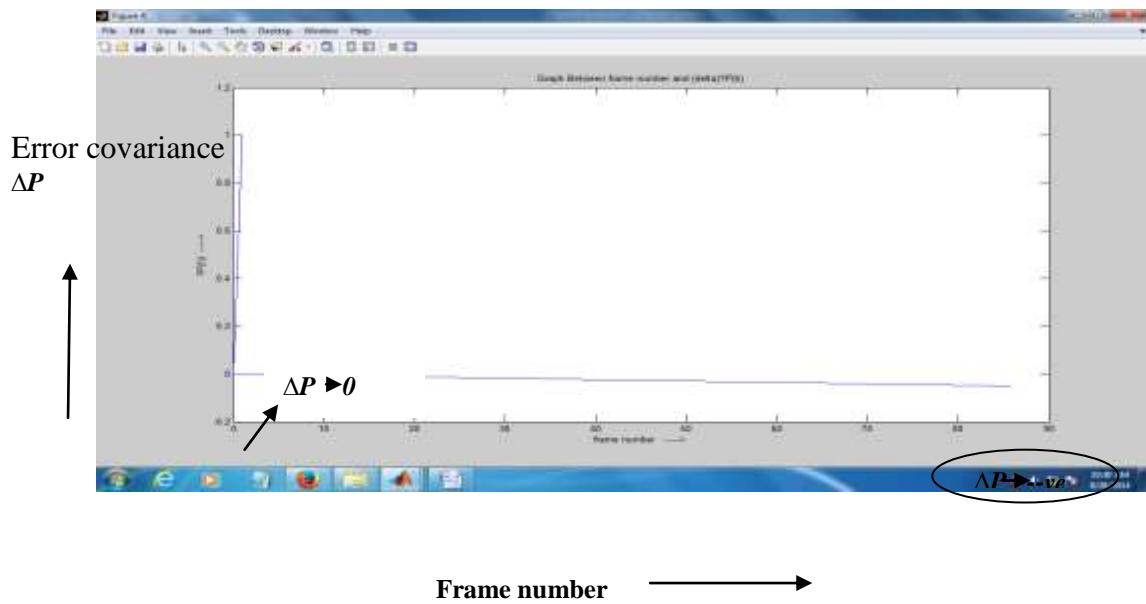
It is observed that up to frame number <20, the correction factor drops to -22.5 from zero and from greater than 20 onwards, the correction factor rises to above 5 and immediately approximate to zero point till 82<sup>nd</sup> frame .After 82<sup>nd</sup> frame correction factor drops to -20 and within an ample amount of time, it rise to -5 .It is also observed that least value of correction factor is between -20 and -25 and The maximum value of correction factor lies between 5 and 6. Hence from the above discussion it is inferred that correction factor is sustained at a value approximately to zero for more number of frames.

Here  $\Delta x$  is approximating to zero up to frame number 15, and also in the range 30 to 75, indicating that the predicted state is approximately equal to corrected state. In the other frames a correction factor of -20/+5 is to be added to the predicted state to attain the corrected state.

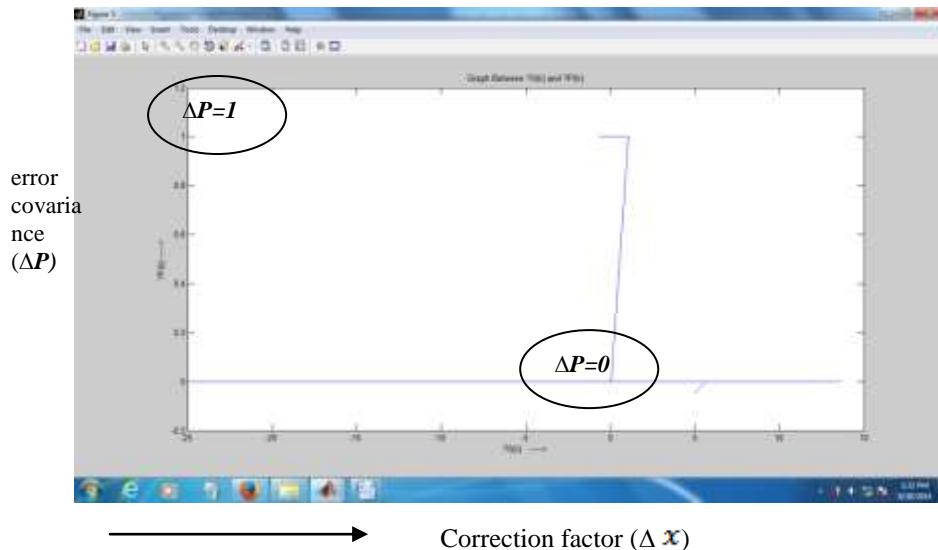
In the eq (17) estimated state and the measurements are weighted and are combined to calculate the corrected state. If the estimated error covariance ( $\Delta P(t_i)$ ) is much smaller than that of the predicted state, the measurements weight will be high and predicted state will be low. Then the uncertainty will be reduced.

The covariance matrix of the corrected state  $P^+(t_i)$  is given by the law of error propagation[8] by

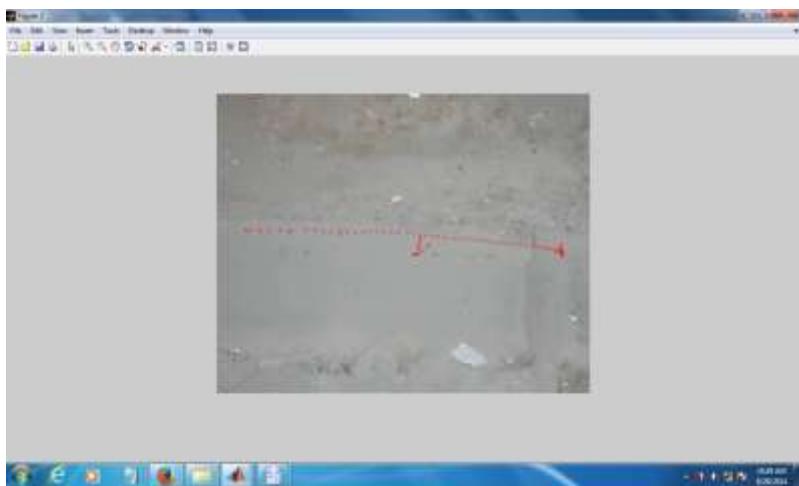
Where  $\Delta P(t_i) = -K(t_i)H P^-(t_i)$

**Fig. 1(b): variation of error covariance  $\Delta P$  with respect to frame number**

The above graph is plotted with **error covariance  $\Delta P(t_i)$**  on Y axis and **frame number** on X axis. The results show that  $\Delta P$  is reduced to zero and going to negative. **As the  $\Delta P$  approaches to negative, covariance of predicted state will be low and so the uncertainty is reduced.**

**Fig. 1(c): variation of error covariance  $\Delta P$  with respect to correction factor for predicted state vector  $\Delta \hat{x}$** 

**It is observed that** as  $\Delta \hat{x}$  approaches to zero,  $\Delta P=I$ , at  $\Delta \hat{x} \geq 0$ ,  $\Delta P$  falls to zero showing that the error covariance is minimized and so uncertainty will be reduced. At  $\Delta \hat{x}=0$ ,  $\hat{x}(t_i)=\hat{x}^-(t_i)+0=\hat{x}^-(t_i)$ , which means that the predicted state vector will be equal to corrected state vector. Thus it can be established that Kalman filter is the best estimator.

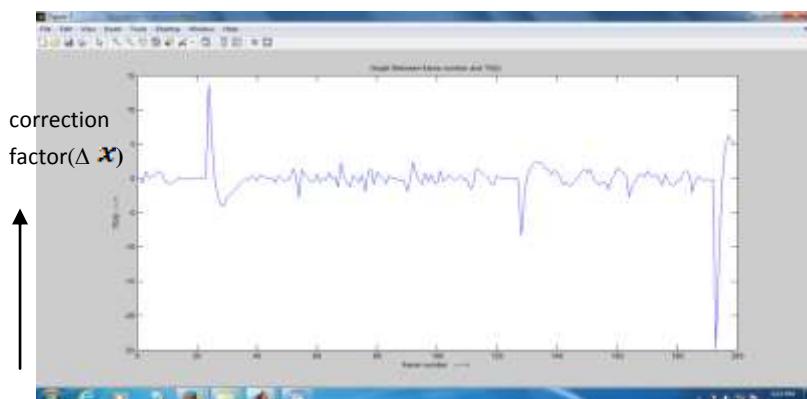


**Fig. 1(d): shows the tracking results of single object tracking without occlusions.**

The algorithm is tested on a single object moving with constant velocity with occlusions and tracking results are presented for discussion.

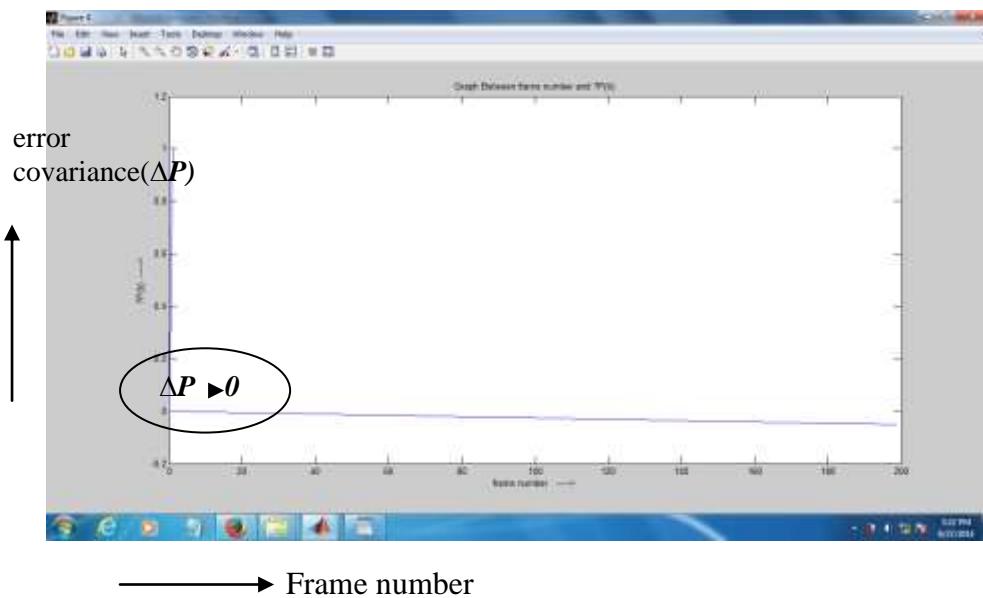


**Fig. 2(a) single object tracking with occlusion**



**Figure 2(b) the above graph is plotted with correction factor  $\Delta x$  to the predicted state vector  $\tilde{x}(t_i)$  on Y axis and frame number on X axis**

It is observed that up to frame number <20, the  $\Delta x$  will be approximated to zero. At frame number =20, correction factor will be greater than 20. At frame number >20 the  $\Delta x$  lies between -5 and +5. Hence it is inferred that the least value of  $\Delta x$  is -25, maximum value  $\Delta x$  is 5. The correction factor  $\Delta x$  will more or less to zero value in more number of frames.  $-5 \leq \Delta x \leq +5$ . It is also inferred that the correction factor  $\Delta x$  of -5 to +5 is to be added to the predicted state vector to get the corrected state vector.



**Figure 2(c): variation of error covariance  $\Delta P$  with respect to frame number**

The above graph is plotted with **error covariance  $\Delta P(t_i)$  on Y axis and frame number on X axis**. The results show that  $\Delta P$  is reduced to zero and going to negative. **As the  $\Delta P$  approaches to negative, covariance of predicted state will be low and so the uncertainty will be reduced. Thus in this it is proved in this case also that Kalman filter is best estimator**

#### IV CONCLUSION

In order to study in depth the essence of these algorithms developed based on their mathematical and environment of their applications, complex situations like partial and full occlusion are chosen and are successfully implemented. A critical evaluation has been made in measuring uncertainties in the tracking scenarios with error covariance parameter and it is proved from the experimental observations that Kalman filter is the best estimator in the above two cases.

#### V FUTURE WORK

There is a possibility of extending the work in identifying and tracking the location of stationary and moving objects in 2D /3D space based on acoustic waves and visual ability i.e. with complex interaction of light, eyes and brain.

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# INTEGRATED APPROACH FOR SENTIMENT ANALYSIS IN SOCIAL MICRO-BLOGGING SITES LIKE TWITTER

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## ABSTRACT

*Millions of people share their opinions and emotions on twitter about events, products and services and political views. Tracking such discussion on twitter provides useful insight on how to market their product better or know their stand in politics. Sentiment analysis helps in tracking the sentiment of the public. Sentiment analysis is the task of identifying whether the opinion expressed in a document is positive or negative about a given topic. There are multiple methods for sentiment analysis. In this paper, a method of combining lexicon based and learning based systems is presented in order to achieve higher degree of accuracy and efficiency.*

**Keywords:** Machine Learning, Lexicon Based, Sentiment Analysis, Twitter.

## I. INTRODUCTION

TWITTER is an online social networking site which provides a popular communication platform for the public to express their opinions and sentiments about social events and products in the form of “tweets”[9]. Twitter has 200 million active users posting more than 400 million tweets a day [8]. Sentiment analysis is twitter can help in decision making in various domains. For example, if the sentiment analysis against a political personality is negative, he/she can devise new ideas and change their propaganda styles to win the masses. Marketers can use this analysis to know about the consumer satisfaction. Consumers can use this analysis to make their decisions about their purchase of a product/service.

Various researches have collected the twitter data set from the Stanford Network Analysis Platform [8].The tweets from a streaming API based on the keyword specified is collected. The tweets so collected have the following features:

**Size:** Tweets can have a maximum length of 140 characters.

From [6], the average length of a tweet is 14 words or 78 characters.

**Data Collection:** Tweets from twitter can be downloaded using the Twitter streaming API.

**Realm:** Unlike other sites, twitter doesn't have a specific domain. Users talk about various topics ranging like products, politics, movie reviews and so on.

**Language used:** Millions of users from all over the world use twitter and the language of tweets differ. Also, the degree of misspellings and use of slang words is high in twitter.

Feature reductions from the obtained dataset are done in order to provide a highly efficient sentiment analysis system.

Sentiment analysis is also known as opinion mining. The tweets are classified as either positive or negative. Sentiment analysis has contributed to the following areas or may do so in the future:

- Structuring reviews
- Political arena
- Improving text processing
- Enhancing business marketing strategies.

At the higher level, two systems were used for sentiment analysis namely: lexicon based and learning based. Machine learning depends on various supervised classification approach where the sentiment is produced as either negative or positive. Whereas, lexicon based approach uses a list of words where each word is associated with a specific sentiment

However, both the methods have their own advantages and disadvantages. To decide upon the system to be used has been the topic of research these days. This paper provides a method of integrating the above mentioned two systems to achieve a higher degree of accuracy .The proposed approach is to combine the best of both the methods for accurate results.

The rest of this paper is organized as follows:

Section 2 consists of related work. Section 3 consists of approach. Section 4 consists of Experimental analysis. Section 5 consists of conclusion.

## **II. RELATED WORK**

All his section provides a brief review of related work from other perspectives:

Generally Sentiment analysis is divided into statistical method [14],semantic analysis [12], unsupervised machine learning [13], semi-supervised [11] and supervised machine learning .

Such sentiment analysis has been applied to various document types like blogs [1]. Although [1] didn't deal with the micro blogging services like twitter. Some of the techniques used by [1] are Concept identification, Query Expansion, SVM. The method dealt in [1] is time consuming and the retrieval efficiency is poor.[2] uses machine learning techniques, NLP techniques like BOW, SentiwordNet. But, the classifier used doesn't work well on popular emotions.[3] uses Text mining approach, Naive Bayes algorithm, word based approach, emotional based approach for sentiment analysis. But, it made a comparison between texts and tweets. Sentiment in texts was ambiguous. [4] combines rule-based classification, supervised learning and machine learning into a new combined method. This method is tested on movie review. Pang and Lee [5] researched the performance of various machine learning techniques (Naive Bayes, maximum entropy, and support vector machines) in the specific domain of movie reviews. They modelled much of our research from their results. They were able to achieve an accuracy of 82.9% using SVM with an unigram model.[6] used Twitter sentiment as a tool for sentiment analysis. It didn't combine any other tool. [7] used SentiStrength for sentiment analysis. This paper tries a different phenomenon of combining both the systems mentioned in [6] and [7] to achieve greater accuracy and efficiency.

## **III. APPROACH**

The proposed approach is to integrate two sentiment analysis systems, i.e. two methods namely, learning based

and lexicon based for better performance. Figure 1 describes the architecture of the system proposed. Twitter sentiment is a learning based sentiment analysis system and Senti Strength is a lexicon based sentiment analysis system. This framework provides an idiosyncratic feature of independency between preprocessing and sentiment analysis. These two modules can be treated separately.

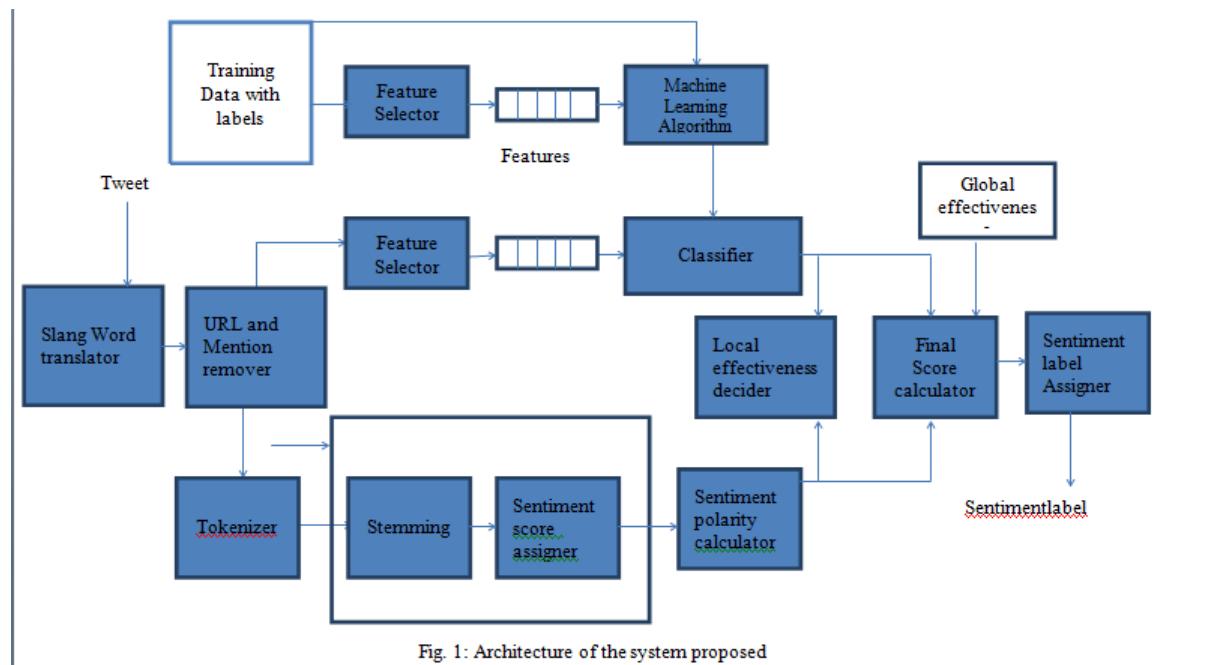


Fig. 1: Architecture of the system proposed

### 3.1 Preprocessing

The tweets have many properties. The tweets are preponderantly vernacular and often projected in an ad-hoc modus operandi. Sentiment analysis tools applied to unprocessed tweets leads to poor performance. This paper exploits the tweets' properties to minimize the space used by the features. The following are the feature reduction techniques applied:

#### 3.1.1 Mentions Removal

The tweets are usually accompanied by usernames. The usernames are represented with an @ symbol at the front. For example, (@ameccg). This symbol is removed for further processing.

#### 3.1.2 URL Removal

Many users have the style of including URL in their tweets. These URLs make the analysis complex. Therefore, The URLs are removed.

#### 3.1.3 Slang Word Translator

The tweets predominantly contain slang words like omg(Oh My God) and lol(Laughing out loud). These play a major role in sentiment analysis as LOL can be given a positive score but detection of LOL as a proper English word proves to be futile. Therefore, all the slang words are replaced with their full forms for better processing and analysis results.

### 3.1.4 Language Detector and Non-English Tweets Filtering

Most of the sentiment analysis tools work only with English words. So, the non-English words from the tweets have to be removed. The words are considered non-English if it's not present in the GNU-Aspell dictionary. A tweet is filtered if more than 20% of the words do not appear in the dictionary.

In mathematical terms, a tweet is filtered if the Equation (1) is satisfied.

$$\frac{\text{no.words matching with GNU-Aspell list}}{\text{no.words in the tweet}} \leq 0.08 \quad (1)$$

## 3.2. Methods for Sentiment Analysis

### 3.2.1 Maximum Entropy

The max entropy classifier is a probabilistic classifier which belongs to the class of exponential models. It provides least biased estimate possible based on the given information. Maximum Entropy is a general purpose machine learning method based on empirical data. Nigam et al and Berger et al[10].The idea behind Maximum Entropy models is that one should prefer the most uniform models that satisfy a given constraint[6]. Max Entropy models are feature-based models. In a two class scenario, it is the same as using logistic regression to find a distribution over the classes. Unlike naive Bates classifier the MaxEnt does not assume that the features are conditionally independent of each other. It is based on the principle of maximum entropy.This means features like bigrams and phrases to MaxEnt can be added without worrying about features overlapping. The model is represented by the Equation (2).

$$P_{ME}(c|d, \lambda) = \frac{\exp [\sum_i \lambda_i f_i(c, d)]}{\sum_c \exp [\sum_i \lambda_i f_i(c, d)]} \quad (2)$$

In this formula,  $c$  is the class,  $d$  is the tweet, and  $\lambda$  is a weight vector. The weight vectors decide the significance of a feature in classification. A higher weight means that the feature is a strong indicator for the class. The weight vector is found by numerical optimization of the lambdas so as to maximize the conditional probability.

Theoretically, MaxEnt performs better than Naive Bayes because it handles feature overlap better. However, in practice,Naive Bayes can still perform better.The Twitter Sentiment System (Sentiment 140) to perform Maximum Entropy classification is used.

#### 3.2.1.1 Sentiment 140

Sentiment 140 formerly known as Twitter Sentiment finds a sentiment of a tweet for a brand, product or service. It is a project from Stanford University. The method provides API to classify tweets to polarity classes.The output of the sentiment 140 is extracted for each tweet which corresponds to the polarity of the tweet. This is different from other sentiment analysis tools for the following reasons:

- 1) Classifiers from machine learning algorithms are used. Some other tools use a simpler keyword-based approach, which may have higher precision but low recall.

- 2) This system is transparent in how it classifies individual tweets. Other tools do not show the classification of individual tweets but only show the aggregated numbers, which makes it difficult to test its accuracy.

In order to train the classifier distant supervision was used; in which emoticons serve as noisy labels [6].The classifier has been trained by collecting 1,600,000 tweets collected using twitter streaming API with emoticons as noisy labels. It contains 800,000 positive tweets and 800,000 negative tweets.

### **3.2.2 Lexicon Based Approach**

Lexicon based approach performs text analysis and evaluates emotional, cognitive, and structural components of a given text based on the use of a dictionary containing words and their classified categories. For example, the word “agree” belongs to the following word categories: assent, affective, positive emotion, positive feeling and cognitive process. The lexicon based approach is based on the assumption that the contextual sentiment orientation is the sum of the sentiment orientation of each word or phrase. The lexicon can be created manually or automatically by expanding a seed of words. The core algorithm for lexicon based sentiment classification is as follows:

```

SentimentAnalysis_Lexicon()

{
    positivity := 0
    negativity := 0
    for each word in the text
        stemmed_word = stem(word)
        score[i] = retrieveSentimentvalue(stemmed_word)
    end for
    if( positive value exists in the score array)
        positivity = maximum value in the score array
    if(negative value exists in the score array)
        negativity = minimum value in the score array
    finalSentimentScore = positivity + negativity
}

```

RetrieveSentientmentvalue returns the positive or negative sentiment strength of the word. The polarity of the text can be identified using the sign of the finalSentimentScore. There are various tools that use this lexicon based approach. One such tool is the Senti Strength.

### 3.2.2.1 Senti Strength

Senti Strength estimates the *strength* of positive and negative sentiment in *short texts*, even for informal language. It has human-level accuracy for short social web texts in English. SentiStrength reports *two* sentiment strengths:

- -1 (not negative) to -5 (extremely negative)
- 1 (not positive) to 5 (extremely positive)

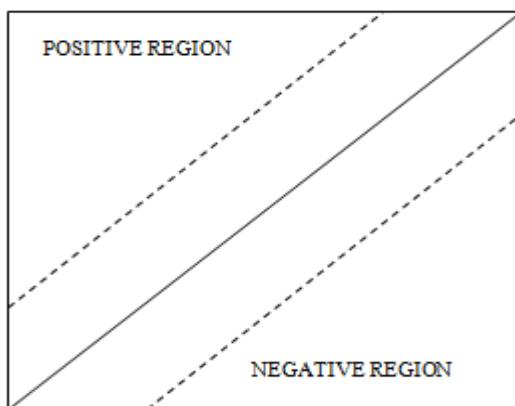
It can also report binary (positive/negative), trinary (positive/negative/neutral) and single scale (-4 to +4) results. SentiStrength was developed through an initial set of 2,600 human-classified MySpace comments, and evaluated on a further random sample of 1,041 MySpace comments.

SentiStrength considers linguistic aspects of the passage such as a negating word list and an emoticon list with polarities. To boost up the performance the method also incorporates a spelling correction algorithm, booster and negating word lists sand emoticon list. The method also modifies the sentiment score if repeated characters or repeated punctuation are detected.

From each tweet three features related to the SentiStrength method, SentiStrength Negativity (SSN) and SentiStrength Positivity (SSP), that correspond to the strength scores for the negative and positive classes, respectively, and SentiStrength Polarity (SSPOL), that is a polarity oriented feature corresponding to the neutral label is extracted.

### 3.3 Proposed method of integration:

Any classifier or analyzer has its own effectiveness. The effectiveness of a classifier can be divided into two types namely, global and local effectiveness[15]. In general, the decisions made by sentistrength is more accurate than the ones made by sentiment140 i.e., sentistrength performs better than sentiment140 in



**Fig. 2: Illustration of local effectiveness. Dashed lines represent decision boundary**

most of the cases. But not all the decisions made by sentistrength are correct. A globally effective classifier may perform poorly on some cases. Hence the local effectiveness of the classifier must also be taken into account. Local effectiveness of a classifier depends whether the tweet lies closer to the decision boundary.

Any tweet that falls into the lower triangle will be classified as negative and those that lie on the upper half will be categorized as positive. Figure 2 projects this idea. Decision boundaries are represented by dashed lines. If the tweet gets plotted farther away from the decision boundary then the classifier is sanguine about the decision. Hence the classifier's local effectiveness increases sharply. If the tweet is present near the decision boundary

then the classifier's local effectiveness decreases. Global effectiveness of a classifier,  $\alpha_i$  can be predetermined but the local effectiveness of a classifier  $\beta_i$ , fluctuates for every tweet. By global effectiveness, relative global effectiveness is taken into account and not absolute global effectiveness.

*The global and local effectiveness of the classifier is normalized such that  $0 < \alpha_i < 1$ ,  $\sum \alpha_i = 1$  and  $0 < \beta_i < 1$*

The final polarity of the tweet can be decided using the sign of the final score that can be computed by integrating the decisions of the two classifiers given by the Equation (3)

$$\text{finalScore} = \sum (\text{decision}_i * \alpha_i * \beta_i) \quad (3)$$

where  $\text{decision}_i$  is the polarity decision made by the classifier  $i$  for that specific tweet

$$\text{decision}_i = \begin{cases} 0 & \text{if neutral,} \\ 1 & \text{if positive,} \\ -1 & \text{if negative} \end{cases} \quad (4)$$

The decision boundary of the two classifiers can be fixed as follows:

If the final score returned by the sentistrength is close to 0, then the tweet is said to lie near the decision boundary.

TABLE I  
NOTATION FOR THE PROPOSED MODEL

Symbol	Description
$\alpha$	Global effectiveness of the classifier
$\beta$	Local effectiveness of the classifier for the specific tweet
$\text{decision}$	Decision made by the classifier for the given text

If the decision returned by sentiment140 is neutral, then the tweet is said to lie near the decision boundary.

### 3.3.1 Parameter Setting

It has been observed that the sentistrength performs better than sentiment140 in most of the cases. Hence  $\alpha_{\text{sentistrength}}$  is assigned a value greater than  $\alpha_{\text{sentiment140}}$ .

In our experiments, we empirically set  $\alpha_{\text{sentistrength}}$  according to Equation (5) and  $\alpha_{\text{sentiment140}}$  according to Equation (6).

$$\alpha_{\text{sentistrength}} = 0.6 \quad (5)$$

$$\alpha_{\text{sentiment140}} = 0.4 \quad (6)$$

The local effectiveness of the classifiers was set as per the Equation (7)

$$\beta_i = \begin{cases} 0.25 & \text{if the tweet lies near decision boundary} \\ 0.5 & \text{otherwise} \end{cases} \quad (7)$$

The decision boundaries for each classifier were defined earlier.

### 3.4 Experimental Analysis

The proposed approach on twitter dataset is analyzed.

#### 3.4.1 Twitter Dataset

The method was tested using real time twitter data. Twitter provides Searching API to programmatically collect data based on a query term. The Twitter API has a limit of 100 tweets in a response for any request and imposes a limit on the number of API calls a single app can make. Hence a reasonable frequency of polling has to be selected (say 2 minutes). 1000 tweets corresponding to the query term OBAMA were collected to test the efficiency of the sentiment analysis method proposed. These tweets so collected using the API were preprocessed to reduce the features including URL, mentions and replacing slang words as stated earlier.

### 3.5 Evaluation

#### 3.5.1 Performance Measures

The performance is measured using two measures namely precision and recall.

##### 3.5.1.1 Precision

Precision is calculated using the Equation (8)

$$\text{Precision} = \frac{|\{\text{relevant tweets}\} \cap \{\text{retrieved tweets}\}|}{|\{\text{retrieved tweets}\}|} \quad (8)$$

##### 3.5.1.2 Recall

Recall is calculated using Equation (9)

$$\text{Recall} = \frac{|\{\text{relevant tweets}\} \cap \{\text{retrieved tweets}\}|}{|\{\text{relevant tweets}\}|} \quad (9)$$

#### 3.5.2 Verification

To verify the effectiveness of the proposed approach in sentiment classification, the tweets are first labeled manually to find the percentage of the positive, negative and neutral tweets in the dataset.

**TABLE II: The sentiment polarity classification performance**

F-measure	
SentiStrength	0.765
Sentiment140	0.5988
Proposed Approach	0.812

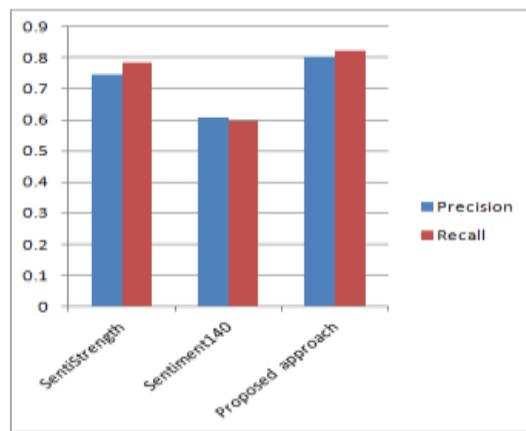


Fig. 3: Precision and recall of different approaches

Then the results of the three methods, the lexicon based approach, learning approach and proposed approach were analyzed to find the percentage of positive, negative, neutral, false positive, false negative classifications. These values were used to calculate the precision and recall of the methods.

Figure 3 shows the comparisons of the different approaches with respect to these values.

As it can be observed in Table II the results measured with precision and recall for the three methods, the lexicon based approach, learning approach and proposed approach. It can be seen that the proposed approach outperforms the methods in isolation in terms of both precision and recall.

#### IV. CONCLUSION

In this approach, an effective framework for integrating lexical knowledge and machine learning for sentiment analysis is developed. The developed approach is successfully applied to the task of sentiment classification — extending the state of-the-art in the field which has focused primarily on using either background knowledge or supervised learning in isolation. Empirical results demonstrate that the framework produces better results than using a lexicon or the training data separately.

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# PETROGRAPHIC – MINERALOGICAL ANALYSIS OF AGGREGATES FROM DEVOLL HYDROPOWER PROJECT

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## ABSTRACT

*The petrographic examination in Devoll aggregates establish whether the aggregate contains chemically unstable minerals such as **soluble sulfates**, **unstable sulfides** that may form sulfuric acid or create distress in concrete exposed to high temperatures during service, or **volumetrically unstable materials** such as **micas**, **smectites** (**formerly known as the montmorillonite-saponite group of minerals or swelling clays**). Specifications has limited the quartz content of aggregates for use in concrete that is subjected to high temperatures because of the conversion to beta-quartz at 573°C (1063°F), with accompanying volume increase. The petrographic tests made on aggregates are based on the American method ASTM C 295, British standard method BS 812: Part 104, European standard EN 932-3. The problems mentioned above are analyzed in aggregates taken from Devoll Hydropower Project.*

**Keywords:** *Devoll Aggregates , Soluble Sulfates, Unstable Sulfides, Petrographic Tests*

## I INTRODUCTION

Natural aggregates are the most important constituent in many building materials e.g concrete, mortar and roads. Natural aggregates of Devoll Hydropower Project are processed from natural deposits of sand, gravel or crushed rock. The method to describe and classify aggregates is the petrographic analysis. The petrographic analysis is a systematic description method for rocks, minerals and other constituents, usually in hand specimens, thin sections or by use of other analytical methods (e.g. XRF- analysis). The purpose with the petrographic analysis is to obtain information on one or all of the material characteristics: Geometrical-mechanical, physical-and chemical properties, impurities, contamination and very important the rock and mineral content. The rock and minerals constituents are in many cases conclusive for the end use of aggregate.

Petrographic examination in this study identify and call attention to potentially **alkali-silica reactive and alkali-carbonate reactive constituents**, determine such constituents quantitatively, and recommend additional tests to confirm or refute the presence in significant amounts of aggregate constituents capable of alkali reaction in concrete. Alkali-silica reactive constituents found in aggregates include:

**opal, chalcedony, cristobalite, tridymite, highly strained quartz, microcrystalline quartz, volcanic glass, and synthetic siliceous glass.** Aggregate materials containing these constituents include: **glassy to cryptocrystalline intermediate to acidic volcanic rocks, some argillites, phyllites, greywacke, gneiss, schist, gneissic granite, vein quartz, quartzite, sandstone, and chert.**

Potentially deleterious alkali-carbonate reactive rocks are usually **calcareous dolomites or dolomitic limestones** with clayey insoluble residues. Some dolomites essentially free of clay and some very fine-grained limestones free of clay and with minor insoluble residue, mostly quartz, are also capable of some alkali-carbonate reactions, however, such reactions are not necessarily deleterious.

Here petrographic examination is directed specifically at the possible presence of contaminants in aggregates, such as **synthetic glass, cinders, clinker, or coal ash, magnesium oxide, calcium oxide, or both, gypsum, soil, hydrocarbons**, chemicals which may affect the setting behavior of concrete or the properties of the aggregate, animal excrement, plants or rotten vegetation, and any other contaminant that may prove undesirable in concrete used at Devoll Hydropwer Project.

## II MATERIALS AND METHODOLOGY

### 2.1 Materials

The samples subjected to be tested for Petrographic-mineralogical analysis are listed below:

1. Limestone (873.6 gr).
2. Natural river gravel (732.9 gr.)
3. Gravel 1 (416.8 gr), 1-4-6 mm.
4. Gravel 1 (50 grains, 73.5 gr.), grain size = 8-14 mm,
5. Gravel 2 (30 grains, 235.8 gr.), grain size = 1-2 cm.
6. Gravel 2 (51 grains, 263.3 gr.), grain size = 12.5-20 mm
7. Gravel 2 (12 grains, 518.4 gr.), grain size = 32.5- 45 mm.
8. Gravel 2 [> 32.5-40 mm].

### 2.2 Methodology

#### 2.2.1 Chemical analysis of samples

**Table 1. Chemical composition of aggregates**

Main oxides	1	2	3	4
	Natural river sand	Crashed gravel 12-38 mm	Gravel 1	Limestone
SiO <sub>2</sub>	53.18	43.25	43.98	2.23
CaO	15.35	23.04	24.01	50.29
MgO	9.10	6.43	5.76	0.77
Fe <sub>2</sub> O <sub>3</sub>	5.67	4.72	3.80	0.63
Al <sub>2</sub> O <sub>3</sub>	9.65	13.93	13.54	0.98
SO <sub>3</sub>	0.11	0.10	0.13	0.21
K <sub>2</sub> O	1.26	1.24	1.24	—
Na <sub>2</sub> O	0.82	0.84	0.83	—
LOI	0.25	2.36	2.19	
<b>Total</b>	<b>95.39</b>	<b>95.91</b>	<b>95.48</b>	

Test results for chemical composition of aggregates are realized at FKCF Cement factory, Albania.

## 2.2.2 Physical analysis of samples

**Table 2. Determination of specific density for CRASHED GRAVEL 05-12mm sample**

No.	TEST DESCRIPTION	UNITS	SAMPLE	
1	Grain size	mm	05/12	05/12
2	Temperature	°C	20	20
3	Water density	g/cm <sup>3</sup>	1.0000	1.0000
4	Sample SSD weight	g	500.10	500.00
5	Pycnometer no.(1000 ml)	ml	1	1
6	Mass of pycnometer + water	g	1,178.60	1,178.60
7	Mass of pycnometer + water+ sample	g	1,493.50	1,494.00
8	Dry mass of sample for absorption test	g	117.20	74.80
9	SSD mass of sample for absorption test	g	115.90	73.90
10	Absorption	%	1.122	1.218
11	<b>Average absorption value</b>	%	<b>1.170</b>	
12	SSD density ( each sample )	g/cm <sup>3</sup>	2.700	2.709
13	<b>SSD density( average value)</b>	g/cm <sup>3</sup>	<b>2.704</b>	

**Table 3. Determination of specific density for CRASHED GRAVEL 12-38mm sample**

No.	TEST DESCRIPTION	UNITS	SAMPLE	
1	Grain size	mm	12/38	12/38
2	Temperature	°C	20	20
3	Water density	g/cm <sup>3</sup>	1.0000	1.0000
4	Sample SSD weight	g	500.10	500.00
5	Pycnometer no.(1000 ml)	ml	1	1
6	Mass of pycnometer + water	g	1,178.60	1,178.60
7	Mass of pycnometer + water+ sample	g	1,496.40	1,494.40
8	Dry mass of sample for absorption test	g	125.00	157.80
9	SSD mass of sample for absorption test	g	124.30	156.60
10	Absorption	%	0.563	0.766
11	<b>Average absorption value</b>	%	<b>0.665</b>	
12	SSD density ( each sample )	g/cm <sup>3</sup>	2.743	2.714
13	<b>SSD density( average value)</b>	g/cm <sup>3</sup>	<b>2.729</b>	

**Table 4. Determination of specific density for LIMESTONE sample**

No.	TEST DESCRIPTION	UNITS	SAMPLE	
1	Grain size	mm	0/3	0/3
2	Temperature	°C	20	20
3	Water density	g/cm <sup>3</sup>	0.9975	0.9975
4	Sample SSD weight	g	500.30	500.20
5	Pycnometer no.(1000 ml)	ml	1	1
6	Mass of pycnometer + water	g	1,173.20	1,173.20
7	Mass of pycnometer + water+ sample	g	1,485.00	1,483.00
8	Dry mass of sample for absorption test	g	148.50	150.20
9	SSD mass of sample for absorption test	g	146.90	148.50
10	Absorption	%	1.089	1.145
11	<b>Average absorption value</b>	%	<b>1.117</b>	

12	SSD density ( each sample )	g/cm <sup>3</sup>	2.6541	2.6271
13	SSD density( average value)	g/cm <sup>3</sup>		2.641

**Table 5. Determination of specific density for NATYRAL RIVER SAND 0-5mm sample**

No.	TEST DESCRIPTION	UNITS	SAMPLE	
1	Grain size	mm	0/5	0/5
2	Temperature	°C	20	20
3	Water density	g/cm <sup>3</sup>	1.0000	1.0000
4	Sample SSD weight	g	500.10	500.00
5	Pycnometer no.(1000 ml)	ml	1	1
6	Mass of pycnometer + water	g	1,178.60	1,178.60
7	Mass of pycnometer + water+ sample	g	1,489.60	1,488.90
8	Dry mass of sample for absorption test	g	107.70	76.10
9	SSD mass of sample for absorption test	g	106.00	74.70
10	Absorption	%	1.604	1.874
11	<b>Average absorption value</b>	%	<b>1.739</b>	
12	SSD density ( each sample )	g/cm <sup>3</sup>	2.645	2.636
13	SSD density( average value)	g/cm <sup>3</sup>	<b>2.640</b>	

### III RESULTS AND TABLES

#### 3.1 Petrographic Description

##### Sample 1 – Crushed limestone sand (873.6 grams)

Figure 1 and 2 represent crushed limestone sand, observed optically, with main composition made of totally crushed calcite [CaCO<sub>3</sub>] represented by beige to yellow color. Limestone grains dimensions range from hundredths of mm (in powder form), which occupies 15% of the total amount, up to tenths of mm which occupies about 55% of the total mass of sample. 35% of remaining mass has non uniform shape with dimensions ranging from 1-3 mm. Minor of clay spots are observed in the limestone grains which gave darker color to the material. By chemical analysis of the sample labeled limestone in Table 1, results that this material content is of pure lime and have calcite main composition.

##### Sample 1 – River sand (732.9 grams)

Figure 3 shows river sand material optically observed as fractioned scarification material with non uniform shape.

From stereomicroscope observation is concluded that:

- a) The size of the granules and aggregates have dimensions ranging from hundredths of mm to powder form, and represent about 10% of the total mass,
- b) Consist mainly of aggregates with size ranging to tenths mm, which made up 60% of total amount of sample taken for petrographic test analysis,
- c) Grain size of this aggregate range from 1 to 4 mm which represent 30% of the total mass of the sample tested.



**Fig. 1: Natural view of limestone sand. Fractioned, granular calcareous material with dimension ranging from hundredths to tenths of mm. Grain size is 1-3 mm.**



**Fig. 2: Limestone sand observed with stereomicroscope apparatus with magnification 8 x. Calcareous granular aggregate represented by beige – yellow colour.**



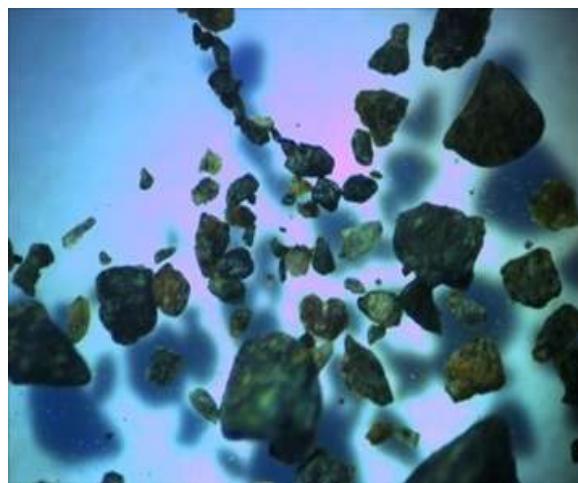
**Fig. 3: Natural view of natural sand. Granular fractioned river sand with ferrous pieces represented by green –black colour, pyroxene (silicate), quartz, calcareous – carbonate, metallic grains.**



**Fig. 4: River sand, observed with stereomicroscope apparatus, with aluminosilicate magnification scale 8x. Chloride aggregates-grains, olivine, pyroxene, olivine – quartz and calcite.**

In mineral composition are included: (Figures no.3; 4; 5)

- a. Chloride aggregates (aluminum silicates of iron), 34% of total mass represented by color green to darkness.
- b. Olivine + Pyroxene (Ca, Fe and Mg silicates) 12% of total mass.
- c. Quartz ( $\text{SiO}_2$ ), 35% of the total mass.
- d. Fractioned calcite aggregates (Calcite –  $\text{CaCO}_3$ ), 13 % of the total mass.
- e. Inserted grains of metallic minerals such as magnetite micro grains, pyrite micronic particles etc., made up 3-5%.
- f. analysis is applied on river sand sample. All magnetic fractions were split apart and the observation was made with Stereomicroscopes apparatus. During observation are noted fractions of inserted grains – aggregates magnetic fractions of magnetite micro grains.



**Fig. 5: Magnetic fraction of river sand sample observed with stereomicroscope apparatus, with magnification scale 20x. Inserted aggregate – grains of micro magnetite mineral particles.**

We should take in consideration:

**First:**

Based on ASTM C 295-03 standard requirements is important to observe the presence of non-stable chemical minerals such as insoluble sulphates and non-stable sulfides which may effect on formation on sulphuric acid or creation of surface tension of exposed concrete structures in high temperatures during the application, or non stable volume minerals such as mica, smectite (known as Montmorillonite- -Saponite mineral group) or expanded clay.

**Second:**

Based on chemical analysis of samples it was necessary to prepare the sample for mineralogical observation of sulphate content. Relating to petrographic analyses results during transmitted polarized microscope observation there are noted points in range 20-40 microns of sulphur mineralization (Pyrite –  $\text{FeS}_2$ ).



**Fig. 6: Micrograph view of polished river sand sample surface observed on reflected light of mineralogical microscope.**  
Bright grains represent sulphur spots with dimensions ranging from  $20-40 \mu$  and PY index shows pyrite-  $\text{FeS}_2$ .  
**Gravel 1 (416.8 gr.), 1-4-6 mm.**

During the observation with stereomicroscope apparatus it is concluded that this sample, composed from micro-aggregate grains with partially regular shaped size in range of 1mm, made 30% of total sample mass, while dimensions 2-4 mm occupied 40% of total mass. Grains with dimension ranging from 4-6 mm made up to 30% of the total mass of the sample (Fig. 7 & 8).



**Fig. 7: Gravel 1, 1-4-6 mm, Natural view.** Pieces of aggregate-grains with dimensions 1-4-6 mm, consist mainly from sandy material pieces of darkness color, those with green to black color represent basalt material while those colored with white to grey are calcareous aggregates (carbonate  $\text{CaCO}_3$ ).



**Fig. 8: Gravel 1, observed with stereomicroscope apparatus with magnification scale 8x.**

**Carbonate aggregates, sandy material pieces with dimensions 2-4mm.**

Up to 50% of those aggregate-pieces are represented by sandy material, 25-30% from basalt material having dark green to black color, while carbonate material – calcareous material ( $\text{CaCO}_3$ ) make 10-15% of total mass represent by white – grey color.

**Gravel 1 (50 pieces, 73.5 gr.) (8-14 mm)**

During the observation with stereomicroscope is noted that this sample represent aggregate pieces with non uniform shape and dimensions ranging from 8-14mm. Pieces are mostly sandy material making 65-75% of the total mass, while basalt is up to 10-15% and calcareous pieces represent 15% of the total mass. (See Fig. 9).

**Gravel 2 (30 pieces, 235.8 gr.) (1-2 cm.)**

Made from fractioned aggregates with dimensions ranging from 1-2 cm (Fig. 10), which represent 65% of sandy quartz micro grains, 20-25% is calcareous-carbonate which is represented by white-grey color while basalt pieces and volcanic rocks (siliceous – chloride base) made up 10% of the total mass.



**Fig. 9: Gravel 1, 8-14 mm, natural view.**  
Sandy material made of fractioned aggregates.  
Basalt is represented by darkness pieces and  
calcareous material is represented by white-grey pieces.



**Fig. 10: Gravel 2 (1-2 cm), natural view.**  
Fractioned sandy material represented with  
beige-darkness color, while calcareous  
material is represented with white-grey color.,  
Siliceous-chloride base volcanic rocks  
represented with green to darkness color.

**Gravel 2 (51 pieces, 263.3 gr.) (12.5-20 mm)**

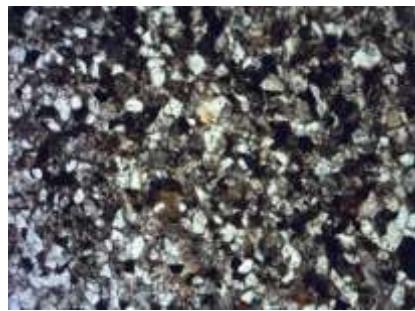
The sample is represented by fractioned aggregates with non-uniform shape (Fig. 11).

Sandy piece materials made 60-65% of the total mass while volcanic rocks (green color) with chloride content, represent 10-15% of the total mass. Calcite pieces ( $\text{CaCO}_3$ ) with beige – yellow color represent 5-10% of the total mass. Few pieces of red siliceous material ( $\text{SiO}_2$  with insertion of ferrous material) are represented with reddish color.

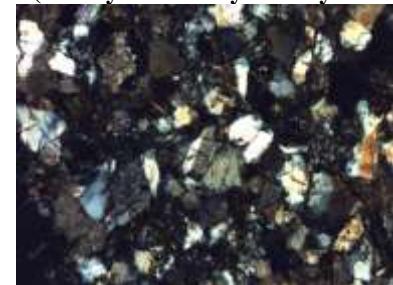
Gravel 2 sample, was polished and prepared in thin section for examination with a transmitted or either reflected light microscope to determine types of mineral rocks taken in this study.



**Fig. 11:** Gravel 2, natural view (12.5-20 mm). Sandy aggregate pieces, chloride volcanic rocks, calcites, while red siliceous pieces are very rare (mainly formed by iron hydroxides).



**Fig. 12:** Gravel 2 sample, textured microstructure of sandy material observed on polarized light petrographic microscope with magnification scale 40 x (Quartz grain size ranging from 0.1 - 0.2 mm).



a.



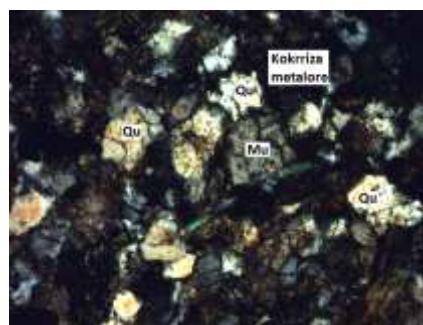
b.

**Fig. 13:** Gravel 2 crystalline Plagioclase with grain size 0.1-0.2 mm. Polarized light microscope:

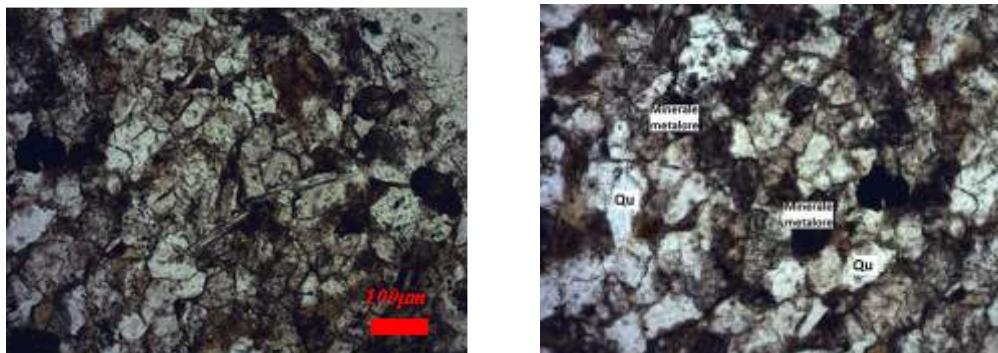
a. Magnification scale 40x

b. Magnification scale 100x

Sand material is composed mainly from quartz (Fig. 12) with dimensions ranging from 0.1 - 0.2 mm making 60 % of the total mass of tested sample; plagioclase-anorthite 7-10 % (Fig. 13); mica grains (muscovite) up to 2-3 % (Fig. 14), inserted in cement of sand where chloride cement represent 15-20%, while opac minerals (magnetite, pyrite etc.) 2-4% of the mass.



**Fig. 14:** Gravel 2, Sandy material containing mica grains (muscovite) in cement between quartz and plagioclase -feldspar quantity with grain dimensions ranging from 0.1-0.2 mm. Polarized light microscope with magnification scale 100x.

**Fig.15: Gravel 2**

- a. Sandy material with chloride cement content observed in polarized light microscope. Magnifications scale 40x.
- b. Black spots represent opac minerals (magnetite, pyrite, etj.) Polarized light microscope. Magnifications scale 40 x.

**Gravel 2 (12 pieces, 518.4 gr.) (32.5- 45 mm)**

Sample composed from sandy pieces, basalt represented from green-black color pieces, calcite and chlorite volcanic rocks are mainly fractioned aggregates with non-uniform shape, with dimensions ranging from 32.5 up to 45mm.

Basalt pieces meet rare and contains secondary calcite ( $\text{CaCO}_3$ ) seam traces represented by white color. The width of seam traces range from 2-5 mm making non-uniform shape of texture (Fig. 16).



**Fig.16: Gravel 2: Natural view (32.5-45 mm) grain size. Basalt pieces with green black color, sandy pieces with yellow-darkness color, alkaline volcanic rocks pieceswith green color, small microcrystalline of calcite secondary ( $\text{CaCO}_3$ ) with white color and dimensions 2-5mm.**

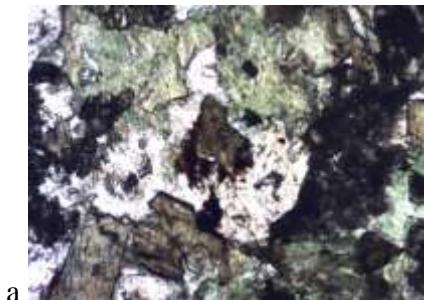
Basalt mineral observation made with petrographic microscope (Fig. 17). Microstructure made by plagioclase, cemented from chlorite. Basalt pieces are almost cracked and filled mostly with calcite secondary (Fig. 18), while volcanic alkaline rocks have high content of chlorides (Fig. 19).



**Fig. 17:** Gravel 2, pieces, basaltic texture with darkness to black color composed from plagioclase rods with size up to 0.2mm, chlorite cement with opac minerals (metallic, such as magnetite, pyrite etc.) observed with polarized light microscope with magnification 40x.



**Fig. 18:** Gravel 2 sample observed with polarized light microscope. View of micro-cracks filled with calcite second ( $\text{CaCO}_3$ ). Magnification scale up to 40x.



a



b

**Fig. 19:** Gravel 2,

- High chloride content volcanic rocks composed from iron hydroxides in the center, observed with polarized light microscope, magnification scale 100x.
- Volcanic rocks with high chlorides and silica content, observed on polarized-light microscope with magnification scale 100x.

Sample 32.5-40 mm grain size

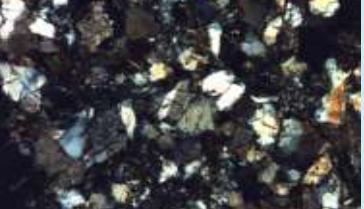
Meet mostly fractioned sandy rock particles almost shaped plate (Fig. 20), with beige to darkness color, with chloride, silica and carbonate cement content and few pieces of volcanic basaltic rocks with chlorides content.



**Fig. 20:** Natural view of sample 32.5-40 mm grain size., Fractioned sand pieces, shaped plate with gray to dark beige color.

### III CONCLUSIONS

According to mineralogical-stereoscopic test results, the conclusions for this study are:

Sample/Mineral	Microscopic examination	%	Grain size	Description
Limestone		100%	0-3 mm	This limestone sample consists entirely of calcite. Where replacement of the original calcite is apparent, the newly formed carbonate contains a minor amount of MgO (ca. 0.21 wt %).
Natural river sand		<p><math>\text{SiO}_2 = 35\%</math>            Olivine and pyroxene = 12%            (in form of silicates of Ca, Fe and Mg)            Carbonate (<math>\text{CaCO}_3</math>) = 13%            Metallic minerals(magnetite micro grains &amp; pyrite) = 3-5%            Aluminum silicates of Iron = 34%</p>	0-4 mm	The microscopic examination of natural river sand shows the presence of quartz and aluminum silicates of iron as main components. A few grains of additional minerals were optically observed include carbonate, olivine, pyroxene, and metallic minerals.
Gravel 1		<p><math>\text{SiO}_2 = 50\%</math>            Basalt = 25-30%            Carbonate (<math>\text{CaCO}_3</math>) = 10-15%</p>	1-4-6 mm	River gravel 1 with grain size 1-4-6 mm. Sandy material made of 50% $\text{SiO}_2$ , some black to dark green basalt pieces up to percentage as identified in related section. It is found carbonate content too.
Gravel 1		<p><math>\text{SiO}_2 = 65-75\%</math>            Basalt = 10-15%            Carbonate (<math>\text{CaCO}_3</math>) = 15%</p>	8-14 mm	Sandy material made of 75% $\text{SiO}_2$ , and some black to dark green basalt pieces up to percentage as identified in related section. It is found carbonate content too.
Gravel 2		<p><math>\text{SiO}_2 = 65\%</math>            Basalt = 10%            Carbonate (<math>\text{CaCO}_3</math>) = 20-25%</p>	10-20 mm	Sandy material made of 65% $\text{SiO}_2$ , and some black to dark green basalt pieces up to percentage as identified in related section. It is found carbonate content too.

Gravel 2		<p>SiO<sub>2</sub>= 60% (0.1-0.2 mm)      Feldspar      (plagioklazianorit group)= 7-10%      Muscovite = 2-3%      Iron aluminum silicates = 15-20%      Magnetite &amp; pyrite = 2-4%</p>	12.5-20 mm	Sandy material made of 60% SiO <sub>2</sub> . Feldspar and muscovite trace are founded in mineral microstructure under the microscope examination. Opac mineral such as magnetite and pyrite are founded too during the examination.
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# MGNREGA: ITS IMPLICATION IN INDIA: A OVERVIEW

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## ABSTRACT

The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) scheme was started by Govt. of India in lieu to provide atleast 100 days employment to people at the rural level. Its major aim was to strength the rural society. The Indian Govt. has contributed huge capital in this scheme and almost every year this amount is increased. After 8 years of its launch, this scheme has given the mixed results. As MGNREGA is started all over India, we can easily analyze both the positive and negative effects of this scheme with this paper. In some parts it has made the people especially women self dependent and increased the employment rate while in some parts a number of reports regarding the corrupt activities in MGNREGA, non availability of work, biasness regarding distribution of work had come. This paper aims at providing an overview of MGNREGA's implementation in several parts of India.

**Keywords:** MGNREGA, Employment Guarantee, Labour, Rural Areas, Income, Standard Of Living, Women Upliftment.

## I INTRODUCTION

The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is a flagship program of Government of India. The Act was notified initially in 200 most backward districts of the country w.e.f. February 02, 2006 and subsequently extended all over India in two phases. The program aims at enhancing livelihood security of the rural poor by providing at least 100 days of guaranteed wage employment in a financial year to every household whose adult members volunteer to do unskilled manual work. The Act seeks to create durable assets and strengthen the livelihood resource base of the rural poor. The choice of works suggested in the Act address causes of chronic poverty like drought, deforestation, soil erosion, so that the process of employment generation is on a sustainable basis.

### 1.1 Salient Features of MGNREGA

All adult members of a rural household willing to do unskilled manual work have the right to demand employment. After verification, the Gram Panchayat will issue a Job Card with photograph of all adult members of the household willing to work under the program. Job Cardholder can apply for work to the Gram Panchayat which will issue him/her a dated receipt of the work application. Employment will be provided by the Gram Panchayat (local self governing body) within 15 days of work application, failing which unemployment allowance will be paid. Disbursement of wages has to be done on weekly basis and not beyond a fortnight. Wages will be paid at the wage

rate to the wage earners through their Bank/Post office accounts. An annual shelf of works to be prepared in advance for each year. A ratio of 60:40 for wage and material costs should be maintained at GP level. No contractors/and no labour-displacing machinery shall be used in execution of works. Panchayati Raj Institutions will have a principal role in planning, monitoring and implementation. At least one-third of the workers should be women. Inbuilt incentive-disincentive structure to the State Government for guaranteeing employment.

### **1.2 Permissible activities under MGNREGA**

Water conservation and water harvesting including contour trenches, contour bunds, boulder checks, gabion structures, underground dykes, earthen dams, stop dams and spring shed development. Drought proofing including afforestation and tree plantation. Irrigation canals including micro and minor irrigation works. Provision of irrigation facility, dug out farm pond, horticulture, plantation, farm bunding and land development. Renovation of traditional water bodies including desilting of tanks. Land development.

Flood control and protection works including drainage in water logged areas including deepening and repairing of flood channels, chaur renovation, construction of storm water drains for coastal protection. Rural connectivity to provide all weather access, including culverts and roads within a village, wherever necessary. Construction of Bharat Nirman Rajiv Gandhi Sewa Kendra as Knowledge Resource Centre at the Block level and as Gram Panchayat Bhawan at the Gram Panchayat level. Agriculture related works, such as, NADEP composting, vermi-composting, liquid bio-manures. Livestock related works, such as, poultry shelter, goat shelter, construction of pucca floor, urine tank and fodder trough for cattle, azolla as cattle-feed supplement. Fisheries related works, such as, fisheries in seasonal water bodies on public land. Works in coastal areas, such as, fish drying yards, belt vegetation. Rural drinking water related works, such as, soak pits, recharge pits. Rural sanitation related works, such as, individual household latrines, school toilet units, anganwadi toilets, solid and liquid waste management.

### **1.3 Funding**

The Central Government bears the 75% of the cost of material, wages of skilled and semi-skilled workers while the State Government bears the remaining 25% of the cost.

### **1.4 Program Implementation and Outcomes**

MGNREGA has generated the employment to around 4.48 crore persons in the year 2012-13 and this is increasing year by year. Around 64.54 lakh works have been started under this.

## **II LITERATURE REVIEW**

Poonia [1] in the study compared the different employment schemes being operational in various states of India like EGS in Maharashtra, NREGA and findings from Kerala. NREGA also helped in social protection and hike in wage rate among women from Rs 70-80 to Rs 110 to 125. Das [2] researched that MGNREGA helped in

increasing/providing employment to rural workers in the lean season. It helped the small agriculturists to create surplus of cash to meet daily expenses. It also helped to stop the migration from villages to cities in the off seasons. Ahuja et. al [3] analyzed the impact of MGNREGA in two different districts of Haryana. One the agricultural advanced: Karnal and other the agricultural backward: Meewat. It was found that the employment in Karnal under MGNREGA was just around 13% while in Meewat it was around 24%. But MGNREGA has not been able to check the migration from the developed region because of higher market wage rates at destinations. Ghosh [4] compared the wage differentials between MGNREGA activities and other wage employment activities and the pattern of migration from rural to urban areas across five districts of West Bengal. The MGNREGA wage was found to be higher than the wage for agricultural workers in the state and this led to distortion of the wage labour market. The study postulates that the net effect of MGNREGA has been negligible.

In a case study of Implementation and Impact of MGNREGA on Agricultural Produces Cost- A case study of Sagar district [5] it is found that MGNREGA has increased the labour wage rate in agricultural sector and problems of less availability of labour has also been analyzed on another hand. It has also helped to overcome the problem of poverty but it also created the problem of increase in input cost of agriculture. Jain [6] said that the government should discourage the educated people from doing the unskilled jobs and provide them the jobs according to their educational qualifications. Dhiman [7] researched that India has launched many schemes to end the vicious cycle of poverty and NREGA was started with much fanfare in 4 states including H.P. but these are not performing well. Reddy [8] said that agricultural wages have been increased from Rs.700 to Rs. 2,000 per acre in just about 2 years in Punjab due to the implementation of NREGA. Farmers are blaming implementation of NREGA in UP, Bihar and Jharkhand etc. There is great problem in peak season in finding the labour to sow paddy in the month of July in Punjab.

In a report namely Sutra [9] submitted to Ministry of Rural Development (Govt. of India) concluded that NREGA enabled to higher women participation especially in Amritsar, Jalandhar & Hoshiarpur districts. Also no gender discrimination is done in case of wage payments. In all India report on NREGA – A survey of 20 districts [10] submitted to Govt. of India it was analyzed that NREGA has increased the income levels of beneficiaries but it did not able to stop migration from villages to the cities. It has been revealed that around 70% of the total migration from villages to cities is due to survival rather than for better wages. In a report Appraisal of Impact Assessment of NREGS in selected districts of Himachal Pradesh, Punjab, Haryana. Districts: Hoshiarpur, Sirsa, Sirmaur [11] it has been analyzed that there has been increase in the issuing of new job cards in all the districts but the percentage of the job card holders in getting 100 days work is very low. Ghuman [12] accessed that NREGA was not much fruitful in the initial years in Hoshiarpur district of Punjab. Workers were given on average just Rs. 92 per day as compared with the national average of Rs. 148 per day. Upto this time NREGA has not helped to uplift the standard of living of the people.

In NREGA Sameeksha Report [13] prepared by Ministry of Rural Development Government of India it is analyzed that about Rs. 1,66,000 crore has been distributed to people from FY 2006 upto FY 2011-12. Maharashtra has observed highest increase in notified wages of about 200% and Kerala at the lowest at just 31%. According to the

report, Impact of NREGA on Wage Rates, Food Security& Rural Urban Migration in Punjab [14] submitted by PAU, Ludhiana revealed that poorest of the poor people are more inclined towards NREGA but the average working days is 54.15 per annum. Also the participation of SC's people are more than BC's. Even wages of casual labour have been increased due to an overall decline in the supply of labour in the agricultural sector. Jha et al. [15] explored the important but relatively neglected issue of real income transfers, net of the opportunity cost of time, under India's National Rural Employment Guarantee Scheme. They used representative household level primary data for three states, Rajasthan, Andhra Pradesh and Maharashtra to depict various individual and social characteristics of the population in these states as well as those of the participants in the NREGS. Kareemulla et al. [16] revealed that Rajasthan, Andhra Pradesh and Madhya Pradesh are the three states leading in scheme implementation with a large number of works, expenditure and employment. In Andhra Pradesh, soil and water conservation (SWC) works have accounted for over 80 per cent. The share of labour wages under the scheme has been 80 per cent with only 20 per cent for material, which is well within the prescribed norm of 40 per cent for the later. The field study in the Ananthapur district has indicated that almost two-thirds of the beneficiaries are farmers. The scheme has brought down the migration levels from about 27 per cent to only 7 per cent in the villages. Rahmatullah [17] in his study said that MGNREGA has increased the standard of living in the rural areas which will motivate the people to migrate in the urban areas due to increased income and standard of living. He also clarified that many persons associated with MGNREGA are not fully satisfied due to non availability of work and sometimes due to hard work being given to them. According to him, Govt. has to amend the MGNREGA to provide more employment opportunities to the unskilled labor. Bhattacharyya and Vauquelin [18] in their study find that due to gender discrimination and lack of proper infrastructure facilities like toilet, childcare facilities and vulnerability of women is proving a great hindrance in the full participation of women in MGNREGA. Also the male workers attitude towards the female workers, non availability of regular work and presence of corruption etc are responsible for lesser results under MGNREGA. Prattoy Sarkar et al. [19] in the study done in the Burdwan district of West Bengal revealed the poor economic condition of the people working under MGNREGA in the rural villages. They laid emphasis in starting the some other developmental works also for these poor labourers. They concluded with providing more facilities to the elderly persons engaged in MGNREGA, fair and fast payment of wages and ending the political interference in providing the work. Holmes et al. [20] in the study done in the parts of Madhya Pradesh revealed the ground position of working under MGNREGA in two districts of Madhya Pradesh. Women have to suffer a lot while working under this. They are forced to leave their breastfeeding children at home. There is also no provision for giving specific work to the pregnant and recently delivered women and physically challenged persons. Other things include lack of childcare facilities at the workplace etc. MGNREGA has also put women in some tension as they had to work double first at home and other at workplace.

Berg et al. [21] after studying the monthly wages data of 219 districts of 18 Indian states concluded that MGNREGA has increased the real daily agricultural wages 4.8 per cent per year in these districts since the introduction of this scheme. It has made more impact in the agricultural sector engaging unskilled labour. In a study

of the villages of Tamil Nadu done by Indian Institute of Technology, Chennai [22] it is researched that almost all works done under MGNREGA has some social benefit like water harvesting and water bodies renovation. It has done a great job by providing job to the unskilled labour. But to strengthen and broaden its base the Govt. has also to engage the educated and skilled persons under MGNREGA to take help in various activities like map making, keeping of records etc. The skilled and unskilled, educated and illiterate labour can be divided into various proportions to give them specific work. In a project, Hirway et al. [23] have given some recommendations to make some changes in MGNREGA to make it more output oriented . It includes providing skill training to the workers, making of public assets like conservation of rainwater sources, including of more services etc. Raabe et al. [24] in their research used the Process Influence Mapping to study the effects of MGNREGA in the villages of Bihar. They have given some suggestions to overcome the challenges of MGNREGA. These mainly include to design the proper work process, to provide job cards to the people at proper time, to make people more aware about the MGNREGA scheme, to check the proper utilization of funds and providing proper training to the persons who actually supervises the MGNREGA works.

Das [25] in his study researched that the schemes like MGNREGA are proving very fruitful to preserve the age old irrigation system in southern India like ponds, wells etc which are now neglected by both the local communities and the various governments. Banerjee and Saha [26] studied the impact of MGNREGA in the areas of Chattisgarh, Jharkhand and Orissa. This study was done by taking into account some specific factors. This research revealed that MGNREGA has increased the wage rates in the rural areas. It has also increased the agricultural investment as now farmers have some additional income to buy fertilizers etc. And it also make increase in the household income and it has controlled outmigration in the villages of the above states upto some extent. Bordoloi [27] in his study regarding the implementation of MGNREGA in Assam observed that MGNREGA has improved the life of people living below poverty line in Assam upto some extent. It has also resulted in increase of income of the households in rural areas. But it has not able to give the desired results due to various factors like corruption, delay in wages, non planning of execution of work etc. He also suggested some measures to improve the life of people in rural areas. These include increasing the number of days under MGNREGA upto 150 from the existing 100, no political intervention, time period for the execution of work, non intervention of other departments in the village panchayats and taking all the natural assets and resources under the purview of MGNREGA to make it more output oriented [27]. Adhikari and Bhatia [28] studied the role of banks in giving wages to the MGNREGA workers. They researched that some bank officers are also indulged in corrupt activities while dealing with MGNREGA workers. Even other financial institutions like post offices are not so efficient to deliver wages and keeping the records of MGNREGA related persons. They have suggested some methods like delivery of wages directly to the worker, proper updation of the record, payment must be made from the centralized and computer operated banks, direction of RBI to the banks regarding payment of wages and social audit of all the works done under MGNREGA.

### III CONCLUSION

From the above review, we can come on conclusion that MGNREGA is proving a significant employment providing scheme being started by Govt. of India as it has increased the rate of employment, level of income of the people living in rural areas and helped in increase in standard of living and making/ formation of assets. MGNREGA also helped the poor farmers to build assets, power to buy good quality seeds and fertilizers and increase in income as now they are able to work in the off seasons. But still this scheme lacks in various issues like corruption, irregular availability of work, non-payment of wages at proper time and lack of planning of starting of new work. Many authors have given their views to cover the loopholes in this which can be taken into consideration by Govt. for further increase in its output.

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## **MECHANICAL WEED CONTROL BY CONOWEEDER IN SRI METHOD OF PADDY CULTIVATION**

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### **ABSTRACT**

*The study revealed that weeders and methods selected for the study has its own strengths and limitations. Conoweeder can be recommended in the early stages of weed growth as the better weeding efficiency, more turning of the soil and uprooting of weeds overrules the higher cost of operation. Conoweeder performed the task with comparatively higher field capacity, better performance index in the early stages of weed infestation. The field performance analyses have shown that Weeding efficiency as 72.2 % for Conoweeder with damage factor of 4.1% respectively. It was found that a male subject took an average of 80.8 h/ha respectively for weeding operation with conoweeders; whereas the female subject took 125 h/ha. The hand weeding was a superior weeding system for crop growth parameters than any other system employed in this study. The Conoweeding system also showed consistently greater results which were comparable to hand weeding. The performance analysis results demonstrated that weeding tools can produce large reductions in the weeding costs and significant reductions in labour time, whereas hand weeding reached the best efficiency in weed control. The combination of Conoweeding and chemical weeding is very effective as compared to other treatments.*

**Keywords – SRI, Conoweeder, Mechanical weeding, Chemical weeding, Hand weeding**

### **I. INTRODUCTION**

Paddy is major crop of Gadchiroli district over 1,42,500 hec with average annual rainfall of 1440 mm. The System of Rice Intensification (SRI) method is new emerging technique in the farming community of Gadchiroli. As a new way of looking at rice cultivation SRI is emerging as an alternative to conventional water and chemical intensive rice cultivation. One of the major laborious and time consuming operations in rice cultivation is weeding. The global figure for crop yield loss is accepted as 10% of actual yield (Fletcher, 1983). The yield losses ranges from 10-50% in transplanted rice and 50-90% in upland rice depending on the extend of weed infestation (Pathak et.al., 1976). In Gadchiroli paddy growers grant their higher priority to hand weeding in traditional as well as in SRI method. As SRI paddy cultivation is now more popularizing and to mechanize the weeding, Conoweeders are used for weed control.

So it is highly significant to study the comparative evaluation of these weeding methods in terms of performance with competitive methods like manual and chemical weeding and its cost effectiveness. Therefore, this research project is undertaken.

## **II METHODOLOGY**

This study is conducted on the farm of Krishi Vigyan Kendra, Sonapur – Gadchiroli. The farm selected has soil with clay fractions. The experimental field was well prepared through two ploughing, leveling and puddling with puddler. The PKV HMT variety of paddy was grown in bed nursery. After 15 days the crop was transplanted to the main field with a row to row spacing of 25cm and plant to plant spacing of 25 cm by manual transplanting as per the SRI method. The test field was divided into twenty five plots of 10 m x 10 m size. As per the treatments weed control operations were followed for manual, mechanical, chemical and combine treatments. After emergence of weeds Conoweeder was applied for intercultivation and weed reduction. Performance evaluation of Conoweeder was studied and the use of Conoweeder was compared with the conventional hand weeding and newly emerging chemical weeding. Effect of Conoweeder application on the yields of paddy was recorded.

Different characteristics, treatments and replications selected as below –

<b>Characteristics 11</b>	<b>Treatments 6</b>	<b>Replications 5</b>
Weeding Efficiency (%)	Hand Weeding (T1)	5 for each treatment
Damage Factor (%)	Cono Weeding(T2)	
Field Capacity – Male ha/day	Chemical Weeding(T3)	
Field Capacity – Female ha/day	Cono + Hand(T4)	
Performance Index - Male	Chemical + Hand (T5)	
Performance Index - Female	Cono + Chemical (T6)	
Time reqd. – Male hr/ha		
Time reqd. – Female hr/ha		
Cost of operation – Male Rs/ha		
Cost of operation – Female Rs/ha		
Yield qtl/ha		

### **Experimental design and treatment details**

Treatments	Symbol	Details of Treatment
T1	H	H – Hand weeding
T2	W	W – Conoweeder
T3	C	C – Chemical weedicide application
T4	WH	WH – Weeding using Conoweeder and one hand weeding
T5	CH	CH – Weeding using Chemical weedicide Butachlore and one hand weeding
T6	WC	WC – Weeding using Conoweeder and chemical weedicide application

There were six treatments as above and each replicated five times.

The specifications of the Conoweeder selected for analysis is as shown below

Specifications	Conoweeder
Weight (kg)	6.5
Effective width (cm)	16
Depth of cut (cm)	4
Handle length (cm)	42
Handle circumference (cm)	9
Rotor spacing (cm)	25
Float Width (cm)	9.5
Float Length (cm)	35
Weeder Height (cm)	109
Weeder Length (cm)	171
Angle of Inclination (Degree)	32.5

### **Evaluation of Field Performance of Weeders**

To evaluate the field performance of Conoweeder and other methods different parameters like weeding efficiency, damage factor, field capacity, performance index, time required for weeding etc. were measured with standard formulas.

A square loop ( $0.25\text{ m}^2$ ) was randomly thrown to the experimental plots and the number of weeds included in the loop was counted before and after weeding. Five sets of readings were taken and the average was calculated. The weeding efficiency or weeding index is calculated using the formula:

#### **Weeding Efficiency (WE)**

$$\text{WE} = \text{W}_1 - \text{W}_2 / \text{W}_1,$$

Where,  $\text{W}_1$  = Number of weeds before weeding

$\text{W}_2$  = Number of weeds after weeding

#### **Damage Factor (DF)**

DF or quality of work done is the measure of damage on crop plants, while weeding operations, denoted by the expression given below.

$$\text{DF \%} = \text{Q}_2 / \text{Q}_1 \times 100,$$

$\text{Q}_1$  - Number of plants in 10 m row length before weeding

$\text{Q}_2$  – Number of plants damaged along 10 m row length after weeding.

#### **Performance Factor (PF)**

The performance factor was calculated as:

$$\text{PF} = \text{Field Capacity (ha/h)} \times (100 - \text{DF (\%)}) \times \text{WE (\%)} / \text{Power (Hp)}$$

Where , DF = Damage Factor (%)

WE = Weeding Efficiency (%)

### **III RESULTS**

#### **3.1 Weeding Efficiency**

Weeding efficiency was 83.4, 72.2, 80.3, 86.4, 82.4 and 88.8 respectively for Hand weeding, Conoweeding, Chemical weeding, Cono + Hand Weeding, Chemical + Hand weeding and Conoweeding + Chemical weeding. The increased soil contact and soil inversion capacity of Conoweeder add greater values to its higher weeding efficiency. Conoweeder gives better performance on initial stages of weed growth. If the weeds are matured the Conoweeder just rolls over the weeds with minimum uprooting and inversion. Chemical weedicide applied is Butachlore with 2.5 lit/ha dose. This is pre emergence weedicide. Weeds grown after application of Butachlore were measured.

#### **3.2 Damage Factor**

The damage factor 0.76%, 4.1%, 0%, 4.16% and 0.54% and 4.04% for Handweeding, Conoweeding, Chemical Weeding, Cono + Hand Weeding and Chemical + Hand weeding. The higher percentage damage in the case of Conoweeder due to the higher effective width of cut of weed rolls and uneven transplanting. Moreover, greater depth of cut and inversion of Conoweeder cause the uprooting of crop, which are extending to the row spacing.

### **3.3 Velocity & Field Efficiency of weeding operations**

Conoweede had higher velocity of operation. For male subjects, the velocity of weeding is 0.44 m/s and for female subjects 0.32 m/s respectively. The time loss for turning was 1.73 h/ha for male subjects and 2.4 h/ha for female subjects. For Conoweede the field efficiency was 86.5%. The time loss independent of area, which is required for the operation, was about 4 h /ha. The time loss for turning was 1.83 h/ha for male subjects and 2.51 h/ha for female subjects for the same.

### **3.4 Field capacity**

It is observed that Conoweede had higher field capacity. The field capacities of Conoweede were 0.16 ha/day and 0.12 ha/day for male and female subjects respectively. In case of hand weeding by male and female laborers, field capacities were obtained as 0.0232 ha/day and 0.0202 ha/day respectively. That is the male and female laborers took an average of 367 and 310 labour hours per hectare respectively. In case of chemical weeding field capacity of female is 0.91 ha/day and for male is 1.132 ha /day.

### **3.5 Performance Index**

Performance index of a weeding implement would be directly related to the field capacity, weeding efficiency and (100-damage factor in percentage) inversely related to power exerted. The performance index for male and female that of Conoweede were 372 and 371. The performance index of Chemical weeding was higher than that of the hand & Cono weeding; this is because of higher field capacity and minimal or no damage factor.

### **3.6 Time required for Weeding**

The study shows that the time required for hand weeding per hectare was in the range of 360-380 h (average value 360 h) for male labours and that for female labours was 300-320 h (average value 310 h). For the same area, male labours took an average of 80 h for conoweeding and female labours performed the task in 125 h for conoweeding respectively. For chemical weeding hr/ha required for male & female were 45 & 63 respectively.

### **3.7 Economic Analysis**

The economic aspects of weeding were analyzed using the straight-line method. The expenses associated with different weeding operations are depicted in Table 2. The study showed that cost of weeding for female labours could be reduced by 2.5 times by using Conoweede, compared to hand weeding. While for male labours the weeding cost could be reduced by 4.5 times by using Conoweede compared to hand weeding.

**Table 1 . Mean performance characteristics of different weeding operations**

<b>Characteristics</b>	<b>Hand Weeding</b>	<b>Cono Weeding</b>	<b>Chemical Weeding</b>	<b>Cono + Hand</b>	<b>Chemical + Hand</b>	<b>Cono + Chemi</b>
Weeding Eff. (%)	83.4	72.2	80.3	86.4	82.4	88.8
Damage Factor (%)	0.76	4.1	0	4.16	0.54	4.04
Field Capacity – Male ha/day		0.15858	1.132	0.0414	0.1262	0.10978
Field Capacity – Female ha/day	0.0232	0.11156	0.91	0.052	0.1342	0.0848
Performance Index – Male	427.4	372	515.8	366	492.2	877.8
Performance Index – Female	442	371	499.6	363	503.2	814.8
Time reqd. – Male hr/ha	367	80.8	45.4	115.2	65.8	123.6
Time reqd. – Female hr/ha	310	125	63	144.8	75.2	151.6
Cost of operation – Male Rs/ha	5716	1250	1680	1596	1942	3220
Cost of operation – Female Rs/ha	4646	1840	1900	2252	2180	3780
Yield qtl/ha	22.56	26.38	23.3	30.44	28.6	31.32

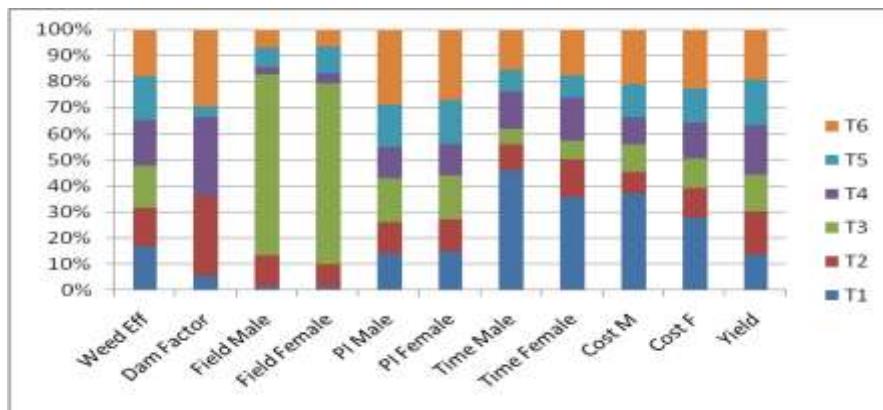
### 3.8 Statistical Analysis

Statistical analysis is done for the five treatments and five replications with characteristics as shown in the table

From the statistical analysis it is revealed that Treatment T6 (Conoweeder + Chemical Weeding) recorded weeding efficiency of 88.8 % and was at par with T4 (Conoweeding + Hand Weeding) which recorded weeding efficiency of 86.4%. Treatment T4 (Conoweeder + Hand Weeding) recorded weeding efficiency of 86.4 % and was at par with T1 (Hand Weeding) which recorded weeding efficiency of 83.4%. T4 & T1 were significantly superior over T5 (82.4%), T3 (80.3%) & T2 (72.2%).

Characteristics	WE (%)	DF (%)	FCM ha/day	FCF ha/day	PI – Male	PI – Female	TM hr/ha	TF hr/ha	Cost Male Rs/ha	Cost–Female Rs/ha	Yield qt/ha
Treatments											
<b>Hand Weeding (T1)</b>	83.4	0.76	0.0232	0.0202	427.4	442	367	310	5716	4646	22.56
<b>Cono Weeding (T2)</b>	72.2	4.1	0.1585	0.11156	372	371	80.8	125	1250	1840	26.38
<b>Chemical Weeding (T3)</b>	80.3	0	1.132	0.91	515.8	499.6	45.4	63	1680	1900	23.3
<b>Cono + Hand (T4)</b>	86.4	4.16	0.0414	0.052	366	363	115.2	144.8	1596	2252	30.44
<b>Chemical + Hand (T5)</b>	82.4	0.54	0.1262	0.1342	492.2	503.2	65.8	75.2	1942	2180	28.6
<b>Cono + Chemi (T6)</b>	88.8	4.04	0.1097	0.0848	877.8	814.8	123.6	151.6	3220	3780	31.32
<b>SE</b>	0.51	0.07	0.02	0.01	4.38	6.64	2.68	2.96	61.41	51.91	0.62
<b>CD</b>	1.5	0.21	0.05	0.04	12.93	19.6	7.92	8.74	181.12	153.11	1.84
<b>CV</b>	1.39	7.17	13.2	13.97	1.93	2.98	4.51	4.57	5.35	4.2	5.14
<b>Significance</b>	S	S	S	S	S	S	S	S	S	S	S

Graphical representation of the weed control treatments is as below



#### IV CONCLUSION

The study revealed that the weeders and methods selected for the study has its own strengths and limitations. Conoweeder can be recommended in the early stages of weed growth as the better weeding efficiency, more turning of the soil and uprooting of weeds overrules the higher cost of operation. Conoweeder performed the task with comparatively higher field capacity, better performance index in the early stages of weed infestation. The field performance analyses have shown that Weeding efficiency as 72.2 % for Conoweeder with damage factor of 4.1% respectively. It was found that a male subject took an average of 80.8 h/ha respectively for weeding operation with conoweeders; whereas the female subject took 125 h/ha. The hand weeding was a superior weeding system for crop

growth parameters than any other system employed in this study. The Conoweeding system also showed consistently greater results which were comparable to hand weeding. The performance analysis results demonstrated that weeding tools can produce large reductions in the weeding costs and significant reductions in labour time, whereas hand weeding reached the best efficiency in weed control. The combination of Conoweeding and chemical weeding is very effective as compared to other treatments. Farmers avoid the chemical weed control if manual and mechanical options are available. More precision is required to use the chemical weedicides. This is the good option in the scarcity of labours on time. The study could conclusively identify weeding operation, as one of the major factors which can pose a great influence on crop yield.

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# OBJECT REMOVAL USING MODIFIED DIRECTIONAL MEDIAN FILTERING FOR DIGITAL IMAGE INPAINTING

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## ABSTRACT

*Digital Image Inpainting is a technique of correcting a damaged part of an image in such a way that it appears normal and continuous for a not so familiar observer. The important applications of Digital Image Inpainting include restoration of old photographs, elimination of chosen objects from photographs, removing texts or logos and creating artistic effects in an image. In Digital Image Inpainting technique the information surrounding the damaged portion of an image is used to estimate the pixels in the damaged region. In this paper, we propose an efficient method to inpaint a damaged image based on modified directional median filter. The method proposed in this paper is tested for removing objects selected by the user. A number of experiments show that the algorithm can efficiently remove object selected by an user in less time and for homogenous background.*

**Index Terms:** *Digital Image Inpainting, Estimating Damaged Pixels, Object Removal Modified and Directional Median Filter.*

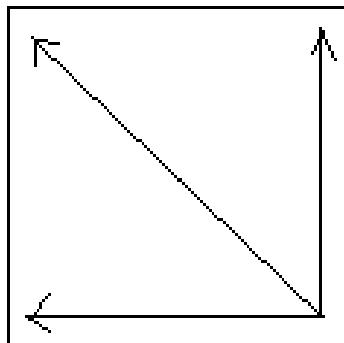
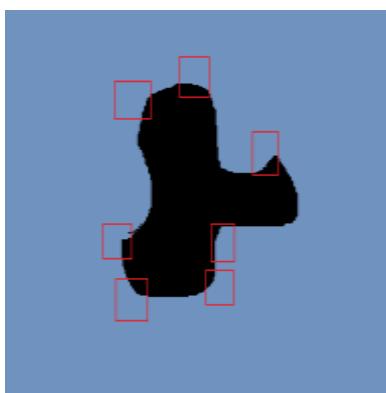
## I.INTRODUCTION

Most of the cultural and scientific heritage is stored in the form of Digital Image. Due to aging the images get degraded, hence restoration or reconstruction is an important research area. The performance of these studies has been rapidly improved in recent years. Missing area reconstruction is one of the most attractive topics for study in the field of image restoration since it has a number of applications. Unwanted object removal, missing block reconstruction in an error-prone environment in wireless communication, and restoration of damaged old films are important applications. In short, the image inpainting is the current hot topic in both computer technology and computer vision and has great application value [1]. Digital image inpainting techniques face great challenges in actual cases and also require constant improvement and development. Although some popular image processing softwares such as Photoshop, CorelDraw, etc can also repair the damaged image, but demand professional skills on the users. And users must be careful to fill the color and texture and follow a complex and tedious manual, which makes it more urgent to do image inpainting automatically and easily. Extensive research has been carried out in the field of digital inpainting. Depending on the approach, digital inpainting algorithms can be categorized into two main categories. Partial differential equation based

algorithms(PDE), like the ones proposed in [2],[3],[4] which fill in missing regions in an image by extending lines of equal intensity values from the source region into the target region. These inpainting algorithms introduce blur artifacts that become more visible when larger areas are inpainted. Papers [6],[7],[8],[9],[10],[11] propose exemplar-based inpainting algorithms which form the second category. Methods in this category try to overcome the drawback exhibited by PDE based techniques, by reconstructing large missing image regions from sample textures. Exemplar-based texture algorithm reconstructs the damaged part of an image by finding a similar patch in the rest of the image. The similar patch is then copied into the missing region of the image. In image inpainting technique the user selects the target region which is to be restored then algorithm automatically starts filling in that region using the available information from the source region. Filling process is based on the pixel priority, higher priority pixels are filled first. Priority of pixel is high if pixel lies on isophote lines arriving at the boundary region [12]. Paper [13], proposes inpainting based on coupled spatial and temporal anisotropic diffusion. The idea is to achieve an adaptive smoothing in both spatial and temporal directions, by solving a nonlinear diffusion equation. This allows removing noise while preserving all spatial and temporal discontinuities. The aim of paper [14] is occlusion removal and reconstruction of the image. An image mainly consists of two parts, structure and texture. The image is decomposed into structure and texture by morphological component analysis (MCA) decomposition method. They are processed separately. Structure image is processed using sparse inpainting method. Texture image is processed using anisotropic diffusion.

## II.MODIFIED DIRECTION MEDIAN FILTER

Paper [15] proposes a digital image inpainting algorithm based on Directional Median filters. The unknown pixel values are estimated by considering a window across the damaged region and median value of known pixels in each direction is calculated. The damaged pixel is replaced by the median of the obtained values. This algorithm can be modified by considering a window size where the damaged pixel is not at the centre but is off centred as shown in Figure 1. The blue region is the known region and the black region is the unknown region. The red colour box shows the window with the unknown pixel value at the right side corner. Figure 2 shows a neighbourhood of 3x3 sizes where zero indicates unknown pixel value.



122	131	129
120	126	120
125	123	0

**Fig 1 Off Centered Window Fig 2 Neighborhood Pixels Fig 3 Aspect of a directional median filter**

Order statistics information like median of pixels in the neighborhood can be used for estimating damaged pixels. In this paper we propose digital image inpainting algorithm based on modified directional median filtering to restore damaged regions. This algorithm is fast, simple and provides good results. The proposed algorithm is as follows. First the damaged regions are detected. A thick boundary region of the missed region is considered for filling. For each missed pixel on the boundary, a window size of 5x5 is selected which consists of known (more) and unknown (few) pixel values. Then, the median value in three directions are determined as shown in figure 3 and finally, the damaged pixel value is estimated to be the median of these medians. For the first iteration, all the damaged boundary pixels are reconstructed. In next iteration, the new boundary is first calculated and the boundary pixels are reconstructed. Steps of the algorithm are as follows.

- a) The colored image is separated into R, G and B planes.
- b) The user selects the object to be removed by manually clicking on the object.
- c) A mask image is obtained with ones in the region to be reconstructed and zeros otherwise.
- d) Fill the region to be reconstructed with zeros in the R G and B planes if mask pixel is one.
- e) Detect the boundary of R plane. Widen this boundary by considering few nearby pixels.
- f) For a pixel on the boundary construct a window of size 5x5 with the damaged pixel at the right corner.
- g) Compute median in all directions as shown in figure.3
- h) Compute median of obtained values in previous step and replace the damaged pixel with this value.
- i) Shrink damaged region one pixel.
- j) Repeat steps e to i till all the damaged pixels are reconstructed
- k) Repeat steps e to j for G and B planes.
- l) Combine R,G and B planes to get back the colored image.

### III.RESULTS

The discussed algorithm is tested on a variety of images to investigate the performance of inpainting. The user manually selects the object to be removed. The information from the surrounding is diffused by calculating the median from the outer edge of the damaged region to the interior part. The proposed algorithm is implemented in MATLAB 7.7.0.471 R2008b. Evaluation of inpainting algorithm is a difficult task and there is no common method for evaluating inpainting algorithms. Figures 4,6,8,10,12 and Figures 5,7,9,11,13 show the input and output images of the algorithm. In figure 4 we can see that the object to be removed is marked by the user and that region is initialized to zero pixel value.



**Fig 4 Original image**



**Fig5 Inpainted Image**



**Fig 6 Original Image**



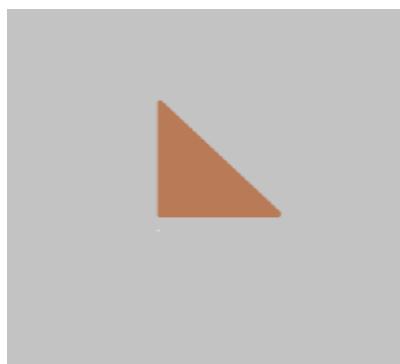
**Fig7 Inpainted Image**



**Fig 8 Original Image**



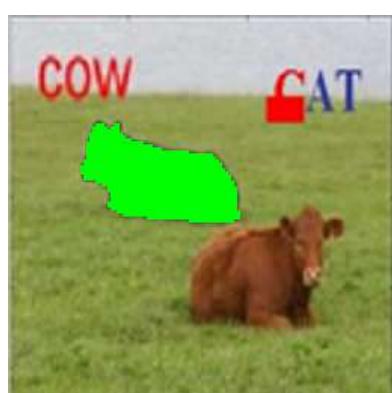
**Fig9 Inpainted Image**



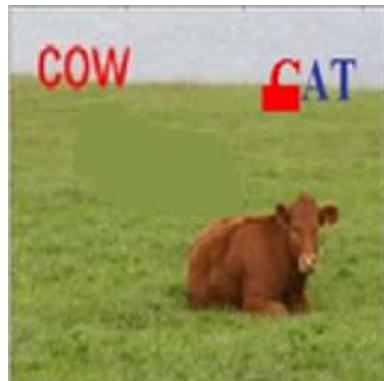
**Fig 10 Original Image**



**Fig11 Inpainted Image**



**Fig 12 Original Image**



**Fig13 Inpainted Image**

#### **IV. CONCLUSION**

In this paper, we have proposed a modified directional median filter, Digital image Inpainting Technique for object removal selected by user. The damaged pixel is estimated by finding the median in all directions of an off centered window. The algorithm is fast and simple. The algorithm results are obtained for several images and the objects are removed in a visually plausible way. Future work will include Object removal for non homogenous images and using other order statistics like mean and variance with different sizes. Performance analysis can be done by finding the time required for filling with respect to number of pixels to be reconstructed. Further efficiency can be calculated as the ratio of number of pixels inpainted to total number of pixels to be inpainted.

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# HUMAN ACTION RECOGNITION BASED ON ENHANCED DYNAMIC TIME WARPING

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## ABSTRACT

*Applications of Human Action recognition (HAR) has started to foray into Gaming, Human computer interaction and surveillance. These new applications require newer and quicker methods that resolves user actions at near real-time speeds. This paper proposes an Enhanced Dynamic Time Warping (EDTW) based approach that recognize human action in a given video in two phases. For this, a kinematic model of the actor is constructed and key poses are found using a suitable clustering method. When a new video dataset arrives, key poses are extracted from it. In first phase of EDTW the similarity of poses from new input are compared with other actions in the repository. In the second phase the measures are processed for confidence and the final classification is done, giving an action label as output.*

**Keywords:** Enhanced DTW, Classification, Human Action Recognition, Human Computer Interaction, Video Processing.

## 1. INTRODUCTION

Human action recognition (HAR), plays one of the most important roles in computer vision. Describing the actions in a video have a large number of applications, and as the amount of video data grows, and our technology becomes more capable, the demand for action recognition grows. Historically, action recognition has mainly been a human task, but automating the process, or parts of it, could provide a number of advantages. Apart from computer vision, Human action recognition has also forayed in to the field of Human Computer Interaction (HCI).

Using marker-based and marker-less approaches to detect track and recognize the humans present in the video. Historically, human action recognition started from marker based system that required the user to wear specialized suite that had dedicated sensors at designated points on the human body. Apart from wearing this suite the user had to be kept in a controlled environment that had predefined background and less or no background clutter. Marker based approaches were deemed unfit for real time usage. With advent of parallel processing and cost effective hardware for acquiring video, real time, marker-less methods for human action recognition came into significant usage in the recent years. Among Marker-less human action recognition came two models for recognizing actions. They are conditional models and discriminative models. Conditional models used offered higher accuracy in recognizing the human actions with a trade off in computational time and required a reasonably large amount of

memory. Discriminative models on the other hand required less time and computational resources with reasonable compromise in the recognition accuracy. But this soon changed with ability to incorporate Depth information of objects and humans in the videos using specialized hard ware such as Microsoft Kinect.

## II RELATED WORKS

Di Wu et all [1] proposed a shape based system that extracts user information in form of silhouette. Their system extracts frames from the given video dataset and constructs a rough silhouette from each frames, extracts information from the silhouettes and recognizes the action conveyed by them using corellogram based estimation algorithm. The advantage of this system is that it uses principle component analysis to reduce dimensions and it is computationally less expensive than analytical approaches. But this falls short in the following areas prone to be affected by occlusion and does not capture spatial variations.

Li Liu et all [2] proposed that uses a ‘kinematic based approach by constructing a model by extracting features from a sequence of frames and estimating Human Pose from them. This approach uses Weighted Local Naïve Bayes Nearest Neighbor Classifier for recognizing the final action. Since not all poses in a sequence are discriminative and representative, AdaBoost algorithm was used to learn a subset of discriminative poses. The advantages of this model is that it uses model to effectively represent human poses and Takes only the key poses that convey information, and discards the rest. Limitations of this approach are that it is computationally expensive than Silhouette and Learning Time overhead in case of using Adaboost.

Alexandros Andre Chaaraouiet all [3] presented a system that uses an adaptive approach that works well with ‘Shape based’ and ‘kinematic model based methods of estimating Human Pose from videos. The main advantage of this method was that it has an evolutionary algorithm that gives room for learning new poses. Though it eliminated the need for retaining the system it suffered from limitations such as time taken for preprocessing frames for adaptation, May require up to 50 iterations to converge and Results may change according to random initialization in K-means.

Wei Shen et all [4] presented a system that Uses Fourier temporal Pyramid representation to estimate Human Pose from videos. Uses a new method of learning called ‘Actionlet Ensemble. As Human actions usually involve human-object interactions, highly articulated motions, high intra-class variations, and complicated temporal structures. The final action recognition was done using Hidden Markov model or Neural networks. The main selling point of this method was that it was robust to temporal misalignment and had high tolerance for noise. Limitations of this algorithm was that works well only on simple activities such as drinking, running etc and it needs some supervision in case of complex tasks.

Jamie Shottonet all [5] proposed a system that allowed us estimate simple depth pixel comparison features and parallelizable decision forests to detect poses in real-time. It uses a Parallel decision forest algorithm to estimate the action of human present in a video dataset. This method preforms well in real time speeds when compared to other methods. To achieve such a performance it requires depth information to be present in the video and often results in lower recognition rate.

Al Mansur et all [6] proposed a system for HAR using a physics-based model that articulates and actuates muscles and consists of joints with variable stiffness. The main advantage is that these features are more discriminative than kinematic features, resulting in a low-dimensional representation for human actions, which preserves much of the information of the original high-dimensional pose. However any abrupt changes in positions cannot be handled with this method.

RavitejaVemulapalliet all [7] have made an approach to HAR using a Kinematic model with a combination of Support vector machine to arrive at a target action class. They used a new skeletal representation that explicitly models the 3D geometric relationships between various body parts using translations and rotations in 3D space. Since 3D rigid body motions are members of the special Euclidean group SE(3), the proposed skeletal representation lies in the Lie group. With the proposed representation human actions can be modeled as curves in this Lie group. The main advantage is that this performed on better than the state of the art skeletal based systems with a higher recognition rate, but required time to converge.

### III SYSTEM ARCHITECTURE

#### 3.1 Proposed System

This Paper presents an approach that uses combination of kinematic modelling and EDTW. Kinematic modelling is mainly used to represent humans present in the given video and then a Bag of key poses model to represent the sequence of key poses. Thus, a repository is created to store the training data of various selected actions. When a new video is given as input, kinematic model of the human is constructed and action recognition is performed using an Enhanced Dynamic Time Warping (EDTW). The classification algorithm here compares the similarity between each key pose in the repository against each key pose in the new video dataset. The overall similarity is computed in terms of two measures, as the overall bag-wise distance and the posewise similarity. Based on the two measures and the proposed algorithm, the system arrives at an action label output.

#### 3.2 Module Design

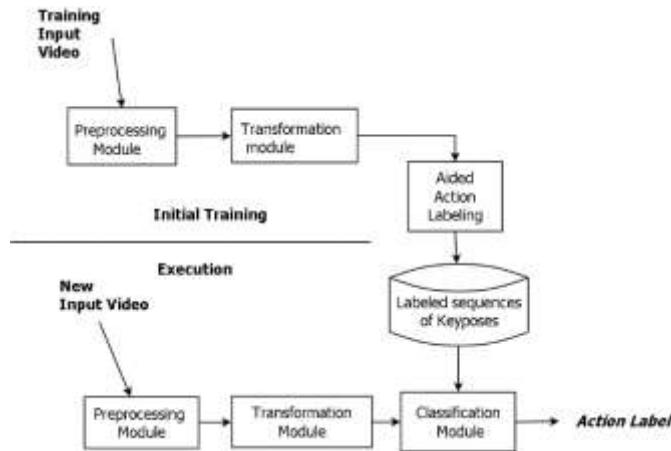
The system consists of three major module. They are Preprocessing, Transformation and Classification Module.

##### 3.2.1 Video Pre-Processing Module

This module consists of three sub modules, they are Frame Extraction, background subtraction and feature extraction.



**Fig – 1 Proposed System**

**Fig – 2 Frame Extraction**

### 3.2.1.1 Frame Extraction

The frames extracted can be actual frames used in the recording according to the frame rate or further processing to arrive at key frames can be used. If a full length video dataset is used it would be better to use Key Frame extraction. On the other hand if only a video snippet or a small dataset is used normal frame extraction will suffice. The results of the frame extraction is shown in figure 2 which corresponds to a person walking.

### 3.2.1.2 Background Subtraction

Once the frames are extracted, each frame is taken one by one and the foreground objects are separated from the background clutter. This is done by background subtraction, this removes background from foreground objects of interest, in this case it is the human or actor in that frame.

Say if

$$\text{Background Image at time } T_0 = B(x,y,t_0)$$

$$\text{Current Image at time } T_n = I(x,y,t)$$

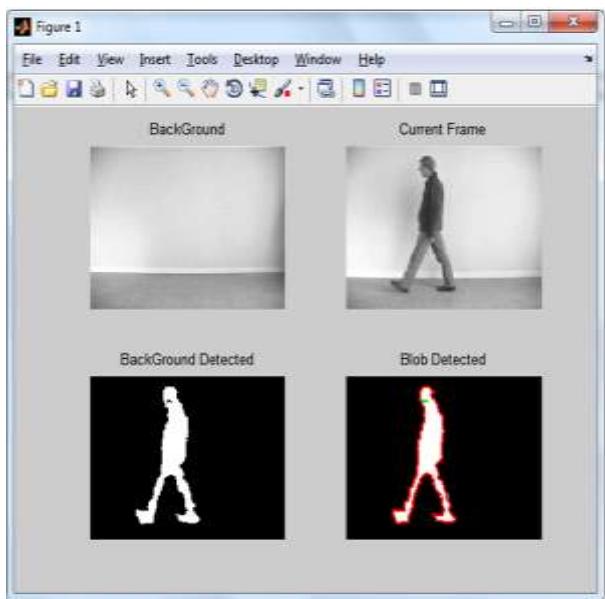
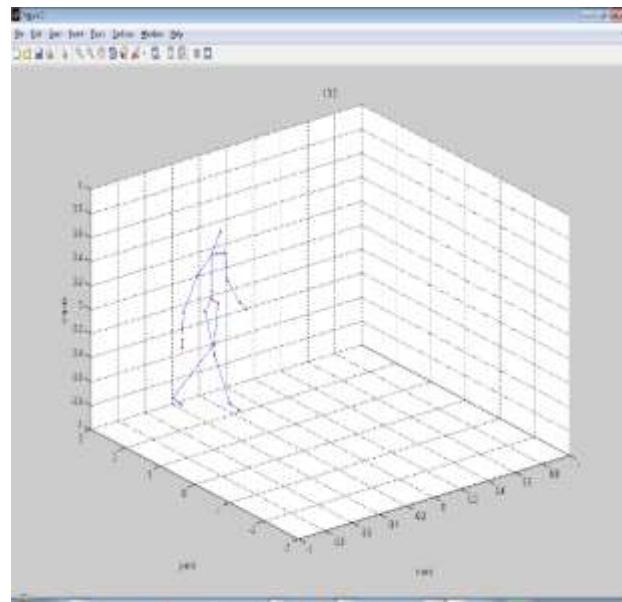
The foreground mask can be obtained by

$$F(T_n) = I(x,y,t) - B(x,y,t_0) \quad (1)$$

An example of background subtraction is shown in the figure 3, the initial frame, the foreground detected, are shown one after another.

### 3.2.1.3 Feature Extraction

Feature extraction converts the foreground objects present the frames obtained after background subtraction into numerical data to aid in further representation and computation, in this case Gaussian or Fourier pyramidal features is used to extract position information from each frame. The data thus extracted is stored in an interim storage or in a text file. To aid in simplification in representation a csv file can also be used.

**Fig.3. Background Subtraction****Fig.4. Kinematic Model of Actor**

### 3.2.2 Transformation Module

The transformation module, converts the numerical data into a human model and does the job of dimensionality reduction. After reduction, it converts the models into bag of key poses by transforming the set of numerical data into clusters and storing them in a repository.

#### 3.2.2.1 Kinematic Model Construction

This module is used to convert the numerical data obtained, into human model. Here, the system constructs a kinematic model with 20 points. Each point represents a joint or a part of the actor present in the frame. Thus, each frame will have a 20 point Tuple representing which part moved and to what extent it moved. The model is constructed from the set of feature vectors received from the feature extraction phase, using the depth information as and when available.

#### 3.2.2.2 Clustering

Pose selection is done using a Clustering Technique. Here K-Means or K- Metoids can be used to select poses that convey maximum amount of information and put them in a bag called as bag of key poses. The current system uses K-means. Now, the system has a set of Human 3D models ( $X_1, X_2, \dots, X_n$ ), where each observation is a 20-dimensional vector, k-means clustering aims to partition the n observations into k (= n) sets  $S = \{S_1, S_2, \dots, S_k\}$  so as to minimize the within cluster sum-of-squares.

The number of centroids varies anywhere from 25 to 50 depending on the temporal intensity of the action. Faster the action being performed, more centroids and slower the action, lesser centroids. The Bags of key poses thus obtained for different actions is collected and Action Labels are assigned. Such labeled bag of key poses are stored in a common repository. This serves as reference for further action recognition task. The Repository in this case are dedicated text files each for an action. The text file, contains all the 20 – point Tuples centroids each with 3 Values (Orientation, X-Co-ordinate, Y – Coordinate). The joint data is stored in text files in .dat format for the ease of further processing.

### **3.3 Classification Module**

The Classification module is responsible for computing the similarity between the centroids in the current bag of poses versus the centroids of all the bags present in the current repository.

#### **3.3.1 Enhanced Dynamic Time Warping**

Classification is carried out in two stages, by Enhanced Dynamic Time Warping (DTW), DTW extracts one pose at a time and compares it with all other poses in the repository, calculates the distance between them and stores them in an N x M matrix. Here N is number of key poses in the current action label and M is the number of actions present in the repository.

Once Distance measurement is completed, the system has pose wise similarity between all poses in new input to all poses present in the repository and the overall all distance by which the current bag varies from the bags present in the repository. Now using this distances confidence of the values are measured. The runtime output is presented in figure 8.

Input – Repository of key poses and key poses of current video

Output – Bagwise Distance, Posewise Distance measurements

Algorithm

Set N = number of centroids in current dataset

Set M = number of actions in repository

Set Q = number of centroids in repository

Create DIST [N] [M]

Create ODIST[M]

For (n=0; n<N; n++)

{

    Get point (X<sub>n</sub> ,Y<sub>n</sub>)

    For (m=0; m<=M; m++)

{

        Set DIST [N] [M] = 0

        For(q=0; q<=Q; q++)

```

{
    Get point(Xq , Yq)
    DIST [n] [q] =  $\sqrt{(Xn - Xq)^2 + (Yn - Yq)^2}$ 
    Write Pose-wise similarity
}

ODIST[m]= $\frac{\sum_0^N dist(n,m)}{\sum_M m}$ 

Write Bag-wise similarity
}
}

```

### 3.3.2 Class Confidence Processing

Class confidence measurement, normalizes the distances and helps to identify the sequence of poses which is significantly similar to an action present in the repository. If such a bag of poses is found the action corresponding to that bag can be given as the output label. Here the distance are normalized with respect to their mean, and threshold for confidence is set relative to the variance and the standard deviation of the normalized distribution of the sample space.

Input – List of bag-wise Distances

Output – Action label if a class with high confidence is found.

Algorithm

1. Get ODIST[M]
2. Set Mean= $\frac{\sum_0^M ODIST[m]}{M}$
3. Compute Variance of ODIST[M]
4. Threshold =  $0.10 * (\text{Variance})^{0.5}$
5. Sort(ODIST[M]) in non-decreasing order
6. If( $(ODIST[1] - ODIST[0]) \geq \text{Threshold}$ ) then
 

Output Label corresponding to ODIST[0].

Else

Output("New Action\Actor Encountered");

## IV EXPERIMENTAL RESULTS

The implementation was done in MATLAB 2014a and in C. First two modules implemented in Matlab script files (\*.m). The interim Outputs are written into Images, text files or kept as temporary .mat variables as and when required. The last two modules were implemented in C language to improve the execution speed of numeric intensive parts such as Enhanced Dynamic Time Warping classifier, confidence measurement.

The Dataset used for this system are mainly from Microsoft Action Recognition Datasets [8], Weizmann dataset [9] and UT Kinect [10] Human Action Recognition dataset. The datasets contain videos of 16 actions such as drinking, eating, reading a book, calling, walking, push, pull, throw, writing on a paper, using laptop, etc. All the actions were performed by different actors. Some of these videos were captured using a kinetic device and the stored offline for processing.

#### 4.1 Results

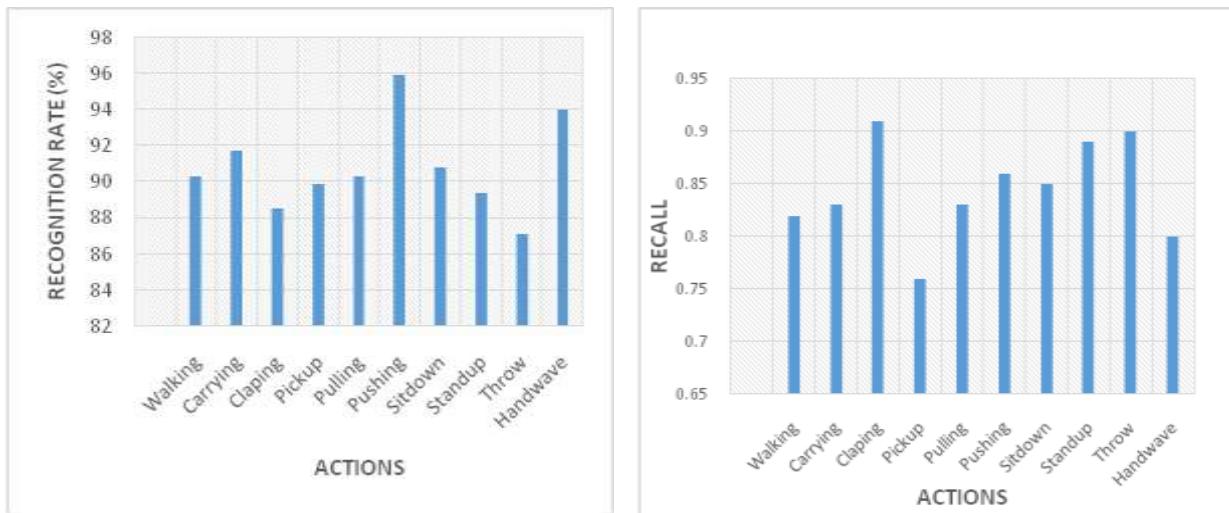
Recognizing actions present in the video narrows down to a classification problem. Instead of traditional measures of precision, the system uses a slightly modified factor called as Recognition rate. This determines the percentage of actions the system classifies correctly out of the total number of input actions with respect to the key poses present in repository.

$$RR = \frac{\text{No.of instances of correct positive recognition}}{\text{Total no. of positive recognitions}} \quad (3)$$

$$\text{Recall} = \frac{\text{No. of instances of positive recognition found}}{\text{Total no.of relavent Input Instances}} \quad (4)$$

The results for action recognition in terms of recognition rate is summarized in Table 1. Recognition rate is the equivalent to precision in this case. From figure 6, it can be observed that the current system performs on par with the existing system. However, the previous implementation has relied fully on highly sophisticated platform for their execution. Since parts of this implementation runs on relatively simple environments such as C and windows batch scripts, this makes more suitable for running on less powerful machines and can execute at near real time speeds.

The results for action recognition in terms of recall is summarized as follows in Table 1. From the figure 7, it can be observed that recall for actions similar to existing action in the system is lower than that of action that are considerably distinct from others. From the results, it can be observed that the system performs on par with the existing systems but does so at near real time speeds on a relatively lighter platform. Also, the system performs well against standard/regular actions at higher rates of accuracy. The system does tend to misclassify some videos which is due to the fact that there are some actions that have common poses between them.

**Figure 6 – Recognition Rate for different actions      Figure 7 – Pose Recall Measures obtained****Table – 1 – Recognition Rate and Recall Measures**

Action	Recognition Rate (%)	Recall (%)
Walking	90.31	81.67
Carrying	91.71	82.66
Clapping	88.57	90.67
Pickup	89.91	75.69
Pulling	90.29	83.4
Pushing	95.91	86.36
Sit down	90.83	84.51
Standup	89.42	88.73
Throw	87.15	89.57
Hand wave	94.04	80.32

## V CONCLUSION AND FUTURE WORK

Thus in the current approach, the system is able to successfully recognize the action performed by the humans present in the video using kinematic modeling and Enhanced Dynamic Time Warping and achieves an on-par performance with the current systems. Final Classification results were obtained at near real-time speeds with an on-par accuracy in recognizing the actions. The system can be further extended to recognize complex actions,

incorporate learning capabilities to learn new actions, classify actions that involve interaction with objects and other humans. The system can also be improved in terms of being more robust to detect similar actions.

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