HELPLINE ON EMERGENCIES FOR PUBLIC SECURITY

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***Abstract*—Emergency service is one of the essential life guarding services in the world. Most of the services do not reach the public on time due to many reasons like lack of communication between the police and the public. Even though after requesting a service, many individuals have not received the service in correct time. This is because of the inability of officers to communicate and serve people on time. This proposed work focus on improving the effective communication between the public and the police through a GPS (Global Positioning System) service at all time, which is a more convenient way for the public. In case of any incident happens, the victim make a request to the police who is nearest to the crime scene. Once the request is confirmed by the user, the request is forwarded to the nearest police officer based on K-Nearest Neighbor algorithm which is used to locate the nearest member who belongs to the police department. In order to provide reliable and secure communication, this application allows encrypted messages to be transferred between the police and the public. The messages are encrypted using the Advanced Encryption Standard algorithm. The real time server is designed to maintain and store the case history, which has been registered by the public for the past one year. Android studio and phpmyadmin is used for developing the application and integrating it with the web server for real-time monitoring of complaints at low cost.**

Key words: **GPS, Android, AES and K-NN.**

I. INTRODUCTION

The vast population leads to increase in crime rates like theft, accidents. For decades, it has been in practice, If any crisis happens then the people have to go to the police station and register the complaint or else they have to give a call to the respective call center and register the complaint. Many people hesitate to give complaint thinking that it would cause any problems with traditional method and also it takes more time to resolve the problem. Even though the complaints have been registered the people do not know when the police will arrive or they don't know any details about the processing of the case. The people are unaware of when the case will get complete. This has been the scenario of our police department for many decades. In order to overcome these drawbacks, we are developing an application in which the people can give their complaints and track the status of their case with the use of a simple mobile device. Moreover, this application can reduce the number of pending cases and reduce the time delay for completion of each case.

This proposed work is based on mobile application, which uses GPS technology powered by Google map services which uses reliable 3G technology to establish communication between police official and public. In section 2, the current working scenario of the police department is explained. In section 3, the proposed work is discussed. In section 4, the technical aspects of the proposed system are explained. In section 5, the future enhancement has been discussed.

II. LITERATURE SURVEY

In the US, 911 controls entire police department. India is the vast country, there is no such system to control the police department. The police force is a constituted body of persons empowered by the country to enforce the law, limit civil disorder and protect property. The working of the existing police department contains following modules such as request of service by the individual, forwarding the request to the police official by third parties and Processing of the complaint. Initially the user or the public has to call and register the complaint through the emergency service [7] center (100) who is a third party. Then the third party finds the police station, which is nearer to the crime scene with the help of predefined data available in the system. Then the request is port forwarded by the third party to the police station. Aftermath the processing of cases starts which includes a visit to the crime scene, physical interaction with the user and collecting useful information from the user or the public. In the existing system, there is no direct communication between the public and police due to third party interaction. The exact location of the user is also not known in the existing system due to no GPS [2] facility available to locate the current location of the user or public. As a result the police officials take long time to reach the crime scene. There is no response given by the police to the public as there is no real time communication. This increases the pressure of waiting. In many cases the police have arrived at the crime scene only after three hours, which in turn takes a long time to solve the cases. The existing system does not have features for easy and convenient way of requesting or registering a complaint.
This system has various issues such as Lack of communication between the police official and public due to third party interaction [4], Exact location of the public is not tracked, Increases the pressure of waiting as there is no response from the police official and the delay arrival of police official to the crime scene.

III. PROPOSED WORK

The Helpline on emergencies is a simple and efficient system proposed for reducing delay in processing cases. This system consists of a desirable user interface which is used to submit requests and track the status of the cases. It is equipped with GPS [2] module to track the location of public and police. Using the attractive user interface the public or individual submit a request in the case of any incident or case. When the public submits a request the location of the individual is sent to the police official who is nearer to the crime scene with the help of the GPS module. The nearest police official would be identified with the help of KNN algorithm. This algorithm computes distance between the requester and the entire police official one by one using the distance formula. The request is first sent to the police official who is nearest to the scene. After the successful request of the complaint, the public would be given a case id. Case ID would be used by the public to get the status and details about the case. In the mean time the

requester would receive a notification, which would contain the details about the police official who has accepted the case. The current location of the police official would be sent to the public with the help of the GPS [3] module. Moreover, using Google maps service [6] the arrival of the police official to the crime scene would be tracked continuously until he arrives at the requester's location. This reduces the pressure of waiting for the services and delay in processing the case. Then the police arrives at the crime scene and he would have physical interaction with the individual or public to collect the information about the case. Finally the processing of the case starts. A real time server is used to store details about the individual and case. The status about the case is also stored in the database which in turn is updated in the client application. The data in the database are stored in the encrypted form using AES algorithm. This algorithm is also used to verify the authenticity and save exchange of messages between the police officials and the public. The proposed system is easy to use and does not need any special training due to its desirable user interface. The system's inbuilt status module helps the public to know the details of the case without going to the police station.

3.1 Architecture

The helpline on emergencies which help the public is designed as per fig 1 here.The registration takes place with the aadhar id and driving license of the user. After login, the victim can make the request to the police who is nearest to the crime scene. In order to avoid sending requests unknowingly, a confirmation alert box is provided to the user to confirm the request for the service. Once the request is confirmed by the user, the request is forwarded to the nearest police officer who belongs to the police department and the coordinating directions are done with the help of Google Maps to track the location using the GPS and gets stored in the cloud database. The approximate time for the emergency service to reach the victim is acknowledged to the user. In order to provide reliable and secure communication, this application allows encrypted messages to be transferred between police and the public.The real time server is designed to maintain and store the case histories which have been registered by the public for the past one year.

The helpline of emergencies system allows user to have direct communication with the police. In this system the user initially has to register and login into the application. Then the user can register a complaint through this application which. The request is forwarded to the nearer police official. The nearer official is determined with the help of a K-NN algorithm which computes the distance between the user and the police. The current location of the user is sent to the police official with the help of the GPS module. The response from the police official for the user is sent to the successful acceptance of request. The location of the police is sent to the user with the help of GPS module [5]. This reduces the mental stress on the user as the expected arrival of the police official to the crime scene is known to the user.

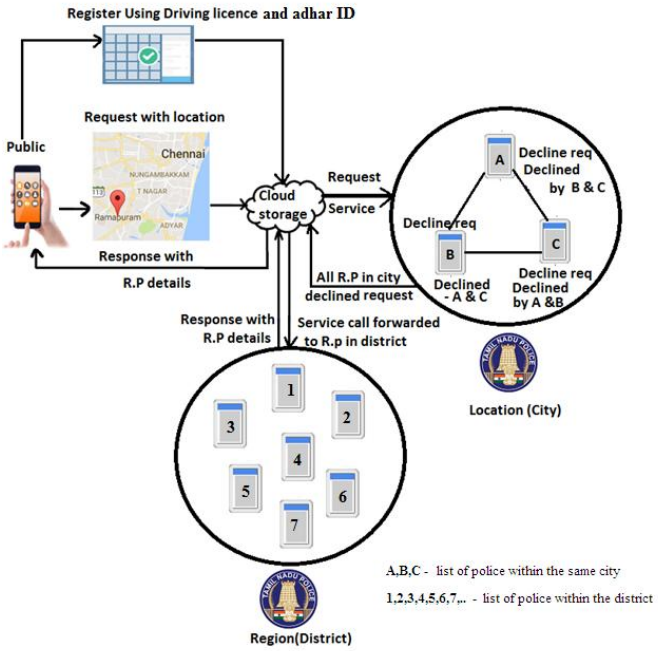

Fig 1: Architecture of helpline on emergencies

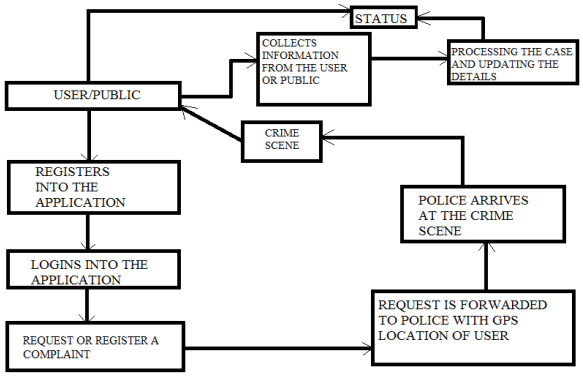

Fig 2: Process flow of helpline on emergencies

While implementing the above work, the various challenges, have raised such as, possibility to get the fake request from the public. Even when a genuine request is made, there could be no response from the resource person. Achieving the transparency between the resource persons is a challenge to be overcome. Maintaining confidentiality in accessing sensitive information and tracking details must be got secured. A Resource could be wasted if it is not managed properly. There could be possibilities when a mobile phone could not get network signal. The implementation of the proposed work comprises of four different phases such as, Registration phase, Request phase, Processing phase, Tracking and update phase.

i. Registration phase

Initially, the registration takes place with the aadhar id and driving license of the user to access the application. Username and password are notified to the user who have registered, those details are used to login to the application. Each Police official officer's details have been updated and

stored in the database and a unique ID is provided, where they can use it to login.

ii. Request phase

User can intimate the police officials as per the crime event which occurs for the user. User have to login to the application. Then the user must request a complaint to the nearby police officials. In order to avoid sending the request unknowingly, a confirmation alert box is provided to the user. When the request is sent, the location of the victim is sent along with that request to the police officials. After the request has been acknowledged by the police, the current location of the police will be fetched using a K-NN algorithm.

iii. Processing phase

The police within the range of victim will get the request sent by the user. After the request is acknowledged by the police officials, the user would get notification about the police like time to reach the victim allowing the user to choose one among them. User can view the information and location about police once the choice has been made.

iv. Tracking and Update phase

With the help of GPS technology, both the police and the public can exchange the current location. The distance and the time for the police to reach the victim is calculated. While processing the case, the police official update the details about the case which can be viewed by the user in the update phase of the application. While implementing the proposed work, the technical background is formed with respective algorithms used for the proposed work are K-Nearest Neighbor algorithm (K-NN), Advanced Encryption Standard (AES).

A) K-Nearest Neighbor algorithm (K-NN)

K-Nearest Neighbor algorithm is a type of instance-based learning or lazy learning, where the function is only approximated locally and all computation is deferred until classification. The k-nearest neighbor algorithm [13] is a non-parametric method used for classification and regression. A commonly used distance metric for continuous variables is the Euclidean distance. The length of the line segment connecting p and q is the Euclidean distance between points.

$p = (p_1, p_2,..., p_n)$ and $q = (q_1, q_2,..., q_n)$ are two points in Euclidean n-space, then the distance (d) from p to q, or from q to p is given by equation 1

$$d(p,q)=\sqrt{(p_1 - q_1)^2 + (p_2 - q_2)^2} \quad (1)$$

where,

p1 x coordinate of public.
p2 y coordinate of public.
q1 x coordinate of police.
q2 y coordinate of police.

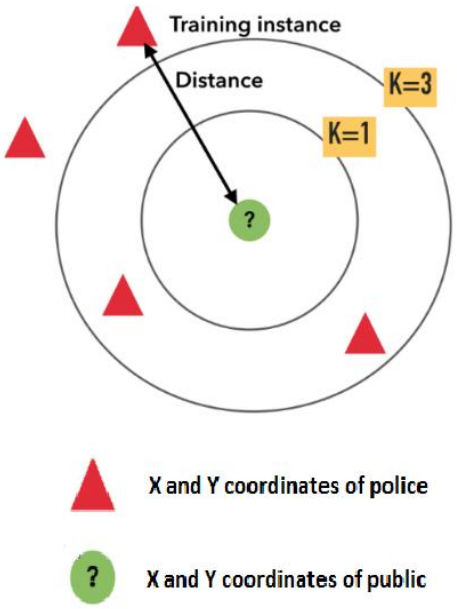

Fig 3: Distance calculation using K-NN

Fig 3, represents the visual representation of K-NN [10], [12] algorithm, where it shows the public and police are taken as test sample and training samples. Initially, the x and y coordinates of every test and training samples are calculated. Then, using the Euclidean distance formula the distance between the test sample and each and every training sample is calculated. Finally, it identifies the close training sample to the test sample returns the result.

B) Advanced Encryption Standard (AES)

The Advanced Encryption Standard (AES) is a specification for the encryption of electronic data. AES operates on a 4 × 4 column major order matrix of bytes. AES calculations are done in a particular finite field. If there are 16 bytes b0, b1,…b15, these bytes are represented as this matrix:

$$\begin{bmatrix} b0 & b1 & b2 & b3 \\ b4 & b5 & b6 & b7 \\ b8 & b9 & b10 & b11 \\ b12 & b13 & b14 & b15 \end{bmatrix} \quad (2)$$

The key size used for an AES cipher specifies the number of repetitions of transformation rounds that converts the input, called plaintext, into the final output, called the cipher text.

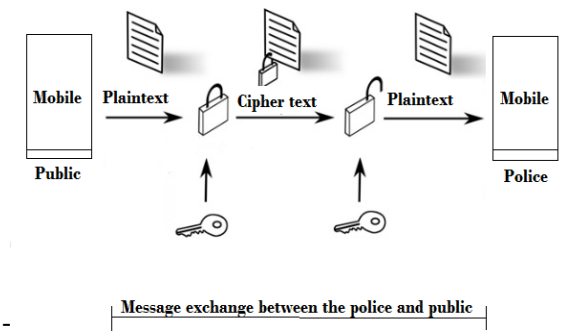

Fig 4: Message encryption using AES

Fig 4, shows the flow of end to end encryption based on AES [8], [11] algorithm, where it is used for exchange of messages securely. When the message is sent from the user to the police it is encrypted and stored in the database. Then the notification is sent by the server to the police by decrypting it. In fig 5, that shows the operation involved in the AES algorithm. The 16 bytes of plain text are substituted by looking up a fixed table (S-box). The result is in a matrix of four rows and four columns.

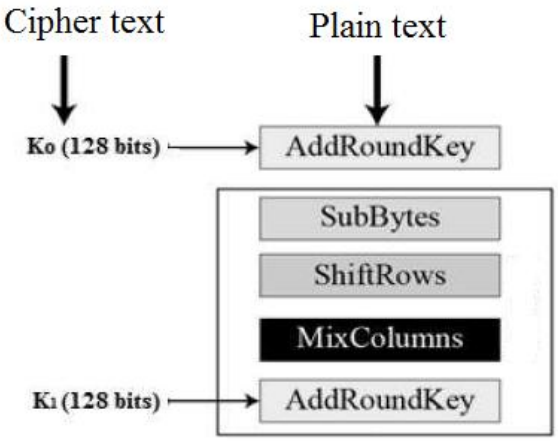

Fig 5: Operation involved in AES algorithm

Each of the four rows of the matrix is shifted to the left. Any entries that 'fall off' are re-inserted on the right side of the row. The First row is not shifted. The Second row is shifted one (byte) position to the left. The Third row is shifted two positions to the left. The Fourth row is shifted three positions to the left. Each column of four bytes is now transformed using a special mathematical function. The 16 bytes of the matrix are now considered as 128 bits and are XORed to the 128 bits of the round key.

IV. EXPERIMENTAL SETUP

The Experimental setup of the proposed work has user U and cops A, B and C respectively, who are at a different distance to the user U. Once the request is made by the user U the notifications are sent to the cops within the range. Fig 6 shows cop A and B receives notifications from U. The notifications are delivered to the police officials at different timings depending upon the distance they are from the user. The cop B receives noticeably faster, since B is very much closer to the user than other cops. Once the police official accepts the request, acknowledgement of the request made is sent to the respective user. There could be more than one response from the police side, so users could view all acknowledgements from all police officials who have acknowledged. There could be a time difference in acknowledgements depending on which user could select the official to attend the case. Once the user has selected the official, the request is sent to the respective official, allowing the police official to view the victim location. The user can also see the cop location and elapsed time to reach the victim place using Google map services.

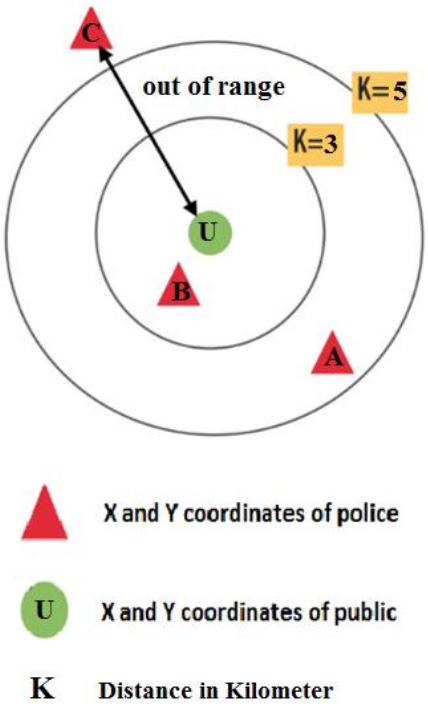

Fig 6: Structure of experimental setup

V. RESULT DISCUSSION

In Test case 1(TC 1), the public had requested a service using the application at 10.05 am. The response is given by two officials who +are 3km away from the user at 10.08. The user accepts the police official who has sent the request first. Finally the police arrive at the crime scene at 10:15am. In TC 2, the user request for service using this application at 4 pm. The entire police officials who are within the range of 3km from the user are busy. So the request is forwarded to the police official within the range of 5km. The response from a police official is received at 4:10 pm. The confirmation is sent by the user. Finally the police official arrives at the crime scene at 4:25.

Table: Experimental output with minimum of 5 public.

Test case	Public request time	Police response time
TC1	10.05 am	10.08 am
TC2	4.00 pm	4.10 pm
TC3	6.00 am	No response
TC4	6.30 pm	6.40 pm
TC5	7.00pm	No response

In TC3, there is no police official within the range of 3km as a result the request needed to be port forwarded to the police official who is in the range of 5km. Moreover, all the police officials within the range of 5km are also busy. So there is a delay in processing the case. The response is being delayed until the police official login into the application. In TC4, during peak many numbers of users would be in the need of service. As the number of patrol personnel's in a particular area is limited, they cannot serve all the public. Assume a person is given a request at 6:30 pm which is a peak time. The police officials who all are in the range of 3km are busy. So the request is forwarded to the police official within the range

of 5km. Once a police official comes into the range he gives response to the user at 6:45. The confirmation is made by the user at 6:47. Finally the police arrive at the crime scene at 7 pm. In TC5, at 7 PM, the user gives the request for the need of service. As the police officials are busy within the range of 3km. So the request is forwarded to the police official within the range of 5km. The numbers of patrol are limited in the particular city. The police official could not fulfil the request of the public. As a result the request fails to be processed.

Table 1 represents the experimented model is tested with 15 users (including both police and public) and also shows the percentage of case that gets processed is equal to 70% without delay during the normal hours. The experimental results have shown that if the number of patrols is increased during the peak hours, then the percentage of cases that get processed without delay can be increased to 89%.

VI. CONCLUSION

This work helps the people in any emergency situation using android smart phones. This application provides effective communication between the police and the public through the desirable user interface. Currently, the mobile cellular network and Wi-Fi technology are used to implement the application. If resources permit, then like to implement this application using an ad-hoc network, so that the service can be provided during natural disasters. As a future enhancement, this application would be implemented in such a way it could handle many users simultaneously in real time. Also, this application is developed for various public services, such as, ambulance, fire services, etc.

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