Section: Research Paper

GPS SPEEDOMETER WITH PARENTAL CONTROL AND REAL-TIME EMERGENCY MEDICAL ASSISTANCE USING WIRELESS SENSOR NETWORKS

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***Abstract*—** The proposed research aims to revolutionize vehicle safety by creating a system that can monitor and control the speed of a vehicle in real-time. Equipped with state-of-the-art software, this system allows drivers or authorized third parties to regulate a vehicle's speed and activity, improving safety and efficiency. The system incorporates GSM and GPRS technologies for accurate tracking and timely data transmission to a centralized server, which authorized users can access via the internet. A prototype model integrating GPS and GSM technologies provides location-tracking capabilities, while a user-friendly mobile application ensures portability and flexibility in accessing real-time information. In the future, this system could become a standard feature in vehicles, providing drivers with a safer and more secure driving experience. Additionally, this paper explores the benefits of hospital vehicle tracking with wireless sensor networks and GPS technology. The proposed system collects data from hospital vehicles using sensors and GPS devices and transmits it wirelessly to a central server. The data is then processed and analysed to provide accurate and up-to-date information on vehicle location and condition, leading to improved patient care, enhanced safety, and increased efficiency in hospital operations. Furthermore, the paper discusses various techniques for determining accidents that occur while traveling using mobile applications, including GPS tracking, motion sensors, audio sensors, and crowd-sourcing. While these systems are not fool proof, they serve as valuable tools for detecting accidents and improving overall hospital vehicle tracking. In conclusion, the proposed research and hospital vehicle tracking with wireless sensor networks and GPS technology offer exciting opportunities for enhancing vehicle safety and hospital operations. With continued advancements in technology, these systems will play an increasingly critical role in improving efficiency, reducing costs, and providing better care for patients.

Keywords— GSM, GPRS, API, Monitoring, Vehicle.

I. INTRODUCTION

In today's fast-paced world, safety and efficiency on the road are more important than ever. With the increasing complexity of transportation systems, we need innovative solutions that can effectively monitor and manage vehicle speed and activity. That's where this project comes in - we're developing a cutting-edge system that leverages the power of GSM, GPRS, and GPS technologies for real-time monitoring and control of vehicle speed. The potential benefits of wireless sensor networks and GPS technology in hospital vehicle tracking, which could lead to improved patient care, enhanced safety, and increased efficiency in hospital operations. And with our user-friendly mobile application, our system is portable and flexible, making it a promising solution for the future of transportation. As technology continues to advance, we're dedicated to contributing to the development of safer and more efficient driving experiences. Our project is paving the way for a transportation landscape that prioritizes safety and efficiency, while also pushing the boundaries of what's possible with wireless sensor networks and GPS technology. Join us on this exciting journey as we revolutionize the way we monitor and control vehicles, and explore the potential of these technologies to transform hospital vehicle tracking and overall patient care.

II. EXISTING SYSTEM REVIEW

A. Development of Speed Control and Accident Alert System for Bike

The goal of this application is to regulate the speed of a bike automatically. In today's fast-paced world, some individuals lack self-control and drive their bikes at high speeds, which can be dangerous to others. This application aims to provide a solution to this problem by controlling the speed through an electrical mechanism, which cannot be altered by the driver. Accidents often occur due to reckless driving, speeding, and a lack of safety measures on the road. Unfortunately, many people do not value human life, which is why we are working on a simple system to address this issue. Our initial plan is to control the speed of the bike, alert parents via SMS or phone call if the bike is speeding, and notify them in case of accidents.

B. Automatic Vehicle Speed Control System in a Restricted Zone

The objective of this project is to implement an automatic speed control mechanism for bikes. Nowadays, due to the fast-paced lifestyle, many individuals lack self-control and tend to ride their bikes at high speeds, making it difficult for them to monitor their driving behaviour. This application offers a solution to regulate bike speed without causing harm to others. An electrical mechanism is used to automatically regulate the speed, and the driver is unable to alter it. The majority of accidents that occur today are due to reckless driving, high speeds, and inadequate safety measures on the road. People tend to ignore the value of human life, which is why we are developing a simple system to address this issue. Initially, our plan is to control bike speeds, alert parents of over-speeding via SMS or phone call, and inform them of accidents.

C. Vehicle Speed Monitoring

The speed limit on highways varies based on location, but the majority of accidents are caused by drivers exceeding the limit. The current methods used to detect speeding vehicles are inadequate, leading to a rise in reckless driving due to a lack of enforcement. The existing techniques employed by traffic control agencies are insufficient in identifying cases of speeding, as there are not enough officers to monitor every vehicle, and it is challenging to determine speed limit violations accurately, especially at high speeds or in unfavourable weather. This system could replace traditional methods involving traffic police and pave the way for an online fine collection.

D. Vehicle Speed Limiting System

The aim of the research was to assess the velocity of a vehicle at various speeds. The observation lasted approximately eleven seconds and was carried out over a distance of approximately 25 meters. An IR device and an encoder attached to the car's wheel were used to determine its speed, with the results displayed on a mobile application in RPM. The primary objective of the study was to observe the car's behaviour when it was traveling at a high speed without any speed limit constraints. Upon reaching the transmitter unit, the car would receive a signal and decelerate until it reached the curb, maintaining the signal until it received another. This system has the potential to improve traffic flow on roads and prevent accidents by regulating the speed of autonomous vehicles. The system has been designed to be part of the Internet of Things (IoT).

CONCLUSIONS FROM THE SYSTEM REVIEW

There are several mobile applications available in the market such as speedometers and speed alarms that are designed to assist users while driving. However, these apps lack certain features like parental control and drive mode, which can lead users to drive without their parent's knowledge and cause accidents. To address this issue, we have developed a Speed Control System that includes tools for parents to monitor their children's daily driving activity, as well as features that enable users to know the speed limit and control their driving behaviour to prevent accidents.

III. PROBLEM STATEMENT

Accidents on the road are a significant risk for individuals and their loved ones, especially when they are busy with their schedules and driving at high speeds. To address this issue, it is crucial to implement safety measures that can effectively monitor and manage vehicle speed and activity. A solution to this problem is GPS-based vehicle tracking systems, which are a cutting-edge safety measure that can revolutionize the way we monitor and manage vehicles on the road. Real-time tracking and management are essential for ensuring patient safety and efficient operations of hospital vehicles. However, hospital vehicle tracking presents unique challenges that require specialized solutions. GPS-based vehicle tracking systems are becoming increasingly popular as they can enhance security and safety on the road, particularly for high-speed driving. The safety and efficiency of hospital operations rely heavily on real-time tracking and management of hospital vehicles. By using GPS-based vehicle tracking systems, patient safety can be enhanced, and hospital operations streamlined.

IV. PROPOSED SOLUTION

The proposed solution involves the development of a cutting-edge system that integrates GSM, GPRS, and GPS technologies to monitor and control vehicle

speed in real-time. This innovative system will be equipped with software that allows drivers or authorized third parties to regulate the vehicle's speed and activity, thereby improving safety and efficiency on the road. The system will provide accurate tracking and real-time data transmission to a central server, which authorized users can access via the internet. Additionally, a prototype model will be developed that combines GPS and GSM technologies to offer location-tracking capabilities. A user-friendly mobile application will be created to ensure portability and flexibility in accessing real-time information, making it a promising solution for the future of transportation. The project will also explore the potential benefits of using wireless sensor networks and GPS technology for hospital vehicle tracking. The proposed system will collect data from hospital vehicles through sensors and GPS devices and transmit it wirelessly to a central server for processing and analysis. This will result in accurate and up-to-date information on vehicle location and condition, leading to improved patient care, enhanced safety, and increased efficiency in hospital operations. By implementing this comprehensive solution, the project aims to revolutionize the way we monitor and control vehicles, ultimately paving the way for a safer and more efficient transportation landscape, as well as improving hospital vehicle tracking and overall patient care.

V. SOFTWARE TOOLS

A. Android Studio

Android Studio serves as a development environment for constructing Android applications. The software facilitates the organization of ordered code modules, which can be divided into files of distinct functionality, allowing for independent building, testing, and debugging. This structured approach is the recommended means of developing Android applications. Our proposed solution entails employing Android Studio as a software development tool for creating the application. The software's user interface creation capabilities and plugins enable easy connection to a real-time database. Furthermore, an Application Programming Interface (API) will be integrated into the Android application.

B. Figma

Figma is an innovative design platform that allows users to create various types of designs, such as those for web and mobile interfaces. It provides an effective way for teams and individuals to collaborate and share their work, enabling them to produce their best results. The Figma platform is used to develop the primary user interface design and workflow for our proposed system due to its lightweight, streamlined, and graceful nature for teamwork, as well as its ease of learning within a short period of time.

C. Kotlin

Kotlin is a modern programming language that runs on the Java Virtual Machine (JVM) and is designed to address some of the shortcomings of Java. Developed by JetBrains, Kotlin is an open-source language that is fully interoperable with Java code. Kotlin is a statically-typed language that offers many features that make it more concise, expressive, and safe than Java. Additionally, Kotlin has become a popular language for developing Android apps, thanks in part to its support for the Model-View-ViewModel (MVVM) architecture. This architecture separates the presentation layer from the business logic, making it easier to maintain and test code. Kotlin's support for functional programming paradigms also makes it easier to write code that is both concise and expressive. Overall, Kotlin is a powerful and versatile programming language that is well-suited to a wide range of development tasks, making it a valuable tool for developers looking to build high-quality software.

D. Firebase

Firebase offers a comprehensive suite of hosting services that cater to various applications requiring backend connectivity with a database. It provides real-time hosting solutions for databases, content, notifications, and real-time communication servers. With Firebase, users can update each data point's details in real-time without the need to update the Android application. In Android Studio, the Firebase Firestore plugin is used to connect the application to Firebase. All data related to livestock, as well as user information, are stored in Firebase, allowing for seamless access to the real-time database. This facilitates regular updates, enabling users to benefit from subsidies based on their eligibility criteria promptly. Additionally, this setup ensures that any new schemes implemented by the state or central government can be quickly reflected in the application. Overall, Firebase's powerful features make it an excellent choice for developers looking to streamline the backend connectivity of their applications.

VI. TECHNOLOGIES

A. SQL

SQL Room is an essential part of Android development projects that rely on local data storage. It is a library for data persistence in Android applications that provides an abstraction layer over SQLite, which is the most common database used in Android apps. SQL Room offers a clean and simple

API for developers to interact with databases and provides compile-time checks for SQL statements, ensuring their correctness. Additionally, SQL Room is optimized for working with LiveData and RxJava, which makes it an excellent choice for building reactive applications. As a Kotlin-based Android development project, SQL Room's integration with Kotlin is seamless, offering developers the ability to write more concise and expressive code. Overall, SQL Room is a powerful tool that enables Android developers to create robust and reliable applications with efficient data storage capabilities.

B. GPS

The Global Positioning System (GPS) utilises a network of satellites to receive signals from a GPS transmitter and transmit information to a receiver. This allows for accurate determination of a location, speed, and events such as opening or closing a door or remembering where a vehicle has been parked. The GPS tracking device, which includes the transmitter, is discreetly installed within the vehicle, making it difficult for thieves to detect and deactivate. The transmitter continuously sends signals to a monitoring station, where the GPS server processes and securely stores the data. The GPS interface or system then facilitates the transfer of speed limit data to the speedometer when the user requests it through their mobile device. There are two kinds of GPS:

- PASSIVE GPS: It is equipped with a receiver that listens to satellite signals, which it records and converts into digital data. To track the movements of a vehicle, the tracker is connected to a computer. Its portable, battery-powered design allows for easy transfer between vehicles without any wires attached. The device captures a GPS signal every second, totalling 60 signals per minute.

- ACTIVE GPS: An active component of the system is an indoor cellular device that repeatedly initiates phone calls to transfer satellite readings and data to a GPS tracker, which then logs the information onto an online platform. This allows for real-time monitoring of the vehicle's speed.

C. GSM

The GSM technology converts and compresses data before transmitting it through a channel along with two other data streams, each occupying its own slot. It functions on either a 900 MHz or 1800 MHz frequency range. To ensure safety, the speeds will be monitored and checked. With GSM-enabled devices installed in vehicles, the devices will communicate with each other automatically within a range of 100 metres in the 900 MHz band. The range, however, can vary based on the power class of the product. The transmission rate also varies among Bluetooth devices, depending on features such as power-saving, bandwidth needs, and the transmission distance. Given the alarmingly high statistics of traffic accidents, the need for such a system becomes imperative.

D. MVVM architecture

The Model-View-ViewModel (MVVM) architecture is a design pattern that separates the presentation layer of an Android app from the business logic and data model layer. In this architecture, the Model represents the data and business logic, the View represents the user interface, and the ViewModel acts as a mediator between the two. The ViewModel retrieves data from the Model and provides it to the View via observable properties, while also receiving input from the View and updating the Model as necessary. MVVM has several benefits, including improved testability, maintainability, and separation of concerns. With MVVM, the ViewModel is responsible for handling all the business logic and data processing, leaving the View to focus solely on displaying the data. This separation of concerns makes it easier to maintain and test the codebase because changes can be made to one layer without affecting the others.

Additionally, MVVM's use of observable properties allows for easy synchronization between the View and ViewModel. When the ViewModel updates the data, the observable properties notify the View, triggering the appropriate updates to the user interface. This approach ensures that the user interface always reflects the latest data, without any need for explicit updating. MVVM is a flexible architecture that can adapt to different use cases and is well-suited to large-scale projects. Because it separates concerns and promotes loose coupling between layers, it can be easier to maintain and scale over time.

VII. RECEIVING GPS SIGNALS

The GPS satellites transmit at least four signals to every location on the Earth, but they are incapable of penetrating through solid objects. In order to determine a person's location, the GPS requires signals from at least three satellites. In case the signals received are not strong enough, most GPS systems will provide a warning.

A. Pinpointing your location

GPS technology provides information about your location, including your longitude, latitude, and altitude. These coordinates can be used to determine your position on a map. By accurately pinpointing your location, GPS enables a satellite-based clock to

provide the time in your area. GPS devices also have the ability to display your current speed, which is calculated by measuring the distance you have travelled over a specific time period.

B. Principle of operation

The Global Positioning System (GPS) is a satellite-based navigation system that works by receiving digital signals from satellites transmitting at a frequency of around 1.5 GHz. This enables the receiver to determine the geographic position (GP) of the satellite and the distance between it and the receiver. The GP represents the exact point on the earth's surface directly beneath the satellite, forming a line of position (LOP).

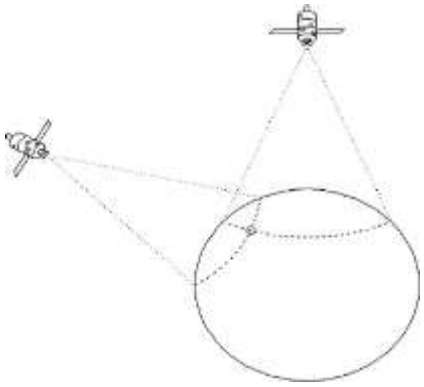

Fig.1 Global Position System

VIII. SPEEDOMETER

The speedometer is a device that displays the speed of a vehicle in miles per hour, kilometres per hour, or both. Despite technological advancements, the speedometer still uses a needle pointing to a number on the dashboard to indicate speed. This device is a permanent fixture in all vehicles and works by measuring the distance travelled from point A to point B to determine the speed. In contrast, satellite navigation systems use GPS satellites to track the vehicle's position and calculate the distance travelled over time to determine speed. The accuracy of this method depends on the quality of the satellite signal, but it can be enhanced by integrating data from the vehicle. To calculate speed, the distance travelled is divided by the time elapsed.

$$v = \lim_{\Delta t \to 0} \frac{\Delta s}{\Delta t} = \frac{ds}{dt}$$

The speed of a driver can fluctuate based on their actions and is represented by delta (Δ) symbols, which indicate changes in time. This velocity is calculated in a brief moment and is dependent on a short time frame. The GPS vehicle tracker measures the speed of the vehicle each time it is updated by recording the derivative of distance with respect to time. This information is then transmitted to the user's mobile device, where they can set a speed limit of either 10, 15, 20, or 25 km/h. The user can then transmit this data to the satellite, where it is digitized and used to adjust the speedometer without alerting the driver. This process ensures that the vehicle's speed is regulated automatically by the speedometer.

IX.SYSTEM ARCHITRCTURE

The tracking system operates by utilizing the Global Positioning System (GPS) technology, which is a key component of satellite navigation. It connects via a mobile data connection and uses computer software to keep an eye on the location and speed of a mobile device or computer. The GPS sends a signal from the tracker to a satellite, which then forwards the signal to the tracking software. The distance travelled is calculated by the satellite based on the received information and an SMS is sent to the parents if the set speed limit is exceeded. GPS enables parents to monitor the vehicle's location and movement. The tracking system has global coverage made possible by the presence of 20 GPS satellites. The software offers detailed information such as location, speed, and activity. On a mobile device, the user can input speed limits (e.g., 10, 20, 30, 40, etc.) into the speedometer through the GPS satellite, and the information is returned through the same process. This can assist in preventing accidents.

Fig.2System Architecture

X. MODULES

In this, we have five basic modules namely:

- Call Block
- Speedometer
- Find Route
- Speed Alarm
- Emergency Report

These modules have sub-modules in them for better information for user understanding.

A. Call Block

- This module gives you the flexibility to decide when and through what means you receive notifications and alerts.

- The integration of this feature makes it convenient to silence all incoming calls, halt any vibrations, and prevent any visual interruptions.
- The incoming calls are blocked by using call-block service and SMS is sent to respective diallers.

Fig.3 Call Block Module

B. Speedometer

- Speedometer is an analog display used to measure the speed by using mobile network service.
- A GPS Speedometer uses a signal receiver to communicate with the satellite that tracks the vehicle's location over time and measures the distance travelled to determine speed.
- They measure speed from km/h-1 = 3.6*(speed from ms-1), using this there is a delay in getting speed on location changed is called after some time.

Fig.4 Speedometer Module

C. Find Route

- The GPS (Global Positioning System) utilises a network of satellites that transmit coded data continuously to serve as a location-determining system.
- The data transmitted from satellites can be decoded by receivers to accurately pinpoint a location on the planet by determining the distances from the satellites.
- The unit offers precise location determination and tracks changes in movement, allowing you to utilize the system for following the path of your delivery trucks or keeping an eye on their progress.

Fig.5 Find Route Module

D. Speed Alarm

- This feature utilizes GPS technology to monitor the vehicle's location and cross-references it with a database of speed limit data. In doing so, it alerts drivers if they are exceeding the speed limit.
- This assists drivers in maintaining a secure

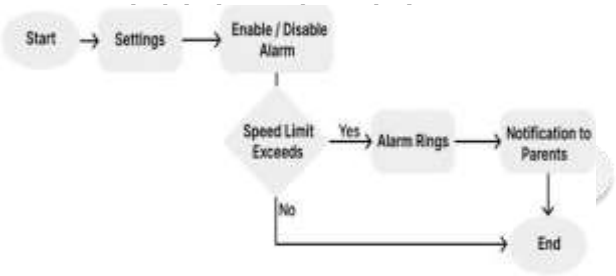

Fig.6 Speed Alarm Module

E. Emergency Report

- In this module, a comprehensive safety system is in place for riders, which includes the use of motion sensors, audio sensors, and crowd-sourced data.
- Motion sensors are electronic sensors that detect movement and acceleration, and are typically used in vehicles to detect collisions or accidents.
- One of the key benefits of this safety system is that it provides real-time location information to the hospital, allowing for expedited medical response.

XI. FLOW CHART

The proposed system follows a systematic flowchart, starting with the user interface. After logging into the system, the user can access the main dashboard, which provides an overview of ongoing trips, including driver location and speed. The dashboard allows users to set speed limits and receive alerts when the driver exceeds these limits. It also provides detailed reports on vehicle activity, such as driving history, speed, and location. The system utilizes GPS and GSM technologies to track the vehicle's location and communicate with the driver, allowing for real-time monitoring and control. The system also provides parental control and monitoring features, allowing parents to track their children's location and driving behavior for added safety. The system's reporting features can be utilized to improve vehicle management and safety and monitor driver performance.

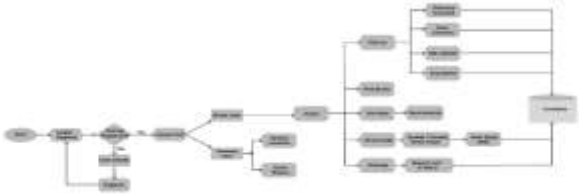

Fig.7 Flowchart of Speed Monitoring System

XII. OUTPUT

This will be the first page of the application, where the user has to enter the login credentials first. After, entering the information, it will be checked with the database whether it matches or not. Then it will proceed to the home page of the proposed system. So that the invalid users will be blocked from accessing the contents of the livestock management. The output will be in some format given below.

A. Login Page

The Login page allows a user to access an application by typing their username and password. It is used to authenticate the user before presenting the secured page of the application.

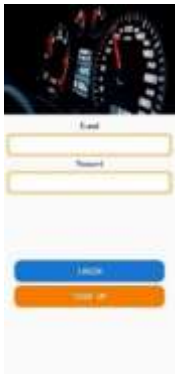

Fig.8 Login Page

B. Registration Page

It allows users to register and gain the access to the application. From this registration, users will fill in their details and sign up with the application. Then they will get access to run the application.

Fig.9 Registration Page

C. Speed Limit Page

The speed limit option in the application is used to set the speed limit. Its main purpose is to maintain the speed within the given limit. If the user crosses the speed limit the alarm will ring on their mobile and a notification send to their parents.

Fig.10 Speed Limit Page

D. User Location Page

In the user, the location page will show the current location of the user and the meter will show the vehicle speed. Through this user will know their place and the speed of the vehicle.

Fig.11 User Location Page

E. Call Block Page

In call block page user can set a message, while the user receives a call during the drive period the notification will send to the called person that the user is driving the vehicle.

Fig.12 Call Block Page

XIII. CONCLUSION

As we strive towards a safer and more efficient future, the role of advanced transportation systems cannot be ignored. Our analysis of GPS speed control

systems has paved the way for the development of a proposed system that promises to revolutionize traffic management through its user-friendly language for modelling. The testing of this system has yielded positive results, demonstrating its potential to enhance the efficiency and reliability of transportation. The benefits of GPS technology and wireless sensor networks extend beyond traffic management and into hospital vehicle tracking, where they can improve patient care and enhance the efficiency of hospital operations. With the potential to develop this proposed system into a comprehensive application, the possibilities are endless. The combination of GPS and wireless sensor network technologies holds enormous potential in transforming the transportation and healthcare industries. Our proposed system has proven practicality and effectiveness in managing traffic, and its implementation can lead to a safer and more efficient future for all.

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