Tracking And Monitoring System For Students In Elementary and Secondary Schools Using IoT

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Abstract.

Every school should provide a safe, dependable transportation service for pupils. It helps schools manage their bus fleet and reduce mistakes. This is when vehicle tracking kicks in. The proposed system offers real-time information regarding the vehicle's numerous properties, such as location, temperature, obstacle detection, alcohol detection, and so on. The device also allows parents is being notified when their children board or disembark from the bus. We use RFID and GPS technologies in this system, and we use a microcontroller to connect it to a remote server. GPS determines the vehicle's location. An RFID scanner reads each student's RFID tag as they board or leave the vehicle. ESP8266 uploads database data to a web server. Parents and school administrators may use a smartphone app to monitor their children. The software alerts the administration about crises.

Keywords. IoT Bus monitoring, Global Positioning system, Sensors, RFID

1. INTRODUCTION

Parents' concerns over their children's safety on the route to and from school have never gone away. Students regularly get on the incorrect busses and exit at the erroneous stations due to their lack of attention. Bus drivers may not always be able to identify all of the children, and they will not be aware of any missing students in a timely manner if they are unable to do so. The parents will not have a reliable means of determining whether or not their children are secure until the school bus returns in the evening. Number of schools using GPS bus monitoring system, this does not mean that these schools are able to ensure students' entire safety [1]. It is not uncommon for some of these gadgets to fail to provide data in a timely manner, while others are prohibitively pricey. A technique of monitoring that does not recognize particular pupils may potentially cause parents and guardians to become complacent [2]. Comprehensive monitoring technology for school buses that keeps tabs on their location, speed, number of people on board, adherence to routes and schedules, and any other data that is relevant to school transportation. Students are able to spend more time participating in activities thanks to the real-time bus monitoring system, rather than waiting for a bus that is running late, and the warning system assures that each student's individual safety. Furthermore, educational bodies such as the CBSE have begun to advocate for the use of school bus monitoring systems, making a cost-effective and dependable solution a must[3]. The microcontroller is used to receive the geographic coordinates from the GPS module and then transmit them to a database that is stored on a distant server via Wi-Fi. This allows the bus to be followed.

Parents, bus drivers, and school administrators may access this information using a smartphone application that shows the database's position on a map. Alerts are sent to caregivers when the RFID tag with their child's id is scanned by the reader. This triggers the arduino to run a client application, which then notifies the carregiver's phone through text message and push notification. Because of this, both the bus and the children who are travelling on it will be under constant surveillance during the voyage [4]. This system encompasses a moderate price school bus display that monitors a variety of variables, including the location, speed, number of students on board, adherence to the route and schedule, and other info that is required by the institution as well as the parents. The notification system aids in ensuring individual ward safety as well as reducing time wastage while students wait for delayed buses. This system uses real-time observation to enable students self-address their concerns. Furthermore, educational boards such as the CBSE have begun to advocate for the installation of university bus observation systems[5]. The GPS module searches for the bus's geographical coordinates, which are then transferred to a distant server via Wi-Fi. This data is then available by parents, bus drivers, and school administrators via a database that may be accessed via a mobile application. A system that equips each school bus with sensors that collect data on the bus's status and transmit it in real time to a server via the telecommunications infrastructure. This data on each bus is then examined, and reports are made for both the school and the Ministry of Education on a variety of topics such as the environment, time, and safety. The method of monitoring the condition of a school bus is known as a school bus monitoring system.

This paper focuses on the usage of an IoT-based system to monitor students on school buses. Parents and guardians will be able to keep an eye on their children at all times because to the invention's emphasis on providing a system that can be used at home or at work. The paper is organised as follows. Part II contains related works. Section III outlines the approach. Section IV presents the experimental data, and Section V wraps up.

2. RELATED WORKS

There are numerous bus monitoring systems are developed by researchers. The bus's location is tracked by the tracking technology and displayed on Google Maps. Those using uniform bar phones may access the site even without internet [6]. In [7], parents were advised to use SMS to follow their children in real time. A GPS module and RFID card are used to monitor the child's location and movements. The tracking of buses' position, speed, list of people on board, and route, together with continually altering this data in a chart using the Google Maps API, helps management, parents, and drivers monitor the school bus and the students on board. When students board or exit the bus, the system will recognize them and send notifications to their close relatives' phones with the event's time and location [8]. In [9], Prototype campus bus tracking system constructed and deployed for UiTM students utilising their smartphone application to locate and estimate the arrival time of the bus they have selected. The GPS-enabled mode of conveyance. By configuring the Arduino UNO to send commands to the Wi-Fi component for setup, connecting to the router, and obtaining an IP address, the tracing system remains operational. The Arduino begins the process of preparing GPS for the purpose of obtaining coordinates. Creating school bus monitoring system that can provide useful services using upcoming technologies such as the Internet of Things (Iota). In addition to tracking, an arrival prediction system is included. Parents may use an Android application to track the bus route and predict when the bus will arrive [10].

There are two primary bus tracking systems on the market now, both based on the existing technique. Geo-coordinates are returned in response to a query. Text messaging is used, which effectively spams the inbox. There is no real-time data available. WIFI-enabled Raspberry Pi systems. These are costly, while being efficient and real-time. Parents do not have consent to track pupils, and none of these have student identity in the database. No database is kept up to date. In this paper, the above mentioned drawbacks are taken into considerations.

3. PROPOSED METHOD

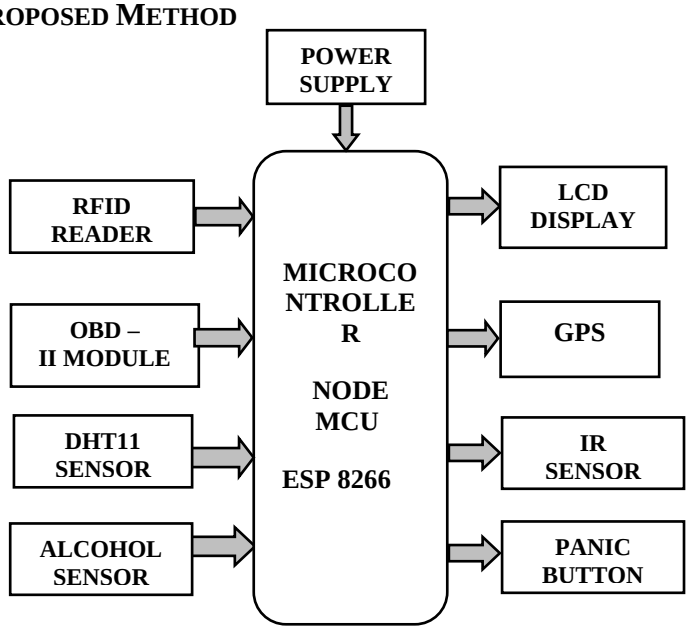

Figure 3.1. Proposed System

The block diagram of the proposed system is presented in Figure 3.1. Node MCU, RFID Reader, OBD II Module, DHT11 Sensor, Alcohol Sensor, Humidity Sensor, GPS, IR Sensor, LCD Display are all part of the proposed system. The temperature of the car is monitored using a DHT11 sensor. When this system detects excessive heat, it will alert the driver through an LCD display to come to a complete stop. The Alcohol Sensor detects whether or not the motorist is inebriated. Humidity sensor that measures the moisture content of the air within the school bus where it is installed. When an illegal person tries to open the vehicle door, the IR sensors sense it and alerts the school administration. The OBD-II module gathers data from the vehicle's network of sensors, which the system can utilize to manage auto systems or notify the driver to problems. RFID (Radio Frequency Identification Module) is a technology that allows pupils to be identified when the school bus door is opened. If there is an emergency on the school bus, the buzzer will go off, and the panic button will be hit. The main advantages of this systems are easy operation, simple and reliable design and more efficiency in real time monitoring.

3.1 Arduino Uno

Arduino UNO uses the Microchip ATmega328P CPU (Figure 3.2). The board's input and output (I/O) pins let it connect to shields and circuits. Programming the board's 14 digital and 6 analogue pins requires the Arduino IDE and a USB type B connection. This may be powered by USB or a 9-volt battery and handles 7 to 20 volts.There are ATMEGA328P microcontrollers used in this project. As input is received, it regulates the whole system and sends out output in accordance therewith.

Figure 3.2. Arduino Uno

3.2 RFID Reader

The RID reader is given in Figure 3.3. student's unique ID number is read from their ID card using an MFRC522 RFID reader. Each student's ID card has an RFID tag placed in it. As students enter and depart the car, an RFID reader detects their individual identification numbers.

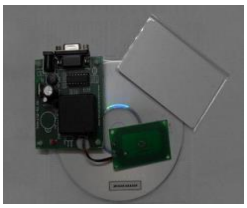

Figure 3.3.RFID Reader

3.3 Temperature Sensor – DHT-11

The DHT11 is shown in Figure 3.4. It is a low-cost, entry-level digital thermometer/humidity sensor combo. It uses a thermistor and a capacitive humidity sensor to gauge the temperature and humidity of the surrounding air, and then generates a digital signal pin. To use, it's a breeze, but timing is everything. This temperature sensor measures the vehicle's interior temperature. The system sounds a warning if the temperature rises over the usual threshold. In this project it is used to monitor the condition of th bus.

Figure 3.4. Temperature Sensor

3.4 Humidity Sensor

Humidity refers to the amount of water in the atmosphere. Numerous industrial production processes and human comfort are both affected by the quantity of water vapour present in the air.In industries, humidity measurement is crucial because it can effect the product's commercial cost as well as the workers' health and safety. As a result, humidity detection is critical, particularly in industrial control systems and human comfort. Humidity control and monitoring are critical in a variety of industrial and home applications. Relative Humidity, Dew/Frost Point, and Parts Per Million are the most regularly utilied humidity measuring measures (PPM). Humidity sensor (Figure 3.5) is used to detect the atmosphere humidity. It measures the moisture of air in surrounding inside school bus.

Figure 3.5. Humidity Sensor

3.5 Alcohol Sensor

The alcohol sensor is given in Figure 3.6. This module was built using the MQ3 Alcohol Gas Sensor. A $1 semiconductor sensor can detect alcohol gas concentrations from 0.05 to 10 mg/L. SnO2, the sensing material, has a lower conductivity in pure air than Sn. The higher the concentration of alcohol gases, the more conductivity they have. It's susceptible to alcohol yet resists smoke, vapour, and gasoline. Module outputs are digital and analogue. MQ3 alcohol sensors may be communicated with microcontrollers, Arduino boards, Raspberry Pi, and other devices. This avoids an accident by detecting whether the driver has been drinking.

Figure 3.6. Alcohol Sensor

3.6 OBD-II

Fiure 3.7. OBD-II

It is an automobile electronic system that enables repair workers to analyse and report on their cars using on-board diagnostics (OBD), and it is given in Figure 3.7.When it comes to the fuel monitor, engine temperature, emission requirements, and so on, this gadget is critical. The OBD-II module gathers data from the vehicle's network of sensors, which the system can utilize to manage auto systems or notify the driver to problems.

3.7 IR Sensor

An IR sensor is one among the most fundamental and extensively utilised sensor modules in an electrical device. It is given in Fiure 3.8. There are several real-time uses for this sensor that mimic a human's visionary senses, including identifying boundaries. This circuit consists of the following components: IR transmitter and receiver pair LM358 IC Two kilo ohm resistors are needed. The resistance of a circuit may be altered by using a variable resistor. LED (Light Emitting Dio (Light Emitting Diode). The school administration gets alerted when an unauthorised individual attempts to access the car door using the IR sensor.

Figure 3.8. IR Sensor

3.8 Panic Button

A panic alarm is an electrical device that alerts people or property to danger in an emergency. Usually, a panic alarm is activated by a secret button. These buttons may be linked to a monitoring centre or a local bell/siren. The alarm may call security, police, or emergency services.

3.9 NODEMCU

The WiFi equivalent of an ethernet module is the NodeMCU, it is given in Figure 3.9. It combines WiFi access point, station, and microcontroller functionality. These properties make NodeMCU a powerful WiFi networking tool. It may work as an access point, station, web server, and internet connection to download or upload data. ESP8266 uploads database data to web servers.

Figure 3.9. NODEMCU

4. EXPERIMENTAL RESULTS

In Figure 4.1, Node MCU acts as the master collects all data and sends to the database through WiFi provided by the school management.MQ3 senses the ethanol level of the driver and permit him to drive the vehicle. When bus is close to the Student's pickup location our system sends notification to the Parents. After scanning RFID concern student is noted as present, then allow to get inside the bus with alert from buzzer for driver.

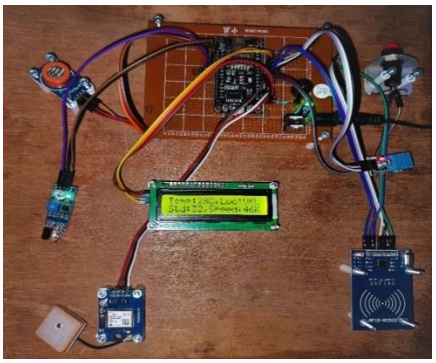

Figure 4.1. Hardware Kit

In the database, the whole voyage will be recorded. The temperature and humidity within the bus are monitored by a DHT11 Sensor, while security is provided by an IR Sensor. Speed, temperature, and brake failure may all be monitored via the OBD-II module. Using the Panic Switch in the event of an emergency alerts the school administration, parents, and the relevant government authorities with the mapping location.

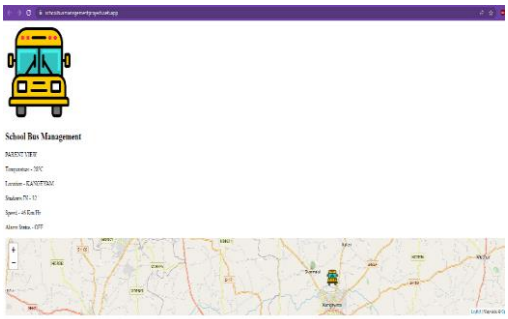

Figure 4.2.Simulated Output

Simulated Output is shown in Figure 4.2. As the result our project works well in all aspects. From the beginning of the Student's journey RFID identifies the students, GPS gives accurate Geo-location of the bus, DHT-11 gives humidity and temperature of the bus, IR ensures the safety, MQ-3 tests the alcohol level, OBD-II gives engine status. These data's are processed by Node MCU and Google Firebase acts as the database through MQTT protocol.

5. CONCLUSION

Improved safety for children on their way to and from school is the objective of this paper. Children who do not board or disembark the bus are flagged by the system's technology and parents are notified. The data will also be forwarded to management. It allows parents to monitor their children while also allowing school administration to maintain tabs on them. The Smart School Bus Management System for Live Location has been proposed and analyzed in this research. The main focus of the proposed study was on a Smart Security and Tracking System for Students. The simulation and prototype findings were thoroughly discussed. The proposed system could benefit both school administration and parents by allowing them to track students in real time using GPS and monitor them using RF and DTH11 sensors.

6. REFERENCES

[1] N. Jahan, K. Hossen, M. K. H. Patwary, 'Implementation of a vehicle tracking system using smartphone and SMS service', Proceedings of the 2017 4th International Conference on Advances in Electrical Engineering (ICAEE), pp. 607-612, 2017.

[2] S. Shah, B. Singh, 'RFID based school bus tracking and security system',Proceedings of the 2016 International Conference on Communication and Signal Processing, pp. 1481-1485, April 2016.

[3] J. T Raj, J. Sankar, 'IoT based smart school bus monitoring and notification system', Proceedings of the 2017 IEEE Region 10 Humanitarian Technology Conference, pp. 89-92, December 2017.

[4] M. T. Kamisan, A. Aziz, W. R. W Ahmad, N. Khairudin, 'UiTM campus bus tracking system using Arduino based and smartphone application', Proceedings of the 2017 IEEE 15th Student Conference on Research and Development (SCOReD), pp. 137-141, December 2017.

[5] R. Jisha, C. AiswaryaJyothindranath, L. SajithaKumary, 'Iot based school bus tracking and arrival time prediction', international conference on advances in computing, communications and informatics (ICACCI), 2017.

[6] R.Jisha, Aiswarya Jyothindranath, L. SajithaKumary, 'Iot based school bus tracking and arrival time prediction', international conference on advances in computing, communications and informatics (ICACCI), 2017.

[7] Wongthai et al., 'The development of an internet of things mobile application for tracking an electric bus in a campus', Joint International Conference on Digital Arts, Media and Technology with ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering (ECTI DAMT-NCON), 2019.

[8] D. Errico et al., 'Design and implementation of a children safety system based on IoT technologies', 2nd International Multidisciplinary Conference on Computer and Energy Science (SpliTech), 2017.

[9] Ahmed et al., 'An intelligent and secured tracking system for monitoring school bus', International Conference on Computer Communication and Informatics (ICCCI), 2019.

[10] Kumari, Mona, Ajitesh Kumar, Arbaz Khan, 'IoT based intelligent real-time system for bus tracking and monitoring', International Conference on Power Electronics &IoT Applications in Renewable Energy and its Control (PARC), 2020.