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The Cop Patrol Monitoring and Tracking System using IoT

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Abstract:
Police officers can now use location-based services from their own homes to find and track other people, objects, machines, cars, and resources, a smartphone. Typically, a user known as the client or network provider requests location sensitive information. Majority of applications today use GPS to provide location information; as an illustration, social networking sites like Facebook allow users to share their location with friends and family. Another typical example is an application that allows users to retrieve weather forecast information based on their current location. With all of these benefits of location-based service, there is no reason not to make usage of that. However, there are privacy concerns that necessitate the implementation of appropriate government restrictions. The goal of this work is to improve a tracking system that is based on GPS module, NodeMCU, to find out their current location. This work will assist the police department or the chief of police in maintaining or tracking the officers' working locations during their duty hours.

Keywords*: GPS, NodeMCU.*

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I. INTRODUCTION

Nowadays, the internet is used for almost everything; even small children use their phones to access the internet for entertainment. Humans are preoccupied with their own work and expect it to be done automatically. As a result, the market for IoT has grown. By utilizing IoT concepts [1], we can automate the system and help to reduce people's manual labor. It is a major and trendy concept in many industries, ranging from home appliance manufacturing to other industries.

We can monitor employees from anywhere in the world using IoT devices. In relation to this concept, a police beat monitoring system is a system that can be proposed to identify police beat monitoring while they are on duty. In an effort to make the unit more effective and transparent, the IoT device beat the system [2].

Beat officers had to manually log their movements on swiping machines installed at strategic locations on their respective beats under the previous system. In the new Police beat monitoring system, they must wear and keep the device in their packet, which is provided by the administrator (superior officer). They have GPS and will track their movements. The officer in charge can use GPS to track their movements while they are on duty in addition to receiving a confirmation when the gadget is turned on. The jurisdictional inspector in charge of the beat system will be given a panel containing information about the beat. Due to this beat system encodes longitude and latitude, it is very simple to monitor, verify, and confirm that all of the beat points are covered.

This system includes an admin module for monitoring and assigning the device to the beat cops, and the device has an ID number for identification. Here, the administrator can enter or register the police to the panel for further procedures such as assigning to the beat and distributing the device. All of the beat officer's information, including their location, will be saved in a database that the administrator can access.

II. OBJECTIVES

The general objective of this system is to monitor thebeatpolice usingthe device.

- Shouldidentifythelocationofthepolicebeat.
- Use IoT devices to track the location of thedutyofficer.
- The location database will be saved in the system and can help to know the details of the beat officer.

III. RELATEDWORK

Sonal et al. [3] designed an employee tracking and monitoring system based on Android. They had utilized the same smartphone with various security profiles for their study. They made use of a dynamic database tool, which pulls information or data from a main database. When an employee enters the company's premises, he is assigned to a different mode. Smartphones monitor all phone-related data, including SMS history, incoming and outgoing calls, employee movements, data consumption, web browsing history, and information regarding Unauthorized Call History. Employees must have an Android phone, and Manager Activities are also tracked [11, 12].

Aparna et al. [5] build the Smartphone Monitoring System. The System is a piece of software that enables managers to keep an eye on their employees' work- related cell phones. Managers have access to and can interrupt all incoming and outgoing calls, text messages, emails, and multimedia messages. They may also monitor their employees' whereabouts, see a history of their travels, and set up alerts in case their workers depart from predetermined geographic areas, receive texts from forbidden numbers, or get calls from prohibited people. The solution allows managers to keep an eye on the mobile devices of their staff members. By monitoring their mobile phone activity and locating them, it enables organizations to eliminate needless employee participation [13].

Shermin and colleagues et al. [8] constructed an intelligent, location-based time and attendance tracking system with an Android app. They suggested a mobile Android app-based location-based time and attendance tracking system that would replace the need for a separate biometric scanner equipment. GPS can be used to pinpoint an organization's exact position. Each employee's smartphone's GPS can determine their location [14].

Priti et al. [4] investigated the use of an Android application to monitor an employee's smartphone. In their system, the software is run on Android-based mobile phones. The mobile device of the employee should be Android-based, whereas the mobile device of the management can be of any type as long as it can receive SMS notifications from the employee. For convenience, alerts like call details, text messages, and multimedia communications, as well as timely location updates of their employees and attendance, are also kept on the centralized server. Managers can later access the centralized server to view data on their employees' mobile usage. Managers can use this technique to track the whereabouts of their staff members using their mobile devices. [15].

Nirmal et al. [5] fabricated an Employee Surveillance System Using an Android Smartphone that combines employee monitoring with GPS location tracking via an Android phone. This programme will monitor the Worker's every step. The system uses 3G technology to communicate between the terminal ends.

All cell phone and computer activities of an employee will be monitored, including incoming and outgoing calls, data usage, secure document modification, web browsing, and illegal transfer of company information such as blueprints, stocks, and projects. Furthermore, GPS will be used to track the employee's global geographic location. As a result, the organization will be under surveillance, limiting employee use of its resources during working hours. The system aided the organization's growth and will allowthe Manager to assess his employee’s dedication to their jobs. [8].

IV. METHODOLOGY

A. EXISTING SYSTEM

The current system is ineffective of the police management is held by manually assigning the police for their duty every day with their location, especially the beat police, some of the duty officers report to the work and can stay in single place while in their beat duty also, this may lead to increasing the crimes in some places and difficult to find the officers duty in their assigned time [9, 10].

GPS module enclosure DC power is required for the GPS sensor. As soon as it recognizes the satellites within its range, it begins to output data as shown in Fig.1. The NMEA protocol, which uses plain ASCII, is followed by the data. The decoding scheme is 8 bits, no parity, and one stop bit, and the transmission rate is either 4800 bps or 9600 bps. Sentences, or data blocks, are 80 or so character long and are referred to as sentences. Latitude, longitude, altitude, and data recording time are all included in these GPS statements. These phrases are decoded using a tiny program and a microcontroller connected to a GPS module.

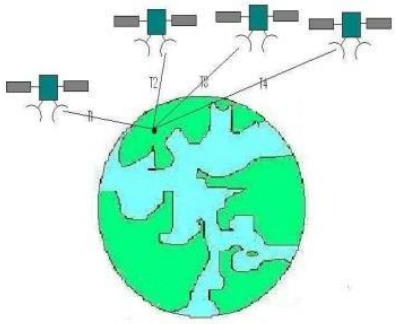

Fig.1 GPS Sensor Working

It will show the latitude, longitude, speed, bearing, and number of satellites it is connected to once it has retrieved satellite data.

B. PROPOSED SYSTEM

Knowing the above mentioned problem, the system is proposed called police beat monitoring system that uses IoT devices to help monitor the beat police during their duty time. Once the beat police are assigned by a higher officer (superior officer called admin) and the device is given to them, the beat police can wear or keep the device in their pockets, which can monitor the police's location and store it in the database. This system allows you to easily track location and time.

This application uses the Google Maps API (Application Programming Interface) to determine the user's relevant personal location. Using GPS data, the application can geo-locate the user and estimate their present location. Then, for further action, the programme sends the user ID and position to the software. The management software stores the information in a database after processing the data.

- Used GPS to speck the location.
- Used a pre-stored (office/workspace) location to verify the location.
- Brief the system with information.

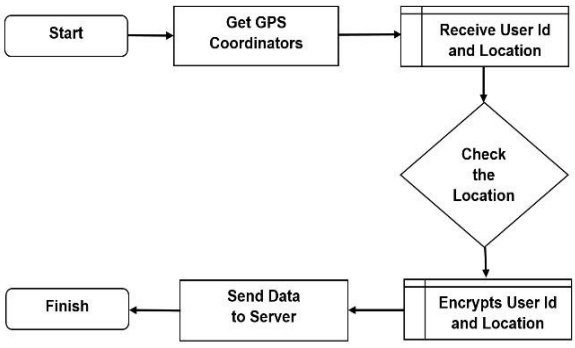

Fig.2 Flow of mobile operation

The flow of operation for mobile applications is depicted in Fig.2. The application uses GPS to determine the position first where the GPS module uses the GPS coordinators to receive the signals through NMEA commands like,

geo fix longitude latitude satellites [altitude] → (1)

By the above equation (1), the details are received by the coordinators in the GPS module and the required attributes like longitude and latitude are retrieved.

The module is connected with the NodeMCU through authentication(auth), wifi-username(ssid), wifi-password(pass). Then the location will be checked and used based on longitude and latitude retrieved.

userId ← auth + ssid + pass → (2)
longitude ← gps.location.lng() → (3)
latitude ← gps.location.lat() → (4)

The data from equation (2),(3),(4) will be encrypted using DES algorithm.

function encrypt(userId, longitude, latitude): ciphertext <-- initial permutation on
retrieved data
for round in rounds [i = 1... 16] ciphertext = round.encrypt(ciphertext)
endfor
return final permutation on ciphertext endfunction
Then, it is sent to the management system via data server to trace the details such as longitude and latitude.

Then, it is sent to the management system via dataservertotracethedetailssuchaslongitudeandlatitude.

Flows of operation:-

- The system software's operational flow is depicted in Fig.3.

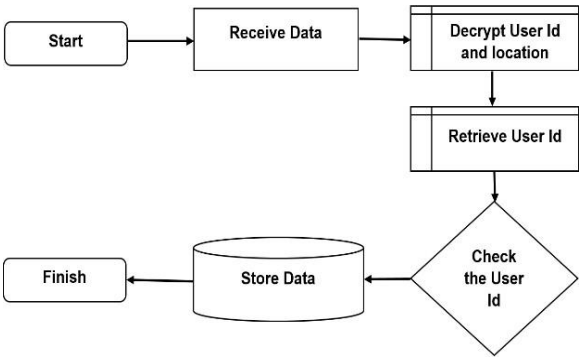

Fig.3 Flow of system operation

- Receive data from the application as, encrypted (userId, longitude, latitude)

 Decrypts the data received using DES and obtain the user ID from the database.
function decrypt(userId, longitude, latitude): plaintext <-- final permutation inverse on sequence
for round in rounds [i = 16... 1] // going in reverse plaintext = round.decrypt(plaintext) endfor
return initial permutation inverse on plaintext endfunction

The information will be cross verified and stored in the database as shown in Table.1.

Table.1 The device details stored in the database

Field	Type	Attributes	Default
userId	int(5)		
Time	timestamp	ONUPDATE CURRENT_TIMESTAMP	CURRENT_ TIMESTAMP
Latitude	double(7,5)		12.9143179
Longitude	double(7,5)		77.5788968

V. RESULTS

The GPS tracking system usually uses the module and a sensor to locate the exact position of the system. Here, the Node MCU and GSM module has been used to which follows the accurate position of the system which has been developed as shown in Fig.4.

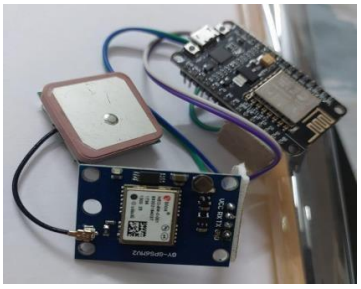

Fig.4 Anabstract modelofthe system

SMS Notification: The user who installs the application can send an emergency message to the police officer who is on beat in their area. The Fig.5 represents the message received by the police when the user sends an emergency text.

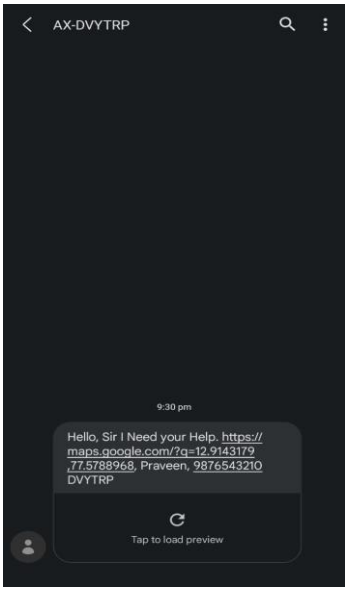

Fig.5 The SMS sent from User

User location: The police officer who gets the emergency text from the user found any crime or accident in his location can view the user's location. The Fig.6 represents that user's location. The police gadget will be given a phone number that the user can use to send SMS notifications.

Fig.6 User's location from Police view

The device will be entered in the data table as soon as it is given a number. The table's longitude and latitude columns will be used to track and store the device's movements. The device's data will be updated once every ten seconds. Similar to this, numerous devices can be registered for the various police departments with their unique phone numbers and easily tracked. The latter method goes by the name of a symmetric key algorithm. When a communication is delivered from the user to the appropriate beating officer, third-party contact is avoided using the encryption approach. Here, DES encryption is employed to reduce this kind of error. DES encrypts and decrypts data using the same encryption key. The same private key must be used by the sender and the recipient. User data cannot be accessed by anyone with access to these devices because of the encryption employed therein. Users can pick who gets access to their data and have control over it as well.

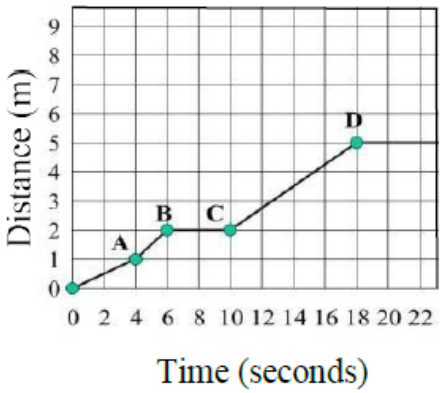

Fig.7The graph of GPS accuracy

Small processors and antennas found in GPS modules are used to directly receive data from satellites using specific RF frequencies. From there, it will get data from various sources, including timestamps from all visible satellites. The random plotting of the distance vs time using the GPS sensor has been created in the Fig.7 where the time is directly proportional to the distance. The A, B, C and D are points plotted for the accuracy of gps where the time varies like 4sec, 6sec, 10sec, 18sec for the distances of 1km, 2km, 4km and soon. As distances varies from meters, the time taken by the GPS coordinators also varies accordingly.

VI. CONCLUSION

This application allows managers to keep track of the overall performance of the cops at their respective sites. A revolutionary application that uses location is this monitoring system. There is no need to manually enter each officer's daily activity details into the database. The traditional method of calculating performance is completely eliminated. This will save a tonne of time and paper in the paper work process. This programme effectively utilizes the most recent innovations in mobile development, which boosts system performance as a whole. The police beat monitoring system is a system that can track the beat cops while they are on duty. The IoT device is assigned to the police, who have the option of tracking the system's location as well as recording the tracked data in the panel. The data within the application is secure and safe, and unauthorized people cannot access it. By using the GPS module for tracking, the graph had been plotted to estimate the GPS accuracy of 70% based on distances vs time. This application becomes user-friendly and comfortable for the administrator to use effectively and efficiently. The application and device assisted the police department in tracking the work of the officers during their duty hours.

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