LIVE TRACKING OF COLLEGE BUS USING GPS MODULE AND WEBSITE

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Abstract—**The Vehicle Tracking System based on IoT is planned to offer real-time location tracking of vehicles via GPS and IoT. The system will be formed through a hardware component that includes an Arduino microcontroller, a GPS module (NEO-6M), and an ESP8266 Wi-Fi module. The GPS module retrieves the real-time position (latitude and longitude) of the vehicle, which is treated by the Arduino and relayed to a web server using the ESP8266 module. The data is then stored in a MySQL database with a PHP backend. To run real-time tracking, a basic-to-operate webpage gathers the location information from the database and shows it on an interactive map—for example, Google Maps. For fleet management, anti-theft prevention, and logistics optimization the system is quite helpful. It offers a cheap and sensible method for real-time car tracking, so supporting security and operational efficiency. IoT, GPS, and web technologies help to integrate this system so making it scalable and flexible for many uses.**

Keywords—GPS, Real-Time Tracking, Web-Based System, College Bus, Transportation Management, Microcontroller, Wi-Fi Module, Live Tracking

I. INTRODUCTION

In the fast-paced world of today, the need for efficient vehicle tracking and management systems has become increasingly important. With the growing logistics, transportation, and fleet management industries, organizations are constantly searching for means to enhance operational efficiency, security, and cost savings. Conventional vehicle tracking systems do not possess real-time capabilities and are used in limited applications. This has created a demand for sophisticated tracking systems using Internet of Things (IoT) technology, which provides real-time monitoring, improved accuracy, and seamless integration with web-based applications. The IoT-based vehicle tracking framework employs GPS and Wi-Fi modules to enable real-time location tracking, making it the ideal solution for the transportation needs of today. The proposed framework employs Arduino, GPS, and ESP8266 modules to implement a robust and affordable vehicle tracking system. The GPS module captures the real location of the vehicle, for instance, its latitude and longitude, which is processed by the Arduino. The ESP8266 Wi-Fi module sends the location data to a remote server as HTTP requests. A PHP backend script is used to fetch and save the data securely inside a MySQL database and thus make it available for future use. This combination of hardware and software modules ensures continuous communication between the vehicle and the central monitoring system, thus making the users continuously accessible to real-time location data. The system also includes a web interface that is easy to use and displays the location of the vehicle on an interactive map, just like Google Maps. This interface gives users the ability to monitor the movements of the vehicle in real time, thus making it a useful tool for fleet management, theft tracking, and logistics optimization. By combining IoT, GPS, and web technologies, the system is a flexible and scalable solution that can be utilized in various industries. Not only is it improving the efficiency of operations, but it is also a cost-effective solution compared to conventional tracking systems. With real-time features and simplicity, the IoT-based vehicle tracking system is set to revolutionize vehicle tracking and management in the contemporary world. Additionally, the system provides added security by enabling users to track stolen vehicles and take action in a timely manner. Through the integration of geofencing, users are alerted if the vehicle moves beyond specified boundaries. This feature is especially beneficial for logistics firms to track driver compliance and ensure operational efficiency. Further, the system minimizes reliance on manual tracking, hence eliminating human errors and improving the accuracy of data. The utilization of cloud storage allows historical data to be retrieved for future route planning and performance analysis. The tracking system can be custom-made for public transport, improving passenger safety and minimizing waiting times. As IoT continues to evolve, the system can be further upgraded with AI-based analytics for predictive maintenance and route planning. Its adaptability also makes it compatible with personal, commercial, and industrial vehicle tracking, providing a highly scalable solution. In general, the IoT-based vehicle tracking system is an intelligent and secure solution to contemporary transportation issues.

II. PROPOSED WORK

In the proposed system, smartphones are an integral part of people's lives now, and their impact on society is increasing day by day. The main driving force behind this fast development in smartphone usage is the availability of a variety of applications to satisfy the various needs of people. In this project, we have designed a smartphone application and an in-vehicle tracking device. These two systems are integrated to offer users an easy and efficient means of tracking the location of vehicles in real time. Vehicle tracking is a basic necessity for all fleet management systems, which are necessary to manage the transportation fleet of a company in an efficient way. Fleet management systems are designed to improve the quality and efficiency of transportation operations by detecting major hindrances on the road and offering real-time vehicle location tracking on a map. Most of the current vehicle tracking systems are GPS/GSM technology-based to calculate vehicle locations. GPS technology offers precise location and time information at any point on Earth, which is an easy and accessible method for data reception and transmission. However, instead of SMS-based communication, the proposed system uses a smartphone application to track and monitor vehicle locations.

III. HARDWARE DESCRIPTION

The components used in this project are:

- ARDUINO UNO
- GPS MODULE
- 16*2 LCD DISPLAY
- EPS8266

Live tracking projects are based on a set of hardware components that allow accurate and real-time positions of vehicles to be tracked. This project integrates a number of required modules, including the Arduino Uno, GPS, ESP8266 Wi-Fi, and LCD, to form an efficient and cost-effective tracking system. The Arduino Uno, based on the ATmega328P microcontroller, is the processing unit that is tasked with processing data received from sensors and communication modules. It has 14 digital I/O pins (6 PWM), 6 analog inputs, a 16 MHz quartz crystal, a USB port, a power jack, and an ICSP header, and is thus an ideal choice for IoT-based devices. The GPS module continuously receives signals transmitted by specialized satellites that transmit signals containing their position and time. Measuring the difference in transmitted times, the GPS receiver determines the correct latitude and longitude of the vehicle, providing tracking accuracy. The ESP8266 Wi-Fi module is a key component of instant data transmission through the provision of internet connection, enabling vehicle position data to be transmitted to an external server using HTTP requests. This cost-effective module is capable of supporting TCP/IP protocols and is massively used in IoT-based applications because of its wireless nature. The system also incorporates an LCD display, which was invented by RCA for the first time in 1971, for the display of real-time updates and representations of tracking information. LCDs function through the manipulation of polarized light through liquid crystals and are thus energy conserving and suitable for low-power applications. Twisted Nematic (TN) and Super Twisted Nematic (STN) displays are commonly used for their high contrast and excellent view angles. For smooth functionality, the system has a dependable power supply module, necessary circuit elements, and communication interfaces to allow the seamless integration of all the components. The integration of the hardware components allows real-time monitoring of the vehicle, increased efficiency in operations, and seamless visualization of data, thus making the system a superior solution to today's transport problems.

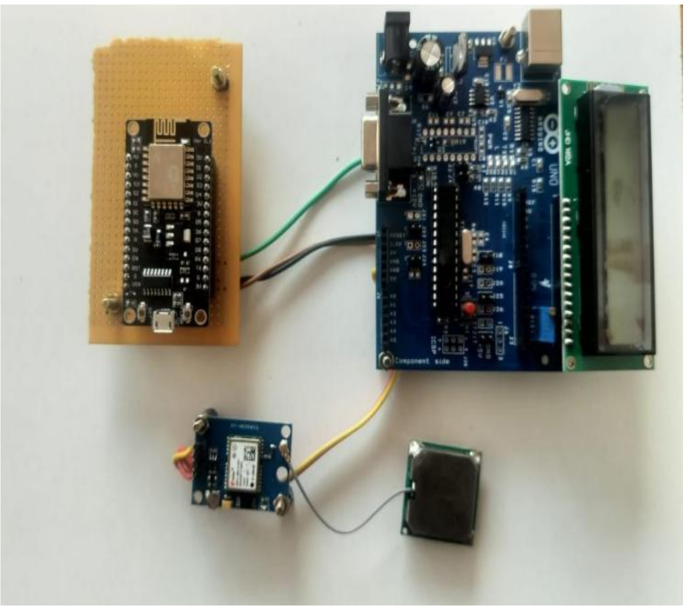

Fig.1. Hardware Setup

IV. SOFTWARE DESCRIPTION

The Software requirements are:

- ARDUINO IDE SOFTWARE
- EMBEDDED C LANGUAGE
- PHP

The software utilized in this live tracking project includes Arduino IDE, Embedded C, PHP, MySQL, HTML, and JavaScript for real-time vehicle tracking. Arduino IDE and Embedded C are utilized to program the microcontroller to read GPS data and communicate through the ESP8266 module. PHP and MySQL are used for backend operations and storing location information securely required to track in real-time. A web interface based on HTML and JavaScript utilizes Google Maps to provide real-time location information. The use of JavaScript and AJAX for real-time modification of data without page reload contributes to the increase in responsiveness in the system. The Google Maps API or OpenStreetMap provides a realistic presentation of vehicle motion to the end user. PHP can be used to provide security features like encryption and authentication that can protect users' information from misappropriation. The system has been designed to accommodate several vehicle tracking requests simultaneously, thus making the system scalable for mass applications. Cloud service integration has the potential to make data accessible and improve storage efficiency. The software has been coded to allow scalability, secure deployment, and easy access on multiple devices, thus providing an enhanced user experience across platforms.

V. BLOCKDIAGRAM

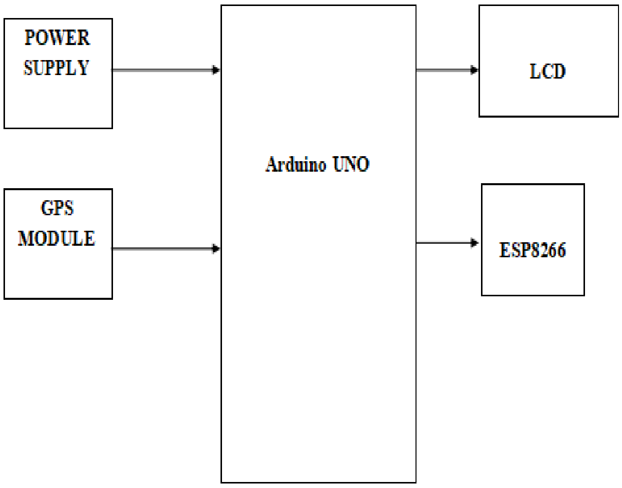

Fig.2. Block Diagram

VI. WORKING PRINCIPLE

The functionality of this IoT-based vehicle-tracking system depends on real-time location tracking using GPS, Arduino, and the ESP8266 Wi-Fi module. The GPS module continuously receives the latitude and longitude of the car, which are processed by the Arduino Uno microcontroller. The ESP8266 module supports the transfer of this location information to a distant server using HTTP requests, thus facilitating real-time communication. A PHP backend receives the data received and stores the same securely in a MySQL database for easy recovery and analysis. The web interface, created using HTML, JavaScript, and the Google Maps API, fetches and displays the car's real-time location on an interactive map. JavaScript and AJAX facilitate auto-refreshing updates without manual page refreshes, thereby making the system responsive and user-friendly. This system can track a number of cars at once, and thus it is highly suitable for fleet management, logistics, and personal automobile protection. Furthermore, the storing of historical information allows for analyzing past routes, thus maximizing traveling efficiency. The system is created to be cost-effective, scalable, and responsive to various transport requirements. The addition of real-time alerts is feasible for geofencing or unauthorized movement detection of the vehicle. The backend system is secured against unauthorized access to data, thereby ensuring data confidentiality and system integrity. Power supply management ensures a reliable supply of power with minimal or no downtime. The system is also scalable and incorporates functionalities such as speed detection, fuel consumption analysis, and driver behavior analysis to make the system even more efficient. IoT-based communication usage allows the vehicle and the server to experience seamless data transfer, leading to efficient tracking with minimal human intervention. Last but not least, the system is a sophisticated yet efficient solution for modern-day transportation requirements, defined by improved efficiency, security, and real-time tracking.

VII. RESULT

The IoT-based vehicle tracking system successfully achieves real-time location tracking through a web-based interface. The login page provides secure user authentication for tracking, and the system utilizes GPS, ESP8266, and PHP to get and show live coordinates of vehicles. As illustrated through the images, the real-time location of a vehicle is properly displayed on an interactive OpenStreetMap, thus making it simple to track. The system effectively refreshes the location information in real time through AJAX and JavaScript, thus reducing human intervention. In addition, the MySQL database stores a history of locations securely such that users can analyze past routes. The utilization of the Google Maps API or OpenStreetMap offers an easy interface for tracking. The system provides consistent transmission of data, and it is suitable for fleet management and logistics. In conclusion, the result proves to be an efficient and scalable tracking solution that improves transportation monitoring.

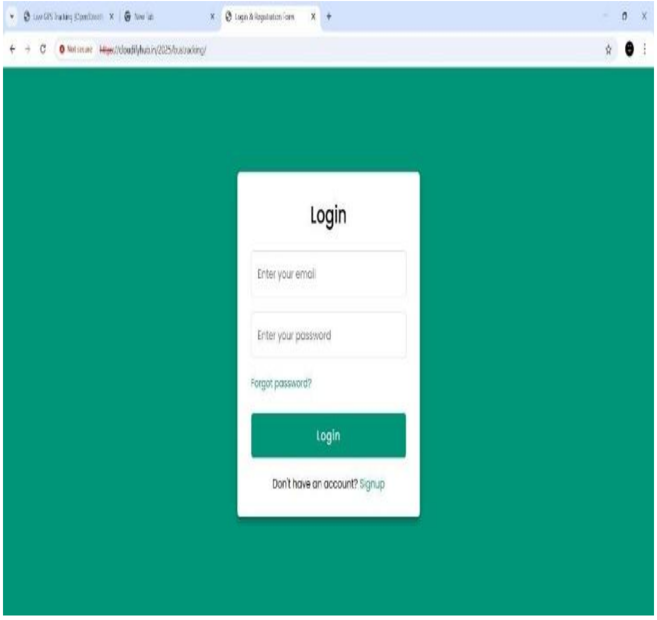

Fig. 3. Login Interface

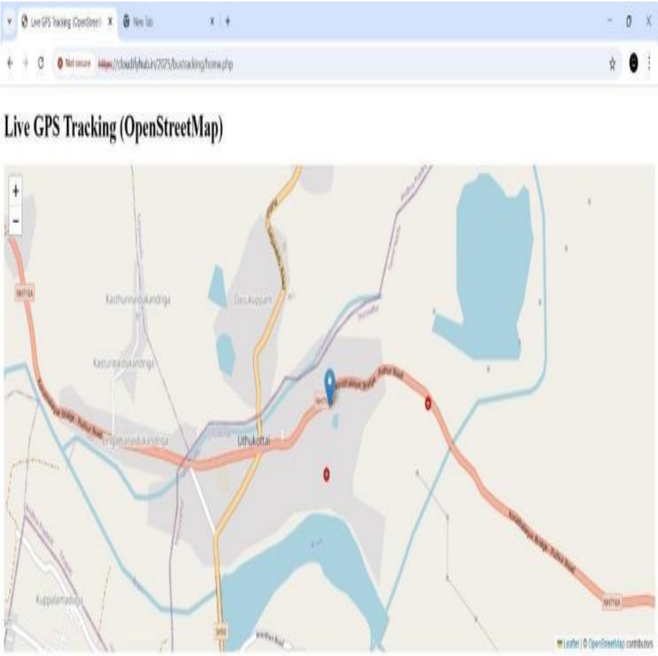

Fig.4. Live Tracking

CASE	GPS MODULE	WIFI MODULE	WEBSITE UPDATE
CASE 1: Normal Operation	Active	Active	Real-time data displayed accurately
CASE 2: GPS Module Failure	Inactive	Active	No location da; alert sent to the transport team
CASE 3 : Wifi Module Failure	Active	Inactive	No data transmission; system retries to reconnect
CASE 4: Bus Deviation from Route	Active	Active	Sends alert to the management team regarding route deviation
CASE 5: Data Transmission Error	Active	Active(with error)	System retries data transmission and logs errors for analysis

Fig .5. Analysis of the Result

VIII. CONCLUSION

In conclusion, the IoT-based vehicle tracking system is an efficient and effective solution for real-time tracking of vehicles. Its integration of advanced hardware, efficient backend processing, and user-friendly interface makes it a complete package for solving modern transportation challenges. The system improves security, minimizes operational expenses, and provides improved fleet management through accurate and real-time vehicle location information. With the use of the latest Internet of Things Technology (IoT), the system can be improved by incorporating optimization, geofences, and predictive analysis. In addition, the system can be associated with machine learning technology and artificial intelligence, which would allow the forecast of real -time traffic, thus encouraging driver behavior research and automatic notifications of illegal vehicle movement. Its scalability component makes the system functional across various industry sectors like logistics, public transport, and personal vehicle tracking. With its benefits and its ability to be further enhanced, the system can change the game for vehicle tracking and management with more efficient, secure, and reliable transport.

IX. FUTURE ENHANCEMENT

The Internet of Things (IoT)-based vehicle tracking system, while already efficient and robust, has huge potential for improvement. One of them is the inclusion of predictive analytics and machine learning algorithms. Through the analysis of historical location data, the system can predict traffic patterns, route optimization, and offer real-time suggestions to drivers. This improvement would not only improve the efficiency of the system but also conserve fuel and decrease delivery time. Besides this, machine learning can also be utilized to identify anomalies in vehicle behavior, e.g., sudden braking or straying from programmed routes, which can indicate problems such as theft or accidents. The other major addition is the inclusion of geofencing features. Geofencing allows users to set virtual boundaries on a map, thus allowing the system to alert users when a vehicle enters those boundaries. Geofencing technology is most effective in fleet vehicle management since it makes possible the potential of obtaining more control over vehicle movement and compliance with set routes. Geofencing also enhances security because it offers real-time notifications in case of unauthorized vehicle use or theft. The system can further be extended to monitor environmental factors and vehicle health. With the addition of auxiliary sensors, like temperature sensors, fuel level sensors, and engine diagnostics, the system can offer comprehensive information regarding the condition of the vehicle. This information is crucial for efficient vehicle maintenance scheduling, breakdown avoidance, and vehicle performance optimization. In addition, environmental sensors will be able to track parameters like weather and air quality, which will enable more efficient decision-making for transportation and logistics operations. Finally, developing a mobile application would make the system more convenient and accessible. A mobile application would enable users to monitor vehicles, receive notifications, and access reports via mobile phones. Additionally, the app would have voice guidance for navigation, real-time traffic information, and integration with other Internet of Things (IoT) devices. With a mobile-based approach, the system would offer convenience and usability to a broader population, thus enabling adoption and impact.

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