

## IMPORTANCE OF LOCATION AWARE ARCHITECTURE FOR CRIMINAL WATCH: A CASE STUDY OF POLICE STATIONS IN SATARA DISTRICT

Prof. Hanmant N. Renushe<sup>\*1</sup>, Dr. Milind J Joshi<sup>2</sup>, Dr. Rajendra D Kumbhar<sup>3</sup>, Prof. Abhijit S. Desai<sup>4</sup>

BVDU, Yashwantrao Mohite Institute of Management, Karad [M.S.], India

hanmant.renushe@bharativedyapeeth.edu

Shivaji University Kolhapur [M.S.], India

milindjoshi@unishivaji.ac.in

Karmveer Bhaurao Patil Institute of Management Studies and Research Satara

rdk14@rediffmail.com

BVDU, Yashwantrao Mohite Institute of Management, Karad [M.S.], India

abhijitdesai@hotmail.com

**Abstract:** This research paper highlights the importance of location aware application to keep a watch on criminals so as to reduce crime incidences under the Satara District Police Station Jurisdiction [SDPSJ]. The police system in any country has to play a very significant role in crime investigation and prevention. Crime and criminal record is stored and retrieved using CIPA and CCIS at the Police Station (PS) and the District Police Office (DPO) levels respectively. This initiative by the Police is useful for getting the criminal data & information but it does not serve the purpose of designing an action to prevent the crime. It has become a major challenge for the police system to detect and prevent crimes and movements of criminals. There is no information of any kind that is available before the occurrence of criminal acts. This results in the increase of crime rate. This paper highlights the use of location aware application technology to keep watch on the movements of criminals, which can be useful in prevention of crimes and thereby bring down the crime rate.

**Keywords:** Mobile, GPS, Crime, NCRB, Investigation, CCIS, CIPA, CrPC

### INTRODUCTION

Police plays an important role in civil administration in India. The Constitution of India assigns a responsibility to maintain the law and order in the country. Police force is in insufficient ratio as compare to population.<sup>[1]</sup> It leads to increasing graph of crime in nation, another reason is lack of use of information technology in investigation and in prevention. Keeping these things in mind govt. of India designed G2G model. In 1986 Govt. of India created National Crime Record Bureau (NCRB).<sup>[2]</sup> Under NCRB the state crime record bureau [SCRb] for state and District crime Record Bureau [DCRB] for districts has been created. In order to making use of information technology, The Government of India designed Crime Criminal Information System [CCIS] to store and retrieve crime and criminal records. To provide the input to CCIS, the Common Integrated Police Application [CIPA] was also designed. CIPA software install in every police station, CIPA is only limited to the informative purposes only, therefore it need to be advancement in existing system such as use of Location Enable [LEA] and Location Aware Application [LAA] Technology along with CIPA & CCIS system.

### SATARA DISTRICT POLICE CURRENT SCENARIO

#### Satara District Police System

The motto of Maharashtra Police is 'संरक्षणाय खलनिग्रहणाय'. It means that Maharashtra Police is committed to PROTECTING THE RIGHTEOUS AND CONTROLLING & ANNIHILATING THE EVIL. The Head of state police is Director General of Police [DGP]. The state is divided into administrative units called as Districts. A group of districts called as a region and Head for each region is Deputy Inspector General of Police [DIGP]. Superintendent of

Police [SP] is head for district and is assisted by Additional Superintendent of Police [Addl. SP] and Deputy Superintendent of Police [DySP] in each district.

Satara District police is headed by Superintendent of Police supported by an Addl. Superintendent of Police with 7 Deputy Superintendent of Police, 20 Police Inspector, 78 Asst. Police Inspector and Police Sub Inspector and adequate number of Constable are working.

### COMMON INTEGRATED POLICE APPLICATION

CIPA is aimed at building the basic infrastructure and mechanisms for the Crime and Criminal Information System, based on CrPC, which is uniform across the country, from Police Station level onwards. CIPA being a National project is to be implemented in a time-bound manner from police station level onwards for computerization of police records and use of IT in their functioning on a uniform basis throughout the country.

The national level Central CIPA Implementation Committee comprising of Director, NCRB and representatives from the Ministry of Home Affairs (Police Modernization and Union Territories Divisions), NIC, National Institute of Criminology and Forensic Science and States, has been constituted to monitor the implementation.

State Crime Records Bureau and State Police Training Academies are conducting State Specific courses in this connection with the assistance of NIC. NCRB has introduced two advanced courses on CIPA in its training calendar for resource persons, who in turn will impart training and attend to trouble-shooting in the States.<sup>[5]</sup>

#### Crime Criminal Information System [CCIS]

In 1986 Government of India created National Crime Record Bureau [NCRB]. Under NCRB the State Crime Record Bureau [SCRb] for States and District Crime Record Bureau [DCRB] for Districts has been created. In order to make use of Information Technology the

Government of India has designed Crime Criminal Information System [CCIS] to store and retrieve crime and criminal records. This system has been upgraded to CCIS Multi-Lingual web-enabled (CCIS MLe) in the year 2005 with facility for 5 regional languages i.e. Marathi, Gujarati, Tamil, Kannada and Gurmukhi. besides English and Hindi. Feature of crime analysis through data warehousing has also been added. The application has been web-enabled so that the field level investigating and supervisory officers can access the CCIS MLe database at National and State Levels through internet, anywhere - anytime.

Information Technology audit of computerization in Police Department noticed that Crime and Criminal Information System and Common Integrated Police Application meant for crime data storage and retrieval did not deliver the desired output. The deficiencies in input controls and supervisory checks have resulted in incomplete and incorrect database, making the systems unreliable and thus not useful. No tangible benefits have thus accrued so far from the computerization. [6][7]

### LOCATION BASED APPLICATION IN CRIMINAL WATCH

Map represents many complex relations and data. Map tells the story of the past, record the present, and reveal the future. The real world provides a commonly understood framework for the endless fields of digital data on desktops, mobile, corporate network or on the internet. The conventional map is changing into digital map and it will have life through its vibrant contributing community of experts that fulfill the dream of access to local knowledge.

Now a day's power of location technology not limited to companies with inelastic needs and ample resources but it can be used in real time world like Real Estate, Motor Transport and many more.

Location-Based Applications are applications that are either know how to process location-based information or make the use of their location for other processing; these are divided into two categories

a) Location-Enabled Application [LEA]. b) Location-Aware Application [LAA]. LEA understands location and knows how to process it whereas LAA are similar to LEA except that they are aware of their own location. A simple Map and direction with GPS Device or Mobile can provide you direction based on your current location. This can be implemented to criminal those are MOST WANTED. Both LEA and LAA Application can be builds using Disconnected or Connected Architecture.

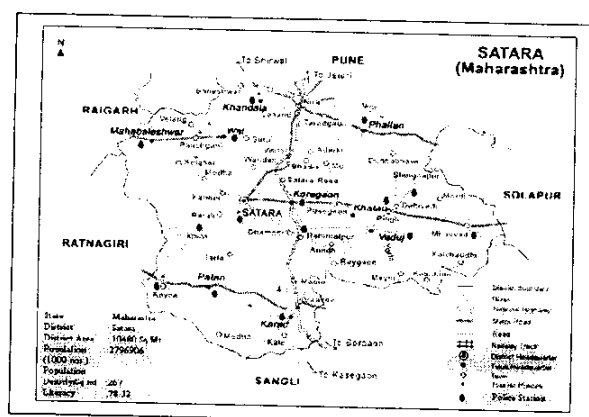
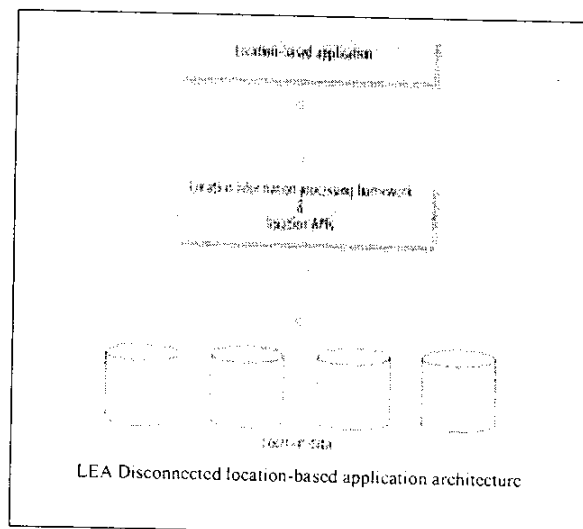
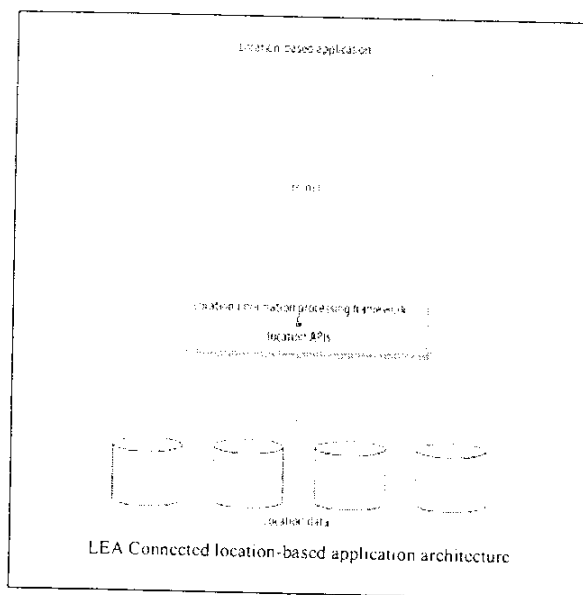


Figure3. The Satara District Map using Disconnected LEA

In order to build LAA it is necessary to use connected architecture. There are number of service provider to provide Map services such as Microsoft MapPoint, Microsoft Location Server, Google API, Yahoo API and Many more. For this

research paper we are considering Microsoft Location Server [MLS]. MLS is an enterprise hosted server that enables real time location scenarios using locatable devices, such as Mobile Phone, Pager etc. It doesn't require a GPS device. MLS locates provisioned user's mobile device by communicating with a mobile/Pager Operator. The MLS Architecture is shown as below.

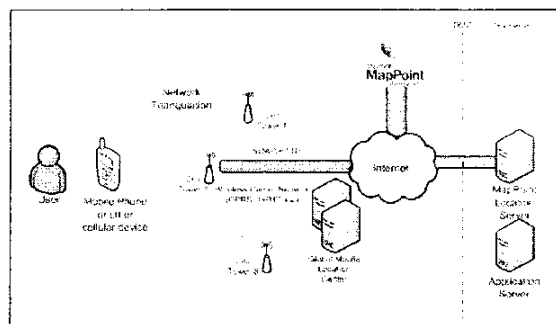


Figure 4. MLS Architecture

In this scenario, the user requests his position using a mobile device equipped with a client that communicates with MLS. When MLS receives a request from the client, it identifies the mobile operator for the user and sends a location request to the mobile operator, which responds by sending back the real time location of the user, expressed as latitude and longitude coordinates. MLS then requests a map from MapPoint Web Service [MPWS] to process the user's real time location. All communications specific to a mobile operator are hidden from the user and developer.

In order to reduce crime, SDP has taken a few steps. Such as building Mohalla Committee, Mahatma Gandhi Tanta mukt Gaon, Community Group, Student Police friend etc. In addition, SDPS are using CCIS and CIPA software, which are insufficient. As part of policy, the MOST WANTED Criminals are banned in the SDPSJ on certain occasions, such as Diwali, Ramjan, Voting Period etc. Even though these criminals come into the area and commit the criminal act, such MOST WANTED Criminals' mobile numbers are registered with the Police Station [PS], using their mobile phone. Crime Investigation and Prevention Officers keep watch on the criminals.

Presently, these services are provided by few organizations such as Google, Yahoo, and Microsoft using Web Services, Web API's, in order to avail these services you need to pay some amount to these service providers.

Today many organizations are preparing a database for Point of Interest [PoI] such as Restaurants, Coffee shop, Malls, Theaters, Petrol Pumps, Trekking, Gardens and many more. Already a Crime and Criminal database is in operation, so there is a need to concentrate on these areas that could be helpful to crime investigation and prevention officers.

Following map shows the location of banned criminals in the police station jurisdiction. As soon as the criminal enters into the banned region, the investigation office will come to know and necessary preventive action may be taken within time and further happening crime can be prevented.

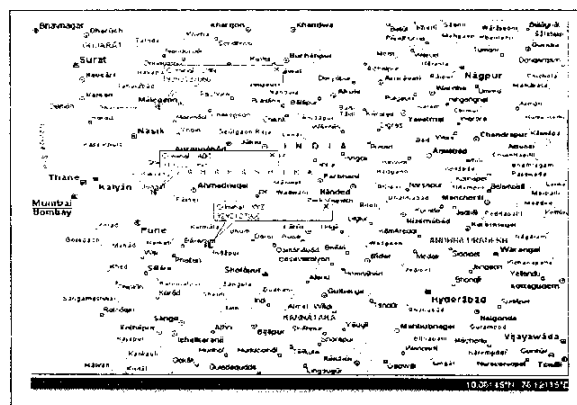


Figure 5. Map of current location of the Banned Criminal

## CONCLUSIONS

Crime Investigation is one of the important tasks of police organizations in India. In today's IT-enabled era, many techniques are available for crime prevention and investigation.

There is a huge gap between the number of cases registered and the completion of investigation, due to many reasons which are stated below.

**Integrated Mechanism for Investigation:** The Common Integrated Crime Analysis Cell [CICAC] must be formed to help the investigation officer on requirement.

**Technology Usage:** Police must use the intelligence technology for investigation. As on today, they are mostly investigating with traditional ways, on the contrary, criminals are using very sophisticated technology and often find the loop hole, due to which, there is a tremendous increase in the crime ratio.

Intelligence failure is an important issue, and it requires improving intelligence.

Innovative Practices Training [IPT] must be provided to the investigation personnel on a regular basis.

## ACKNOWLEDGMENT

The researchers are grateful to the authors, writers and editors of the books and articles, which have been referred for preparing the presented research paper. It is the duty of the researchers to remember their parents whose blessings are always with them.

## REFERENCES

- [1] <http://nitawriter.wordpress.com/2007/08/20/poor-people-to-police-ratio/>, 20 April 2011 4:30 pm.
- [2] <http://ncrb.nic.in/origin.html>, 21 April 2011 2:20 pm.
- [3] <http://mahapolice.gov.in/aboutus>, 21 April 2011 4:50 pm.
- [4] <http://punepolice.maharashtra.gov.in>.
- [5] <http://cipa.gov.in/cipa/pdf/cipabros.pdf>.
- [6] <http://ncrb.nic.in/featuresMLE.pdf>.

## SHORT TERM CRIME FORECASTING FOR PREVENTION OF CRIMES: A STUDY OF SATARA DISTRICT

Prof. Hanmant N. Renushe<sup>#1</sup>, Dr. Milind J. Joshi<sup>#2</sup>, Dr. R. D. Kumbhar<sup>#3</sup>, A. S. Desai<sup>#4</sup>

<sup>#1,4</sup>BVDU, Yashwantrao Mohite Institute of Management, Karad [M.S.], India

<sup>#2</sup>Shivaji University Kolhapur [M.S.], India

<sup>#3</sup>KBP Institute of Management, Satara [M.S.], India

[hanmant.renushe@bharatividyapeeth.edu](mailto:hanmant.renushe@bharatividyapeeth.edu)

[milindjoshi@unishivaji.ac.in](mailto:milindjoshi@unishivaji.ac.in)

[rdk14@rediffmail.com](mailto:rdk14@rediffmail.com)

[abhijitdesai@hotmail.com](mailto:abhijitdesai@hotmail.com)

**Abstract:** This research paper highlights the importance of crime forecasting in crime prevention in Satara District police station jurisdiction. Crime investigation and prevention has very significant role of police system in any country. The crime data has been stored and processed using Common Integrated Police Application [CIPA] and it become useful for getting the criminal information but it does not help for the purpose of designing an action to prevent the crime, it has become a major challenge for police system to detect and prevent crimes and criminals. There is no any kind of information is available before happening of such criminal acts and it result into increasing crime rate. The presented paper highlights the use of Forecasting technique to identify the crime in a specific area which can be useful for crime prevention.

**Keywords:** Crime, NCRB, Investigation, CIPA, CrPC, Forecast, Crime Rate

### I. INTRODUCTION

The Constitution of India assigns a responsibility to maintain the law and order in the country. Increasing graph of crime in nation is major challenge for the police force. There are many reasons for increasing crime rate and one them reason is lack of use of modern information technology in investigation and in prevention. Keeping these things in mind govt. of India designed G2G model. In 1986 Govt. of India created National Crime Record Bureau (NCRB). Under NCRB the state crime record bureau [SCRB] for state and District crime Record Bureau [DCRB] for districts has been created. In order to making use of information technology, The Government of India designed Crime Criminal Information System [CCIS] to store and retrieve crime and criminal records. To provide the input to CCIS, the Common Integrated Police Application [CIPA] was also designed. CIPA software install in every police station, CIPA is only limited to the informative purposes and doesn't forecast or shows any seasonal crime in specific police station region, therefore it need to be advancement in existing system such as use of data mining technology in CIPA as well as CCIS system.

### II. SATARA DISTRICT POLICE CURRENT SCENARIO

To understand current scenario of crime detection, we need to know police structure and hierarchy, technological usage of police force.

**Satara District Police System** The motto of Maharashtra Police is. 'सदृक्षणाय खलनिग्रहणाय' It means that

Maharashtra Police is committed to PROTECTING THE RIGHTEOUS AND CONTROLLING & ANNIHILATING THE EVIL. The Head of state police is Director General of Police [DGP]. The state is divided into administrative units called as Districts. A group of districts called as a region and Head for each region is Deputy Inspector General of Police [DIGP]. Superintendent of Police [SP] is head for district and is assisted by Additional Superintendent of Police [Addl. SP] and Deputy Superintendent of Police [DySP] in each district.

Satara District police is headed by Superintendent of Police supported by an Addl. Superintendent of Police with 7 Deputy Superintendent of Police, 20 Police Inspector, 78 Asst. Police Inspector and Police Sub Inspector and adequate number of Constable are working.

### Common Integrated Police Application

CIPA is aimed at building the basic infrastructure and mechanisms for the Crime and Criminal Information System, based on CrPC, which is uniform across the country, from Police Station level onwards. CIPA being a National project is to be implemented in a time-bound manner from police station level onwards for computerization of police records and use of IT in their functioning on a uniform basis throughout the country.

The national level Central CIPA Implementation Committee comprising of Director, NCRB and representatives from the Ministry of Home Affairs (Police Modernization and Union Territories Divisions), NIC, National Institute of Criminology and Forensic Science and States, has been constituted to monitor the implementation.

State Crime Records Bureau and State Police Training Academies are conducting State Specific courses in this connection with the assistance of NIC. NCRB has introduced two advanced courses on CIPA in its training calendar for resource persons, who in turn will impart training and attend to trouble-shooting in the States.

### III. DATA MINING TECHNIQUES

Understanding and predicting Crime Incidences is vital to police officer to maintain law and order. While forecasts are never perfect, they are necessary to prepare for actual crime incidences. In order to maintain law and order

and effective control in the police station area, accurate crime incidences forecasts are imperative.

Business Intelligence [BI] is a concept and method to improve business decision making by using fact-based support systems. Business Intelligence often aims to support better business decision-making.

Data mining is basically used to find out unknown patterns from a large amount of data. There are popular tools of data mining to rub data mining algorithms. There are two approached to the implementation of data mining, first is to copy data from data warehouse and mine it. Other approach is to mine the data within a data warehouse. There are various data mining techniques available as follows:

**Classification** is used to classify database records into number of predefined classes on criteria. The data with sharing common properties are specified into predefined classes.

**Clustering and segmentation** is used to segment a database into subsets, or clusters based on set of attributes. It is a method to group data into classes with identical characteristics in which the similarity of intra-class is maximized or minimized.

**Association** identifies affinities/ associations among the collection of data as reflected in the examined records. A result is patterns describing rules of association in data.

**Decision Tree** is predictive model that can be viewed as tree, each branch is a classification question and leaves of the tree are partitions of data set with their classification. It divides data on each branch point without losing any of the data. The number of churners and nonchurners is conserved as we move up or down the tree. ID 3, C4.5, CART and CHAID are some algorithms used in this technique.

**Neural Networks** are biological systems that detect patterns, make predictions and learn. The artificial neural networks are computer programs implementing sophisticated pattern detection and machine learning algorithms on a computer to build predictive models for historical databases.

The Microsoft Time Series Algorithm is a novel forecasting algorithm it is a hybrid of auto regression and decision tree technique.

#### IV. CRIME FORECASTING

Crime forecasting helps police to take tactical actions such as targeting patrols to hot spots, conducting surveillance for deployment of special units, scheduling vacation and training of the cops. (Gorr 2003 and Liu and Brown 2003)

Crime forecasting requires crime place (Cohen & Felson1979), ecology of crime (Brantingham & Brantingham 1984) and Hot Spot (Sherman, Gartin, & Buerger, 1989). In order to find out the next month crime forecast we need to know the history of crime. For this research paper we had taken the crime incidences of few categories of crimes from Jan 2010 to November 2010.

Table 1

Total Crime Happens during the January 2010- November 2010

Month	Murder	Att to Murder	RIOT	Hurt	Rape	Dacoity	Robbery	Theft
Jan	2	5	16	38	3	2	11	96
Feb	4	5	13	35	4	3	6	69
Mar	7	7	27	49	5	1	3	58
Apr	3	8	32	49	6	4	9	57
May	4	6	9	49	1	1	4	59
Jun	6	5	18	32	2	2	6	79
Jul	3	5	11	32	2	2	8	80
Aug	1	4	26	28	0	6	7	87
Sep	4	5	18	34	2	0	8	63
Oct	1	5	23	41	0	2	6	64
Nov	3	1	17	39	1	2	5	59

The short term forecasting of crime helps in tactical decision making at police station or at district level. It is divided into two categories (Felson & Poulson 2003) use data for fixed geographic observation in police station jurisdiction, whereas (Corcoran, Wilson & Ware 2003) and (Liu & Brown 2003) work with adhoc areas for spatial cluster of crimes.

To measure the accuracy of forecasted values we need to check the Mean Absolute Percent Error [MAPE], Mean Square Deviation [MSD] and Mean Absolute Deviation [MAD] values.

The Minitab 16 generate the fitted line for Crime Type Murder using the equation

$$Y_t = 4.59 + (-0.19 * t)$$

The t represents the month during which each data point was collected.

Forecast accuracy in the crime incidences can be measured using the MAPE. [10]

Fitted Value is  $Y_t = a + (b * t)$

Value of a and b can be calculated using,

$$\sum X, \sum Y, \sum XY, \sum X^2$$

$$\begin{aligned}\sum X &= 1 + 2 + \dots + 11 = 66 \\ \sum Y &= 5 + 10 + \dots + 17 = 38 \\ \sum XY &= 5 + 20 + \dots + 170 = 207 \\ \sum X^2 &= 1 + 4 + \dots + 100 = 506\end{aligned}$$

$$\begin{aligned}\sum Y &= N a + b \sum X \\ \sum XY &= a \sum X + b \sum X^2\end{aligned}$$

In order to calculate the value for a and b we have line equation

$$\begin{aligned}\sum Y - N a + b \sum X &= \dots \dots \dots 1 \\ \sum XY - a \sum X + b \sum X^2 &= \dots \dots \dots 2\end{aligned}$$

From equation 1 and 2

$$\begin{array}{rcl} 38 & = & 11a + 66b \quad \text{-----} 3 \\ 207 & = & 66a + 506b \quad \text{-----} 4 \end{array}$$

Multiplying equation 3 by 66 and equation 4 by 11 we get

$$\begin{array}{rcl} 2508 & = & 726a + 4356b \quad \text{-----} 5 \\ 2277 & = & 726a + 5566b \quad \text{-----} 6 \end{array}$$

Equation 6- equation 5 we get

$$-231 = 1210b$$

$$b = -0.19$$

Substituting value b into equation 3 we get

$$38 = 11a + (66 \times -0.19)$$

$$a = 4.59$$

$$a = 4.59$$

$$b = -0.19$$

Absolute Deviation = Volume [Y] – Fitted Value
Squared Deviation = Square of Absolute Deviation
MAD = Sum of Absolute Deviation / Number of Observation
MSD = Sum of Squared Deviation / Number of Observation
MAPE = Mean Absolute Deviation [MAD]/ Mean Ratio Or MAPE = Sum of Absolute Deviation/ Total Crime Incidences

Hence the for the month of Nov 2010 forecast value for Murder is as below

$$\begin{array}{l} Y_{12} = 4.59 + (-0.19 \times 12) \\ = 2.31 \\ = 3 \end{array}$$

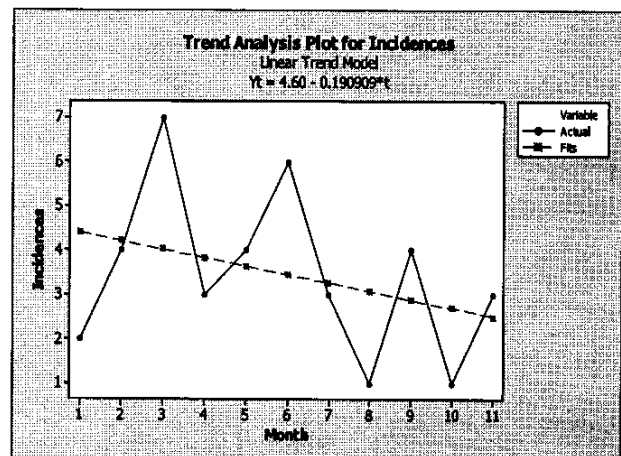
This show that December 2010 may have murder incidences 2 in the Satara District police Jurisdiction. The fitted value, Absolute Deviation, Squared Deviation and Absolute Percent Error for the category Murder is shown in below

Table 2  
Statistical Value Calculated for Murder Category

Crime Analysis								
Month	Murder	t	X2	XY	Fitted Value	Absolute Deviation	Squared Deviation	Absolute Percent Error
Jan	2	1	1	2	4.4	-2.4	5.76	0.025
Feb	4	2	4	8	4.21	-0.21	0.0441	0.0125
Mar	7	3	9	21	4.02	2.98	8.8804	0.007143
Apr	3	4	16	12	3.83	-0.83	0.6889	0.016667
May	4	5	25	20	3.64	0.36	0.1296	0.0125
Jun	6	6	36	36	3.45	2.55	6.5025	0.008333
Jul	3	7	49	21	3.26	-0.26	0.0676	0.016667
Aug	1	8	64	8	3.07	-2.07	4.2849	0.05
Sep	4	9	81	36	2.88	1.12	1.2544	0.0125
Oct	1	10	100	10	2.69	-1.69	2.8561	0.05
Nov	3	11	121	33	2.5	0.5	0.25	0.016667
	38	66	506	207		0.05	30.7185	0.227976
	EY	EX	EX2	EXY		SUM	SUM	SUM
						0.004545	2.792591	0.020725
						MAD	MSD	MAPE

MAD is the average of absolute deviation. An absolute deviation is the absolute value of the actual crime minus the fitted value. The best fitted line should have zero MAD and Murder Category MAD value is approximately Zero value hence model is suited perfect. The trend analysis plot for murder is generated as below

Graph 2  
Trend Analysis for Murder Incidences



Similarly Trend Analysis Plot for all Crime categories has been plotted.

Table 3  
Statistical Value Calculated for All Categories

	Att to Murder	RIOT	Hurt	Rape	Dacoity	Robbery	Theft
A	7.00	18.65	42.82	4.87	2.38	7.45	76.04
B	-0.32	0.07	-0.68	-0.42	-0.02	-0.14	-0.99
Forecast	3	20	35	0	2	6	64
MAD	0.01	0.02	-0.012	0.013	0.012	0.026	0.009
MSD	1.797	46.575	46.64	1.755	2.377	4.591	152.627
MAPE	0.031	0.013	0	0.005	0.005	0.004	0

Accordingly Crime Forecast has been plotted

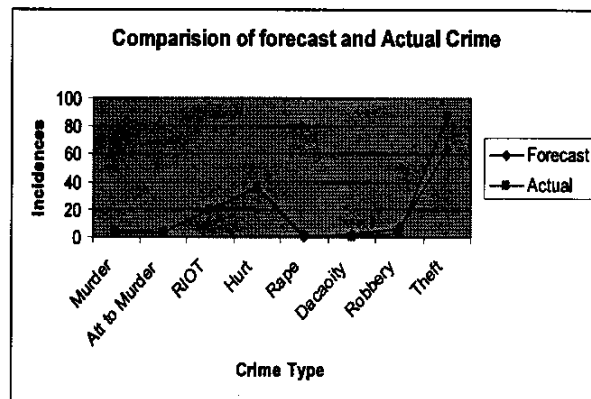
Table 4  
Crime Forecast of all categories for the month December 2010

Crime Type	Att to Murder	RIOT	Hurt	Rape	Dacoity	Robbery	Theft
Forecast	3	20	35	0	2	6	64

Table 4  
Actual Crime of all categories for the month December 2010

Crime Type	Murder	Att to Murder	RIOT	Hurt	Rape	Dacoity	Robbery	Theft
Actual	3	3	20	36	1	0	3	88

Graph 3  
Comparison of Crime Forecast and Actual Crime Incidences of all categories for the Month December 2010



#### IV CONCLUSIONS

Crime Investigation is one of the important tasks of police organization in the India. In today's IT enabled era many techniques are available for crime prevention and investigation.

Crime forecasting is one aspect of crime investigation, for which numerous technique are available such as secular trend cyclic trend, irregular trend etc., secular trend is used for short time forecasting. In the present study the researchers has used short time forecasting of crimes in Satara district for the month December 2010 using the crime data of the period Jan 2010 to November 2010.

From the study it has observed that actual no of crime reported during the December 2010 are approximately

same as the forecasted crimes using short term forecasting. Hence the short term forecasting method is very useful in crime prevention and investigation Process.

#### V ACKNOWLEDGMENT

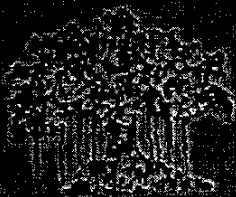
The researchers are grateful to the authors, writers and editors of the books and articles, which have been referred for preparing the presented research paper. It is the duty of the researchers to remember their parents whose blessings are always with them.

#### VI REFERENCES

- [1] <http://ncrb.nic.in/origin.html>, 24 December 2009 2:20 pm
- [2] <http://mahapolice.gov.in/aboutus> 23 December 2009 4:50 pm
- [3] <http://punepolice.maharashtra.gov.in>
- [4] <http://cipa.gov.in/cipa/pdf/cipabros.pdf>
- [5] <http://ncrb.nic.in/featuresMLE.pdf>
- [6] <http://www.cag.gov.in> Audit report of Govt. of India for the ended year 31 march 2009
- [7] Alex Berson, Stephan J. Smith (2004) Data Warehousing, Data Mining, & OLAP, TATA McGraw HILL Publications, New Delhi.
- [8] [http://mahacid.com/agree\\_monthly\\_crime.htm](http://mahacid.com/agree_monthly_crime.htm)
- [9] Hyndman, R.J., Koehler, A.B (2005) "Another look at measures of forecast accuracy", Monash University.
- [10] Cohen, L. E., & Felson, M. (1979). Social change and crime rate trends: A routine activity approach. *American Sociological Review*, 44, 588-607
- [11] Brantingham, P. J., & Brantingham, P. L. (1984). *Patterns in crime*. New York: Macmillan
- [12] Sherman, L.W., Gartin, P. R., & Buerger, M. E. (1989). Hot spots of predatory crime: Routine activities and the criminology of place. *Criminology*, 27, 27-55.
- [13] Gorr, W. L., Olligschlaeger, A. M., & Thompson, Y. (2003). Short-term time series forecasting of crime. *International Journal of Forecasting*.
- [14] Liu, H., & Brown, D. E. (2003). Criminal incident prediction using a point-pattern based density model. *International Journal of Forecasting*
- [15] Gorr & Harries (2003) Introduction to Crime Forecasting. *International Journal of Forecasting* 19-551-555.
- [16] Felson & Poulsen 2003 Simple indicator of crime by time of day. *International Journal of Forecasting* 19-595-601
- [17] Corcoran, Wilson & Ware 2003 Predicting the Geo-temporal variation of crime disorder. *International Journal of Forecasting* 19-623-634.



ISSN 2249-3867



"Education Through  
Self Help Is Our Motto"  
- Karmveer

# Research Dimensions

**S. P. Rajguru**  
Editor-in-chief

**A Multi-Disciplinary Peer-Reviewed International Research Journal**

Rayat Shikshan Sanstha's  
LAXMIBAI BHAURAO PATIL MAHILA MAHAVIDYALAYA  
SOLAPUR (MAHARASHTRA)



**CONTENT**

No.	Title of the Paper	Author	Page No.
1)	Cloud Computing : An Emerging Trend In It Industry	Mrs. A. S. Kadam Dr. K. M. Nalawade	1
2)	Post-1947 Indian English Novel: Major Concerns	Prof. Basavraj Naikar	12
3)	Colonial Conflict In Basavaraj Naikar's <i>A Dreamer Of Freedom</i>	P. V. Laxmiprasad	15
4)	Female Heroism In Basavaraj Naikar's <i>The Queen Of Kittur</i>	P. V. Laxmiprasad	19
5)	Naikar's Anubhava In <i>Light In The House</i>	Dr. Shyam S. Agarwalla	24
6)	<i>The Rejected Addresses</i> : The Birth Of Modern Parody : A Study	Dr. D. S. Paricharak	28
7)	Dr. Sharankumar Limbale: A Dominant Literary Voice Striving For Liberty, Justice And Humanity For Dalits	Capt. Dr. Arvind Nawale	33
8)	Exclusion And Marginalisation Of Dalit Voices In The Autobiography	Mr. Jeevan S. Masure	38
9)	V. S. Naipaul An Enigma On The Exodus (part 2)	Dr. Annie John	45
10)	An Assessment Of T. S. Eliot's Contribution As A Regional And Poetic Dramatist	Dr. Surendra. S. Khandekar	51
11)	Cloud Computing : A Case Study	Mrs. K. S. Pawar Dr. R. D. Kumbhar	56
12)	Higher Education And Human Values	Dr. Mrs. Madhavi Pawar	66
13)	Positive Image of Woman In the Epics	Dr. Nabha Kakade	70
14)	National Human Rights Commission's Strategy For Human Right Literacy And Awareness	Dr. Deepak Nanaware	73
15)	Language Learning Through Cross Cultural Awareness	Ms. Anita Sharma	78
16)	Iconoclastic Perspective in R. K. Narayan's "The Vendor of Sweets"	Dr. S. Parvathi Devi	82
17)	Against All Odds: A Discourse Of Women's Pathetic Condition And Trauma Of A Mix-child	Dr. Ashwin P. Ranjanikar	86
18)	Rabindranath Tagore's The Last Poema Metafictional Defence Of The Aesthetic	Mr. Uttam Kumar Guru	90
19)	A Study Of Goat Concentration Analysis In Solapur District Of Maharashtra	Mr. S. S. Maske Dr. B. R. Phule	97
20)	Mental Trauma And Suppression Of Indian Housewife In Shashi Deshpande's Novel 'that Long Silence'	Dr. T. N. Kolekar Mr. S. P. Rajguru	105
21)	Use Of Technology - An Effective Pedagogy For Teaching Literature, Language & Cultural Study	Mr. Iftekar Khairadi	111

## Cloud Computing : A Case Study

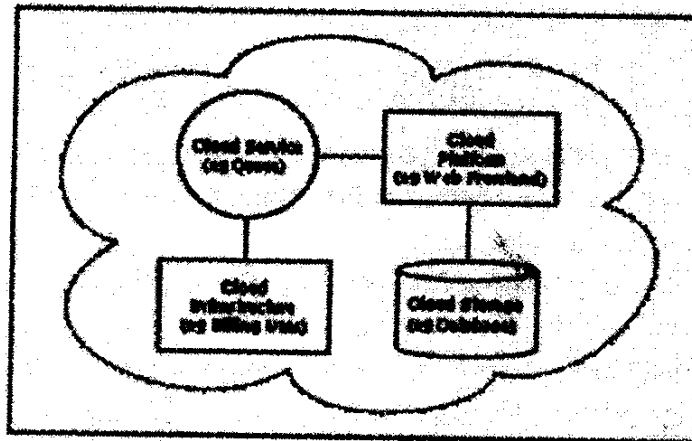
- Mrs. K. S. Pawar

Asst. Prof. Dept. of B.C.A.

College of Computer Application for Women, Satara,

- Dr. R. D. Kumbhar,

Head, Dept. of B.C.A., KBPIMSR, Satara.



### I. INTRODUCTION:

Cloud computing is the delivery of computing as a service rather than a product, whereby shared resources, software, and information are provided to computers and other devices as a utility (like the electricity grid) over a network (typically the Internet). Cloud computing provides computation, software, data access, and storage services that do not require end-user knowledge of the physical location and configuration of the system that delivers the services. Parallels to this concept can be drawn with the electricity grid, wherein end-users consume power without needing to understand the component devices or infrastructure required to provide the service. The concept of cloud computing fills a perpetual need of IT: a way to increase capacity or add capabilities on the fly without investing in new infrastructure, training new personnel, or licensing new software. Cloud computing encompasses any subscription-based or pay-per-use service that, in real time over the Internet, extends IT's existing capabilities. The National Institute of Standards (NIST) definition of Cloud Computing is the most useful, comprehensive, and popular definition - Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models.

### II. ARCHITECTURE OF CLOUD:

*Cloud architecture*, the systems architecture of the software systems involved in the delivery of cloud computing, typically involves multiple *cloud components* communicating with each other over a loose coupling mechanism such as a messaging queue. As of now, the majority of cloud computing infrastructure consists of reliable services delivered through data centers and built on servers with different levels of virtualization technologies. The services are accessible anywhere that has access to networking infrastructure. The cloud appears as single point of access for all the computing needs of consumers.

Fig. 1: CloudArchitecture

### III. DEPLOYMENT MODELS OF CLOUD COMPUTING

**Public cloud** The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services. Public cloud or external cloud describes cloud computing in the traditional mainstream sense, whereby resources are dynamically provisioned on a fine-grained, self-service basis over the Internet, via web applications/web services, from an off-site third-party provider who bills on a fine-grained utility computing basis. In simple, for use by multiple organizations on a shared basis and hosted and managed by a third party service provider. It is very useful. It's free of cost.

**Private cloud** Private cloud is infrastructure operated solely for a single organization. It may be managed by the organization or a third party and may exist on premises or off premises. They have attracted criticism because users "still have to buy, build, and manage them" and thus do not benefit from lower up-front capital costs and less hands-on management, essentially "[lacking] the economic model that makes cloud computing such an intriguing concept".

**Community cloud** Community cloud shares infrastructure between several organizations from a specific community with common concerns (e.g. mission, security requirements, compliance, jurisdiction, etc.). A community cloud may be established where several organizations have similar requirements and seek to share infrastructure so as to realize some of the benefits of cloud computing. Community clouds are whether managed internally or by a third-party and hosted internally or externally. The costs are spread over fewer users than a public cloud (but more than a private cloud), so only some of the benefits of cloud computing are realized. Community cloud offers a higher level of privacy, security, and/or policy compliance. In addition, it can be economically attractive as the resources (storage, workstations) utilized and shared in the community are already exploited and have reached their return of investment. Examples of community clouds include Google's Web App hosting service.

**Hybrid cloud** Hybrid cloud infrastructure is a composition of two or more clouds

(private, community, or public) that remain unique entities but are bound together, offering the benefits of multiple deployment models.

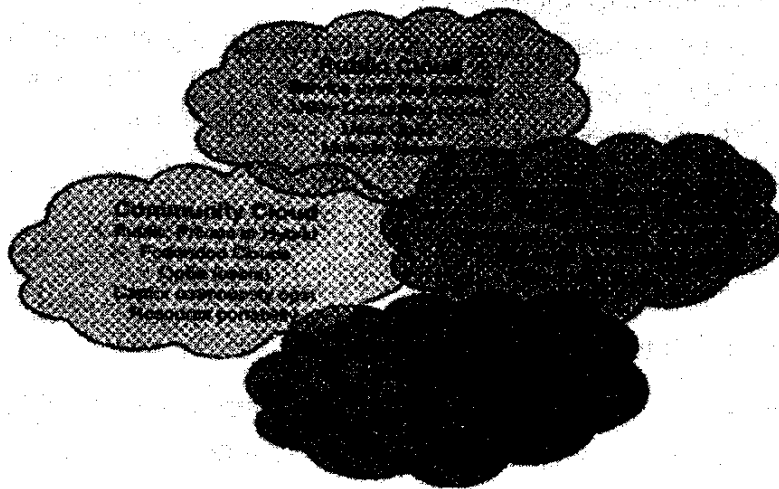


Fig. 2: Deployment Models of Cloud Computing

**IV. CHARACTERISTICS OF CLOUD COMPUTING** Cloud computing exhibits the following key characteristics:

- 1. On-demand self-service:** A consumer can independently provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service's provider.
- 2. Broad network access:** Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, laptops, and PDAs).
- 3. Resource pooling:** The provider's computing resources are pooled to serve multiple consumers using a multitenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or data center). Examples of resources include storage, processing, memory, network bandwidth, and virtual machines.
- 4. Rapid elasticity:** Capabilities can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out and rapidly released to quickly scale in. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be purchased in any quantity at any time.



**5. Measured service:** Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service.

**6. API accessibility:** Application programming interface accessibility to software that enables machines to interact with cloud software in the same way the user interface facilitates interaction between humans and computers.

## V. BENEFITS OF CLOUD SERVICES

### 1. Agility

From a business perspective, there is much more to consider today beyond your ability to manage your core business and deliver great and timely products and services. Today, competitive pressures, marketing challenges, budget issues, and more are considerable requirements. Your ability to manage situations quickly and efficiently is the key. The biggest benefit of cloud computing to business today can be framed in terms of agility. Cloud services can offer huge savings in terms of time (for example, when IT capabilities must be delivered quickly). Scaling up or down with cloud services does not usually require additional hardware or software. Cloud services offer minimal setup time, minimal time to scale, and less cash outlay. This is because as a business model, cloud service providers generally host massively scaled systems' capacity that can be switched on upon request. Suppose, for instance, that you need to scale rapidly for a new project or a seasonal rush. Companies can model these situations using internal resources, but likely at some point they will need to expand beyond that capacity. A decision is made whether to use an external provider to fill the gap; in the world of cloud services, this is called '*cloud bursting*'.

### 2. Business Focus

By using the best service from a cloud service provider, a business can potentially focus more energy and talent on optimizing existing revenue streams and aggressively pursuing the development of new ones. For example, cloud services can enable businesses to gather information, ideas, feedback and so forth from a much wider set of sources (such as customers, partners) than was ever possible by traditional means. This approach is known as '*crowd sourcing*'.

### 3. Cost and Budget Control