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AN EFFECTIVE ANDROID-BASED BUS LIVE TRACKING SYSTEM USING ARDUINO

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ABSTRACT

This work presents a smart Android mobile application for the College Bus Tracking System. Students can use this to locate the bus's position so that they don't run late or show up at the stop too early. This application's primary goal is to pinpoint the precise position of each student's bus and to give other useful information, such as bus specifications. As Android smartphones are now widely available and reasonably priced, college students may utilize this application on a large scale. It is a real-time system since the pupils receive the most up-to-date information on the bus's location every 30 seconds in the form of latitude and longitude that are linked to Google Maps to provide an exact location. Due to inadequate emergency facilities, road accidents regularly result in significant loss of life and property and have exacerbated traffic dangers and other safety risks. In this work, we created an accident sensor that automatically detects an accident and notifies the closest emergency services. The abrupt shift in the bus's axis is detected by the accelerometer. With this technology, the accident's location may be determined, allowing medical assistance to be delivered there right away. The system includes WIFI and GPS modules for information transmission. The accident's location is shown within the kind of Google Map link, which was created using the GPS module's latitude and longitude. Upon the confirmation of the situation, the essential steps will be done. Bus brake failure is discovered via an Infrared sensor. Photodiode for spotting fire mishaps. This will help to expedite the rescue effort and preserve priceless human life. The number of pupils boarding and disembarking the bus is also provided.

Keywords: GPS, Tracking system, WIFI module, Accelerometer, Photodiode, IR sensor.

I. INTRODUCTION

Mobile phones are needed to communicate efficiently and instantaneously is always an undying necessity. Mobile phones are now equipped with navigation systems such as GPS (Global Positioning System) that get the most accurate view of their present location. It acts as both transmitter as well as the receiver. Some people can be saved at that time, but because of a lack of information, time, and place it may not be possible. Our project will provide an optimum solution to that drawback. when a bus met with an accident immediately the details of the bus and passengers were sent to authorities for further help. The IR sensor that we are using in this project is an active IR sensor. Whenever it detects an object inside its range the output is generated. When a fire breaks out, time is of the essence. Prompt measures need to be taken to evacuate the trapped people and contain the fire before it spreads out of hand. However, to accomplish this we need a system that can detect fires before it is too late. Hence fire sensor is going to use to detect fire in the bus and hence can save the bus and its passengers in it by appropriate actions. Speed is one of the foremost important and basic risk factors in driving. It not only affects the severity of a crash but also increases the risk of being involved in an exceedingly crash in which the brake may fail which can cause huge impacts. So, a brake sensor is used for brake failure detection. The student’s count is also detected and all this information

can send to the mobile application from the Arduino kit using the cloud. The above-mentioned information may help students, teachers, and college management to ensure safety and saves their time during the journey.

OBJECTIVE

The main objective is to ensure the college management and students' safety while travelling in the bus. The most up-to-date information about the bus in form of location can be received by students and the college. Emergencies like accidents, fire, and brake failure can be detected and sent data to the app so that we can take appropriate actions respectively.

II. LITERATURE SURVEY

[1] Noor Mohammed, Android Studio was used to design and create a real-time bus tracking system. With this project, we aim to save students' time, especially those who rely on the college transportation service, and we also hope to assist them in overcoming difficult and stressful mornings. This application requires only a smartphone, which is available to all students. It delivers real-time data that allows users to track the buses.

[2] T Kalyani, because the usage of vehicles is increasing drastically, the hazards to vehicles are additionally increased. the better cause for accidents is a high speed, drunk and driving, distracting minds, overstress, and electronic appliances. If the person is not in a position to regulate the vehicle, then the accident occurs. Once the accident shows to the vehicle this system will send an instruction to the registered mobile number.

[3] S Mutharasu, Arduino Based Vehicle Accident Alert System using GPS, GSM, and Accelerometer. Propel technology has made our day-to-day lives easier.Since every coin has two sides similarly technology has its benefits similarly it has its disadvantages. The increase in technology has increased the speed of road accidents which causes huge loss of life. The poor emergency facilities available in our country just increase this problem. Our project goes to produce an answer to the present problem.

[4] Ben Asante, The fire alarm system is simple in design but has a wide range of applications in automobile and industrial safety. It is a low-cost system with dependable performance that is simple to install. According to the test results, the intended vehicle fire outbreak notification system satisfies the design goal. The technology can be simply placed in vehicles to help safeguard personal safety from fire dangers by lowering the threshold temperature.

EXISTING SYSTEM

In the existing system, a GPS tracker is used, which helps in tracking the bus. GSM will send the information of GPS to the freeboard application which is an HTML platform application for viewing the data of the module using Thingspeak which is the cloud server that maintains the information of the bus location and sends it to the application. It shows only the location where the bus is, which helps in reducing the waiting time for the bus.

Disadvantages:

1. In the existing system, we do not have any fire, IR sensors, etc, which can provide safety.
2. Location is not accurate & not much consistent also.
3. It produces the output with some delay.

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III. PROPOSED SYSTEM

The proposed system presents a mobile application called TRACK. This module depicts the process of selecting a bus and shows the current location of the bus along with latitude and longitude values in its corresponding route. GPS Neo-6m is used to track the bus route and bus location sent to the mobile application through the WIFI module connected with an internet connection. If any fire accident occurs in the bus, an alert message will be sent to the mobile application. Accelerometer is used for accident detection where it detects the changes in the acceleration of the bus, and a notification is sent to the mobile application. When the bus's brake fails, the long-range infrared sensor immediately detects the brake failure and sends a notification to the mobile application from Arduino through the cloud via wi-fi. It also updates the count of the students when they boarded and exited the bus.

Features of the proposed system:

1. Live tracking:

- We can track the bus in real-time using our smartphones through a customized app.
- This helps us to relieve tension where the bus is, while also reducing waiting time at the bus stop.

2. Brake Failure Notification:

- When the bus's brake unexpectedly fails, we will be notified that the bus is in a brake failure condition.
- Here we use a long-range infrared distance sensor, which continuously measures the distance between the brake and the wheel.

3. Fire Alert:

- When a fire breaks out on a bus, the fire sensor detects the fire, makes a buzzer, and notifies the user.
- A buzzer can notify all passengers on the bus.
- Notification can be sent to the app and 102 for an immediate response to extinguish the fire.

4. Accident Alert:

- Nowadays there's a rapid increase in the occurrence of road accidents.
- Accelerometer notices the sudden variation within the axles of the bus and the GSM module sends the active message on the app with the situation of the accident.
- Accelerometer is a sensing device that measures the moving object's acceleration.

5. LCD Display:

- Using a 16x2 LCD, we display the location of the bus.
- It can also display the student count, which was measured using an IR sensor.

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Block Diagram

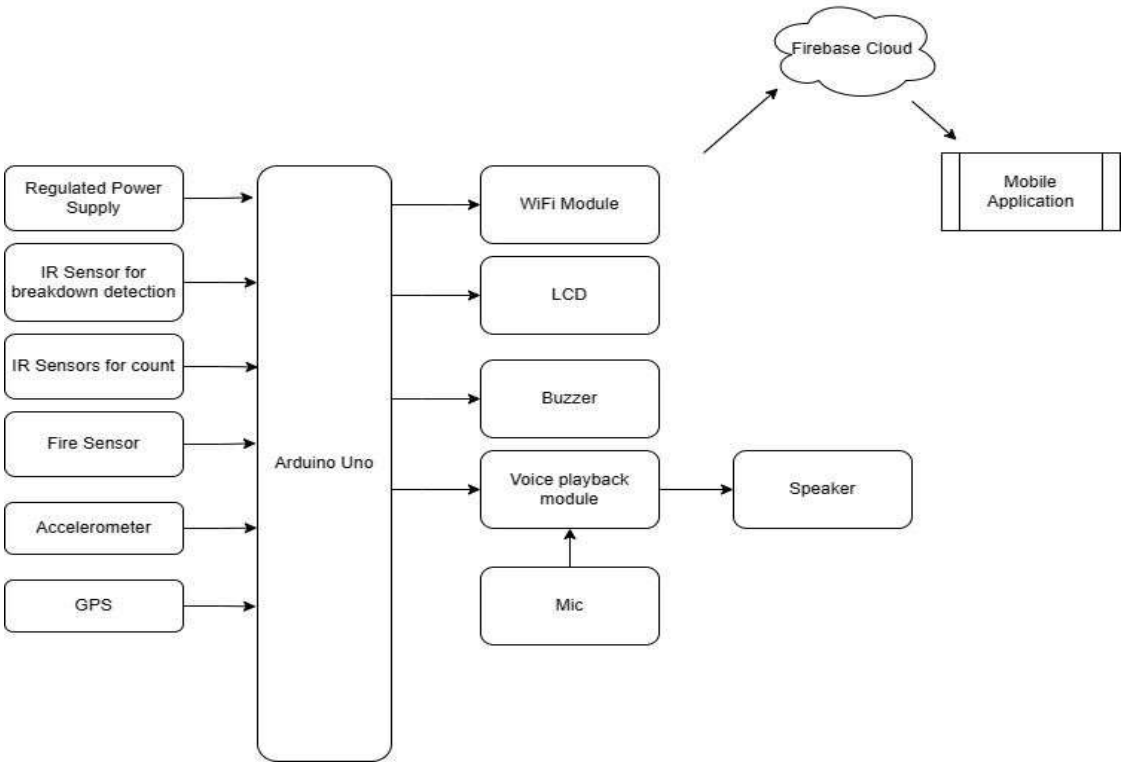

Figure 1: Block diagram of Proposed System

The Arduino board will be powered by a surplus of 5v regulated electricity. The GPS, the WIFI shield, IR sensors, accelerometer sensor, fire sensor, impact sensor and LCD, buzzer, the speaker will derive power from the Arduino board itself. The circuit is first initialized and the GPS and WIFI module is turned on. The system holds till the WIFI module acquires a network and is registered with the network. The system continuously sent the tracking information to the cloud. The system sends a notification when the impact sensor or fire sensor or breakdown sensor gives a positive output. Information retrieved from the cloud is shown via the mobile application. If the GPS is turned on, the position will be continuously shown. The number of pupils may also be shown, and an alert can be sent to an app or LCD when an incident occurs on the bus.

Flow Chart of Live Tracking

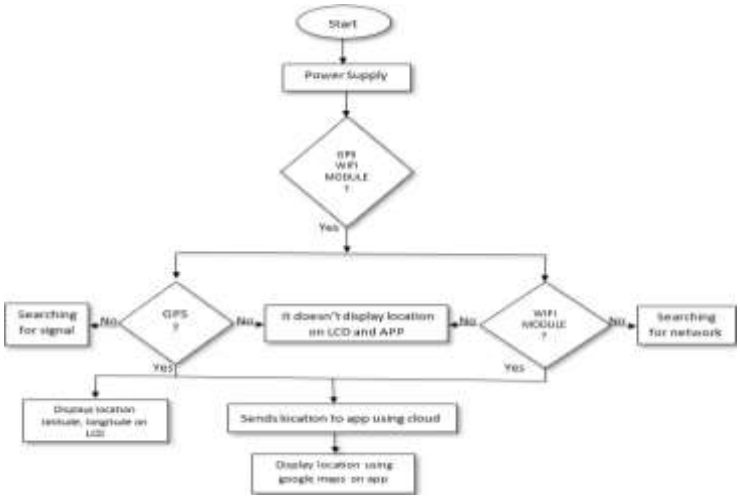

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Figure 2: Flow Chart of Live Tracking

The flowchart of the GPS location tracking is shown in the above figure. When the power supply is given to the board, it checks if the GPS and Wi-Fi modules are on. If GPS is on, it displays the location as latitude and longitude values on the LCD. If both are on, the location is sent to the app using the cloud, and from the cloud information, the location is displayed using Google Maps along with the latitude and longitude values on the app. If GPS is on but there is no signal, it searches until it finds one. If both are off or searching for a signal, it doesn't display the location on the LCD as well as on the mobile application.

Flow Chart of Fire Detection

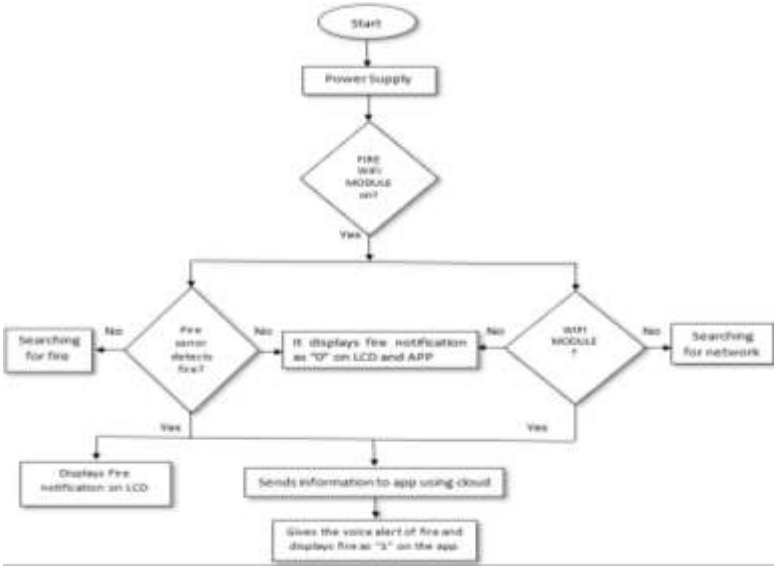

Figure 3: Flow Chart of Fire Detection

The flowchart of the Fire detection is shown in the above figure. When the power supply is given to the board, it checks if the fire sensor and Wi-Fi module are on. If the fire sensor is on, it continuously tries to detect the fire. If it detects any fire on the bus it makes a buzzer sound and displays the fire value as "1" on the LCD. If both are on, the data is sent to the app using the cloud and notified with a voice alert and fire value as "1" on the app. As well, if WIFI is on but there is no network, it searches until it finds the one it was already registered, and if it finds the one with a registered username and password it connects with the network. If both are off or searching for a signal, it displays fire as "0" on the LCD as well as on the mobile application.

Flow Chart of Accident Detection

The flowchart of the Accident detection is shown in the figure below. When the power supply is given to the board, it checks if the accelerometer sensor and Wi-Fi module are on. If the accelerometer is on, it continuously detects the acceleration of the bus. If it detects any collision of the bus it makes a buzzer sound and displays the accident value as "1" on the LCD. If both are on, the data is sent to the app using the cloud, notifies with a voice alert, and displays the accident value as "1" on the app. If the accelerometer is on but there is no collision detected, it continuously collects data on the acceleration of the bus. As well, if WIFI is on but there is no network, it searches until it finds the one it was already registered, and if it finds the one with a registered username and password it connects with the network. If both are off, it displays the accident as "0" on the LCD as well as on the mobile application.

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Figure 4: Flow chart of Accident Detection

Flow Chart of Brake failure Detection

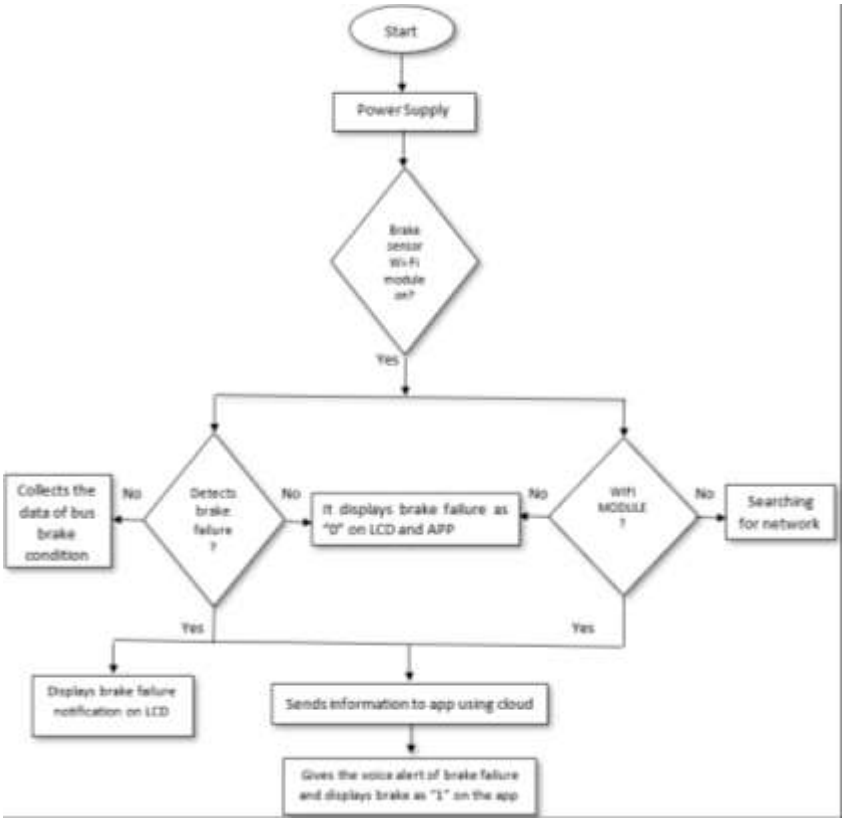

Figure 5: Flow chart of Brake failure detection

The flowchart of the brake failure detection is shown in the figure above. When the power supply is given to the board, it checks if the brake sensor and Wi-Fi module are on. As long as the brake sensor is on, it continuously collects data on the bus's brake condition. If it detects the brake is failed, it makes a buzzer sound and displays the brake failure value as "1" on the LCD. If both are on, the data is sent to the app using the cloud, and notified with a voice alert and displays brake failure value as "1" on the app. If the sensor is on but there is no failure detected, it continuously collects the data on the bus brake's condition. As well, if WIFI

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is on but there is no network, it searches until it finds the one it was already registered, and if it finds the one with a registered username and password it connects with the network. If both are off, it displays brake failure as "0" on the LCD as well as on the mobile application.

Flow Chart of Count Detection

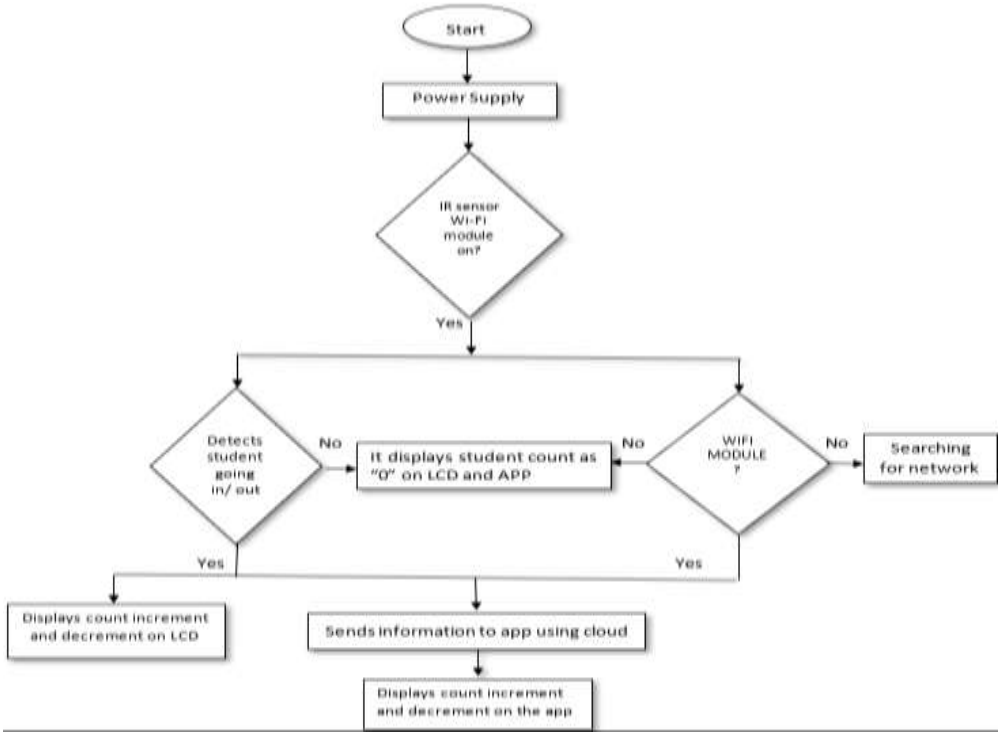

Figure 6: Flow Chart of Count detection

The flowchart of the count detection is shown in the figure above. When the power supply is given to the board, it checks if the IR sensor and Wi-Fi module are on. As long as the IR sensor is on, it continuously collects the data of student count. It increments the count if the student goes onto the bus and decrements the count if the student goes out of the bus on the LCD. If both are on, the data is sent to the app using the cloud and displays the count of students on the app. If the sensor is on but the student has not detected it shows "0" as a count. As well, if WIFI is on but there is no network, it searches until it finds the one it was already registered, and if it finds the one with a registered username and password it connects with the network. If both are off, it displays the count as "0" on the LCD as well as on the mobile application.

IV. RESULT ANALYSIS

Hardware module with components connected:

Figure 7: Hardware Module

As we can see, the Arduino Uno is equipped with two IR sensors to transmit data to the app and an LCD

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to show the number of pupils on the bus. The Arduino Uno and LCD are connected through a photoelectric sensor, which shows if the bus's brakes are functioning or not. The LCD and Arduino Uno are connected through a flame sensor, which displays a fire alarm. To show the bus accident data, an accelerometer sensor is linked to the Arduino Uno and LCD. When a fire, accident, or brake failure happens, a buzzer will ring to alert anyone around so they can provide the necessary assistance. To provide us with an audio message of location, an Arduino Uno and a GPS module are connected through a speaker module.

Live Tracking Notification

The GPS is used for live tracking of the bus. GPS tracks the location and sends data to Arduino Uno, from Arduino Uno via a wi-fi module the location information is sent to the mobile application. The latitude and longitude values of bus's location can be sent to LCD from Arduino Uno to display the latitude and longitude values.

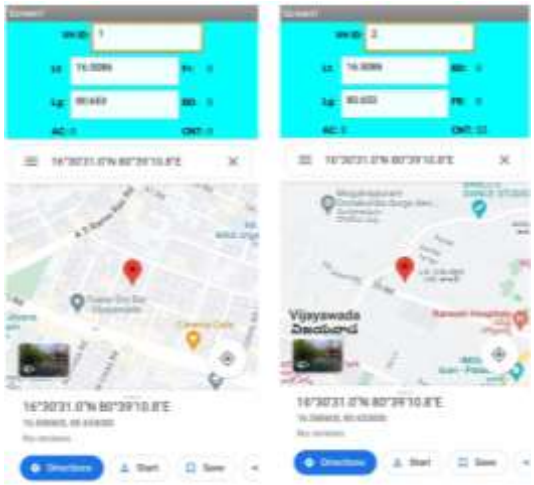

Figure 8: Live Tracking Notification

Here, figure 8 shows the live tracking of two buses via the GPS module in the mobile application. We can track the buses' location and in the app we can choose the bus we want to see the location. Thus, the exact location along with latitude and longitude values can be shown in the mobile application.

Brake Failure Notification

The factors that can cause brakes to fade or fail include not regularly checking brakes for signs of wear or damage. Using brake parts past their expiration date. Damaged brake pads from overuse and overheating water, oil, grease, dirt, dust, and debris in the braking system. So we continuously monitor the braking system every time during the operation of the vehicle using a long-range IR sensor. Sharp long-range infrared distance sensor makes continuous distance readings and outputs an analog voltage proportional to a target's range. When the brakes fail, an audible buzzer sounds, the LCDs "sending alert information," and a notification to the application in the voice format "Bus No. is breakdown due to brake failure" is sent. This will provide information to students on the bus as well as college administration, allowing them to take immediate action, and students will be able to board to transfer to other buses.

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Figure 9: Brake Failure Notification

Here, figure 9 shows the brake failure condition on the kit. The sensor sends information to Arduino, and from Arduino, the information is sent to the application via the WIFI module. From the cloud, the information is collected, and the brake failure condition is shown on the mobile application.

Fire Alert Notification

Bus fires are becoming more frequent, and while they remain relatively rare, their consequences can be severe, both on the human and financial aspects. Electrical failures, friction at the wheel level, and engine component failures are the three main groups of factors that contribute to bus fires. If any of these leads to occur fire accident on the bus, it immediately makes a buzzer sound, displays a "sending alert" on the LCD, and sends a notification to the application in the voice format "Bus No. is on Fire." This will inform students on the bus as well as college administration, allowing them to take appropriate action, and students to be boarded can go through other buses.

Figure 10: Fire Alert Notification

Here, figure 10 shows the fire is detected by the kit's fire sensor after the fire is detected by the fire sensor. The sensor sends information to Arduino, and from Arduino, the information is sent to the application via the WIFI module. From the cloud, the information is collected, and the fire alert is shown on the mobile application.

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Accident Notification

Some people might not be able to be saved at the time of the accident due to the conditions, location, and lack of information. Using an accelerometer, unsafe driving may be detected. The severity of an accident can be assessed using acceleration measurements. When any accident occurs to the bus, it immediately makes a buzzer sound, displays a "sending alert" on the LCD, and sends a notification to the application in the voice format "Bus No. is on Fire." This will provide information for students on the bus as well as to college management, which will immediately take appropriate action and direct students to board other buses.

Figure 11: Accident Notification

Here, figure 11 shows the kit's acceleration being detected by the kit's accelerometer sensor (with a maximum of 180 degrees tilt). The sensor sends information to Arduino, and from Arduino, the information is sent to the application via the WIFI module. From the cloud, the information is collected, and the accident alert notification on the mobile application is shown.

Count Notification

This counts the number of obstacles that pass in front of the IR sensor in one direction only. Hence, we use two sensors: one outside the door and one inside the bus. The count is zero initially and then incremented by one whenever something passes in front of it. You can also adjust the range of the sensor by rotating the inbuilt trim pot. The value of the total counts or the count number is displayed on a 16×2 LCD module. The module has an emitter which is an IR LED and a detector which is an IR photodiode. The IR sensor that we are using in this work is an active IR sensor. Whenever it detects a person inside its range the output generated by it is high otherwise the output is low. For the count of students on the bus, we used two IR sensors to detect students going in and out of the bus. One IR sensor is placed in front of the bus's door to count the number of students who boarded, and another IR sensor is placed on the inside of the bus near the door to count the number of students who exited.

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Here, figure 12 shows the count being detected by the kit's IR sensor. The sensor sends information to Arduino, and from Arduino, the information is sent to the application via the WIFI module. From the cloud, the information is collected, and the count of students is shown on the mobile application.

Figure 12: Count Notification

ADVANTAGES

1. Easy Operation
2. Accurate result
3. Speed response
4. Highly secure
5. Simple and reliable design

V.CONCLUSION

This project ensures college management and students' safety while traveling on the bus. The most up-to-date information about the bus in the form of its location can be received by students and college management, which can help the new students, teachers, and drivers know the route they must travel. Emergencies like accidents, fire, and brake failure can be detected and sent data to the app so that we can take immediate appropriate actions respectively.

FUTURE SCOPE

We can install cameras and utilize the mobile application to monitor buses to enhance the efficiency of the mobile application. Regardless of whether a student boarded the bus or not, RFID technology can be utilized to track their attendance. Mostly in accidents, it becomes serious because the drivers lose control and fail to prevent the vehicle. In such cases, the vibration sensor is going to be triggered due to the vibrations received and also processed by the processor. The processor has got to be linked to the devices which may lock the brakes when triggered. With this improvement, we will stop the vehicle and may weaken the impact of the accident, a camera will even be connected to the controller module to snap pictures of the accident site. We have a variety of breakdown circumstances; for example, in the case of tyre punctures, we can add sensors to each wheel to determine if it is punctured. If the fuel runs out, we can suggest nearby fuel stations or send a message to the appropriate authorities requesting that fuel be provided for buses in cases where there are no nearby fuel stations.

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