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Campus Connect - A College Bus Tracking System

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Abstract: ***A variety of technologies is recommending the sophisticated environment more and more often. Modern business practises are frequently improved by the corresponding advancements in technology. The most recent and quickly evolving technology available to all consumers or users in today's industry is called Android. Over the past few years, there has been a significant increase in end-user assent. The proposal is based on the most recent GPS technology using the Internet of Things, allowing college students to monitor the movement of the college buses, keep a timetable, and provide real-time bus positions for users. The seamless running of the bus system and the switching of vehicles are impacted by the exceptional road conditions. Additionally, daily challenges like traffic, unexpected delays, and dispatching events involving damaged vehicles occur. As a result, the student's schedules are impacted, and they are forced to wait for their specific bus to arrive as well as make an effort to miss it. This application's main goal is to display the precise position of each user's individual buses on Google Maps. It also has the unique feature of alerting the driver if the user is close to the bus stop. It is a real-time system since the latitude and longitude coordinates of the bus's current location are updated every single second and sent to the user's application via the Google Map API. The user can view the estimated arrival time of the bus at their designated stop. This could be particularly useful for students who need to plan their schedules in advance. If the bus is running behind schedule, users could view the delay time to see how long they will need to wait for the bus to arrive. Users could have the option to pay their bus fees directly through the college bus tracking system. This could be done using a variety of payment methods, such as credit card or through Net banking.***

Keywords: IoT, GPS, API, GPRS, Wifi, TCP, IP, IDE

I. INTRODUCTION

The Internet of Things (IoT) refers to the connection of devices, systems, and services through the internet, allowing them to communicate with each other and exchange data. This can be applied to a wide range of industries and situations, from transportation to healthcare to manufacturing. By connecting devices and systems to the internet, it is possible to create a network of interconnected objects that can share information and perform tasks automatically, without the need for human intervention. One example of how the IoT can be used is in the transportation industry. By connecting buses to the internet, it is possible to track their locations in real-time and provide this information to passengers through a smartphone app or other means. This can help individuals make more informed decisions about when to leave for the bus stop and which bus to take, reducing confusion and frustration.

The real-time tracking and notification system is designed to help individuals better understand the location and availability of buses in their area. By using a mobile application connected to Google Maps, the system is able to display the location of the bus on a map in real-time. This allows individuals to track the movement of the bus and receive notifications about its location and availability, helping them to plan their transportation and be on time for their bus. The system uses GPS technology to track the location of the bus and send this information to a server. The server then processes this information and makes it available to users through the mobile application. The mobile application displays the location of the bus on a map, allowing individuals to see where the bus is in relation to their current location.

The system also includes a buzzer that can be activated by the user to alert the driver to wait for them at the bus stop. This can be useful if the individual is running late and needs a few extra minutes to get to the bus stop. Overall, the real-time tracking and notification system helps individuals track the movement of buses and receive notifications about their availability, allowing them to better plan their transportation and be on time for their bus. It is powered by IoT technology, which involves the use of sensors and other tools that communicate with each other through the internet to provide real-time updates and automatic actions.

By using the GPS module and the Google Maps API, the system is able to continuously track the location of the bus and provide this information to the user through an android application.

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The user can access the location of the bus on a map by opening a webpage on their computer or mobile device, which will contain a link to Google Maps with the location coordinates of the bus. When the user clicks on this link, it will open Google Maps and show the location of the bus in real-time. This feature helps the user to better plan their transportation and reduce the risk of missing the bus. The proposed system includes a notification feature that allows the user to send a notification to the driver if they have missed their stop. By using the alarm option in the android application, the user can alert the driver to wait for them at the next stop or to make an additional stop to pick them up. This feature can be useful if the user has missed the bus or if they are running late and need to catch the bus at a different location. By providing the user with the ability to send a notification to the driver, the system helps to improve the efficiency and convenience of the college journey for all users.

The ETA (estimated time of arrival) algorithm is a mathematical formula that is used to calculate the estimated arrival time of a vehicle at a specific location. The algorithm uses information about the current location and speed of the vehicle to estimate its arrival time at different locations along its route. In the proposed system, the ETA algorithm is used to calculate the estimated arrival time and location of the college bus. By providing accurate and up-to-date information about the location and status of the bus, the ETA algorithm helps to improve the efficiency and convenience of the college journey for all users. To use the ETA algorithm in the college bus monitoring and notification system, the GPS module must continuously send location data to the NodeMCU. The NodeMCU then calculates the ETA for the bus at different points along its route, using the current location, speed, and other relevant information. The ETA data can then be transmitted to the local server and displayed on the android application or a webpage accessed by the user.

One of the benefits of using an ETA algorithm in the college bus monitoring system is that it allows users to plan their journey more effectively. For example, if a user knows the estimated arrival time of the bus at their location, they can plan their journey accordingly and arrive at the bus stop at the right time. This can help to reduce delays and improve the overall efficiency of the college bus system. Another benefit of the ETA algorithm is that it can be used to optimize the routing of the bus. By constantly updating the estimated arrival times at different locations along the route, the system can adjust the route to ensure that the bus is running on time and minimizing delays. This can help to improve the overall efficiency of the college bus system and provide a better service for all users.

II. LITERATURE SURVEY

A. Real Time Bus Tracking System

It uses the Google's distance matrix algorithm, it is a service that provides travel distance and time for a matrix of origins and destinations. It allows developers to specify a list of origins and a list of destinations, and the API will return a matrix of travel times and distances between the pairs of origins and destinations. This information can be used to show the user the approximate time taken by the bus to reach their location. Overall, the Google Maps Distance Matrix API is a useful tool for developers who want to provide their users with information about the travel time and distance between different locations. By using this API in a college bus tracking system, developers can help users to plan their journeys and anticipate the arrival time of the bus at their location.

One potential disadvantage of the Google Maps Distance Matrix API is that it may not always provide accurate or up-to-date information about the travel time and distance between locations. Another potential disadvantage is that the Google Maps Distance Matrix API is subject to usage limits, which may restrict the number of API requests that developers can make within a certain time period. If developers exceed these limits, they may need to purchase additional API credits or upgrade to a higher-tier pricing plan.

B. Real Time Web Based Bus Tracking System

It uses GPS, Google Maps, and GPRS technologies to provide real-time location information of buses to users through a web-based application. The system may allow users to access a web-based interface that displays the location of the buses on Google Maps, using data from GPS and GPRS to track the location of the buses in real-time. This can provide users with up-to-date information on the location and movements of the buses, allowing them to better plan their travel and know when to expect the bus to arrive at their stop. It decreases the time remote users must wait for a bus. The bus may be tracked at any time and from any location using a system.

Android apps can work offline, while web-based apps require an internet connection to function. This can be beneficial for users in areas with poor or unreliable internet connectivity, as they can still access the app and its features. Android apps can often offer faster and more responsive performance compared to web-based apps, as they run directly on the device and do not require loading data over the internet. Android apps can more easily access and utilize the features of the device, such as the camera, GPS, or accelerometer. This can allow for more interactive and engaging app experiences.

C. Application Based Bus Tracking System

The Proposed System [3] uses kalman filter, It is being used in a system to improve the accuracy of location data. The Kalman filter algorithm is able to resolve problems related to the accuracy of the location data by using a prediction-correction approach to estimate the true state of the system based on a series of noisy and uncertain measurements. By combining the measurements with a model of the system, the Kalman filter is able to produce an estimate of the location that is more accurate than any of the individual measurements. The implementation of the Kalman filter algorithm is said to greatly improve the accuracy of the location data, likely by reducing the impact of noise and uncertainty on the measurements. The Kalman filter is a mathematical algorithm that can be computationally intensive to implement, particularly in real-time systems. This can make it challenging to use the Kalman filter in resource-constrained systems or in situations where processing power is limited. The Kalman filter combines measurements with a model of the system to produce an estimate of the state. If the model is not accurate or is incomplete, the Kalman filter may not produce reliable results. The Kalman filter is designed to work with linear systems. If the system being tracked is non-linear, the Kalman filter may not produce accurate results.

D. Smart Bus and Bus Stop Management System using IoT Technology

The bus tracking system using the Internet of Things (IoT) can help improve the efficiency and reliability of public bus transportation by providing real-time information on bus locations and availability to users. By connecting buses to the internet and using GPS technology, the system can track the movement of buses in real-time and make this information available to passengers through a mobile application or other means. This can help individuals make more informed decisions about when to leave for the bus stop and which bus to take, reducing confusion and frustration. The system can also be used to improve route planning and scheduling by using real-time data on traffic conditions and bus locations, which can help to reduce travel time and fuel consumption. Additionally, the system can enable the use of electronic ticketing, which can help to reduce the use of paper tickets and the associated environmental impacts. Overall, a bus tracking system using the IoT has the potential to improve the efficiency, sustainability, and user experience of public bus transportation.

E. Real Time Bus Tracking and Location Updating System

It aims to address the challenges of tracking, monitoring, scheduling, and providing alerts for public transportation by automating these services using the Internet of Things (IoT). Your system would use RFID tags and readers, Arduino, a GSM module, and GPS to track the locations of public transport buses in real-time and provide this information to users through their mobile phones. The RFID tags and readers would be used to gather data on the movement of buses, which would be processed by Arduino and sent to the cloud for storage and access by users. The GSM module would be used to send tracking messages to authorized personnel for continuous monitoring, and the GPS would be used to determine the location of the buses. Overall, your system aims to improve the efficiency and ease of access of public transportation by providing real-time tracking information to users through the IoT. One of the main benefits of the proposed public transportation tracking system is that it can help to improve the efficiency of the transportation network. By providing real-time tracking information, the system can help to reduce delays and optimize routes, making it easier for users to plan their journeys and arrive at their destination on time. In addition to improving efficiency, the public transportation tracking system can also be used to enhance safety and security. By continuously monitoring the movement of buses, the system can detect any unusual activity or potential safety hazards and send an alert to authorized personnel. This can help to ensure that the transportation network is always operating safely and efficiently. Overall, the proposed public transportation tracking system has the potential to significantly improve the convenience and effectiveness of public transportation by automating tracking, monitoring, scheduling, and alerting services using the IoT.

F. IoT Bus Tracking System Localization via GPS-RFID

The mobile application being proposed in this paper aims to improve the efficiency and reliability of bus transportation in Malaysia by providing real-time tracking information to users. The application uses GPS and RFID technology to track the locations and movements of buses, and stores this information on a cloud server for online access. The application also uses Internet of Things (IoT) technology and ESP8266 Wi-Fi modules to separate the GPS and sensor functions, and a Blynk mobile app to send messages to bus users. The prototype of the mobile application was tested using GPS coordinates for three different locations, and showed that it was able to track the routes of buses with 0 to 5 passengers on board. The application also used IR sensors to count the number of passengers getting on and off the bus. Overall, the combination of IoT, GPS, and RFID technology in this mobile application aims to help both bus drivers and passengers save time and plan their trips more efficiently by providing real-time tracking information through an internet connection.

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G. Design of Bus Tracking and Fuel Monitoring System

The proposed system aims to improve the efficiency and reliability of public transportation by using GPS and GSM technology to track the location and movement of buses in real-time. The system would have four main applications: first, setting up communication between the school server and the transport system to provide real-time information on the location of buses; second, sending group messages, such as alert messages, to students waiting at bus stops, as well as updates on changes in routes and bus numbers; third, eliminating the need for paper-based vehicle passes by using electronic ticketing; and fourth, establishing an emergency management system that sends alert messages to the school, police, and ambulance in the event of accidents. Overall, the proposed system aims to improve the efficiency and reliability of public transportation by providing real-time tracking and communication, as well as enabling electronic ticketing and emergency management.

H. Smart School Bus Tracking System

IoT-based Bus Tracking System aims to improve the safety of school bus transportation by providing real-time tracking information to the school administration, bus drivers, and parents. The system would include a tracking website and an android application that allows the school administration to add new bus drivers and students to the system, and generates a fixed QR code for each student that contains their personal information. The system would track the location of the bus through the driver's mobile device and provide real-time updates to the parents' application, which would display a map showing the current position of the bus. The system would also send notifications to the school administration and parents if the bus is running behind schedule or if there are any changes to the daily schedule. Overall, the proposed system aims to provide parents with peace of mind and improve the safety of school bus transportation by providing real-time tracking and notification services.

In addition to tracking the location of the school bus, the IoT-based bus tracking system can also be used to monitor the safety and security of the bus itself. For example, the system could be equipped with sensors that detect any unusual activity or potential safety hazards on board the bus. If an issue is detected, the system could send an alert to the school administration and bus driver, allowing them to take appropriate action. The IoT-based bus tracking system can also be used to optimize the routing of the school bus. By continuously tracking the location and speed of the bus, the system can adjust the route in real-time to minimize delays and ensure that the bus is running efficiently. This can help to improve the overall efficiency of the school bus transportation system and provide a better service for all students.

I. Design of Intelligent Bus Positioning Based on IoT for Smart Campus

The proposed intelligent bus positioning system aims to improve the efficiency of bus operations and implement a smart campus by using Internet of Things (IoT) technology to track and locate buses in real-time. The system would use RFID technology to monitor the movement of buses, touch screens at bus stops to count the number of passengers waiting for each bus, and electronic bus-stop boards to display arrival times and other information. The system would also use Zigbee wireless network technology to communicate between the vehicle terminal, platform system, and dispatch monitoring center. To improve the quality and efficiency of bus service, the system would use the simulated annealing algorithm to intelligently schedule buses. Overall, the proposed system aims to meet the travel needs of citizens by providing real-time tracking and monitoring of bus movements, as well as intelligent scheduling to improve the efficiency of bus operations. One of the key features of the intelligent bus positioning system is its ability to provide real-time tracking and monitoring of bus movements. By using RFID technology to continuously track the location of buses, the system can provide users with up-to-date information about the location and status of their bus. This can help to improve the efficiency of the bus system by reducing delays and optimizing routes and can also provide users with greater convenience and peace of mind. In addition to tracking and monitoring bus movements, the intelligent bus positioning system also uses the simulated annealing algorithm to intelligently schedule buses. This algorithm is designed to optimize the allocation of resources, such as buses, in a way that maximizes efficiency and minimizes costs. By using this algorithm to schedule buses, the system can help to ensure that the bus system is operating as efficiently as possible and providing the best possible service to users.Overall, the proposed intelligent bus positioning system has the potential to significantly improve the efficiency and effectiveness of bus operations, and provide a more convenient and enjoyable experience for users.

J. An Advance Vehicle Tracking System Based on Arduino

The proposed vehicle tracking system aims to improve the accuracy of tracking vehicles in order to detect theft cases. To achieve this, the system would utilize GPS and GSM technology to track the location of vehicles in real-time. The system would be equipped with an Arduino controller and SIM800L modules, which are integrated with a GSM modem and GPS receiver.

These components would allow the system to receive global location data from satellites with an accuracy of 2.5-3.5 meters in terms of longitude and latitude coordinates. This information would then be transmitted through the GPRS service to a remote server using TCP (Transmission Control Protocol). The remote server would host multiple web maps that allow users to view the location of the tracked vehicles through a web-based application. The proposed system aims to provide a more accurate and reliable method of tracking vehicles for theft case detection compared to previous approaches.

III. PROPOSED SYSTEM

A. *Objective*

In the current system, if the user does not have accurate information about the location of the bus, it can be difficult for them to predict its arrival time. Without knowing the location of the bus, the user may not know how far away it is and how long it will take to reach the bus stop. This can make it difficult for the user to plan their transportation and be on time for the bus. In some cases, it may be difficult for the user to get accurate information about the location of the bus. For example, the user may have to contact the bus staff directly to ask for the location of the bus. This can be inconvenient and time-consuming, especially if the user is unable to reach the bus staff or if they are not able to provide the requested information. There is a risk that the user may miss the bus if they are not aware of its arrival time or if they are not at the bus stop when it arrives. This can be frustrating and inconvenient for the user, especially if they are relying on the bus for transportation.

If the location of the bus is not known, it can be difficult for the user to anticipate its arrival time or plan their transportation. In this case, the user may need to ask for information about the location of the bus from the bus staff or other relevant individuals. This can be inconvenient and time-consuming, especially if the user is unable to reach the bus staff or if they are not able to provide the requested information. If the user is unsure about the status of the bus, they may wish to contact a friend or a staff member to ask for information. For example, the user may want to know if the bus is running late or if it has been cancelled. Contacting a friend or staff member can provide the user with more accurate and up-to-date information about the status of the bus.

Global Positioning System (GPS) is a popular and effective way to track the location of an object, such as a bus. GPS is a hardware system that uses satellites to determine the location of an object. The accuracy of GPS is typically around 80%, and it is expected to improve in the future as the software and hardware are further developed. In the case of tracking a bus, GPS is used to gather data from multiple satellites and determine the position of the bus. This information is then sent to a server and made available through an application or other means. The application can use this information to track the location, arrival, and departure time of the bus, and display this information on a map using the Google Maps API. Overall, GPS is a useful tool for tracking the movement of objects and providing real-time updates about their location and status.

The proposed system is a bus tracking and monitoring system that is designed to make the college journey more efficient and convenient for users. The system includes a real-time tracking and notification system that continuously tracks the location of the bus and provides this information to the user through an android application. The application includes three different types of user accounts: administrator, users, and drivers. Users can login to the application using their roll number and password and view the location of the bus on a map using the Google Maps API. They can also send a notification to the driver through the application if they have missed the bus. The driver's login allows the driver to view the number of students who should board the bus, their pick-up location, and the route to be followed. The route may change due to road or weather conditions, which will also be reflected in the student login. In the administrator login, the administrator can view the arrival time of the bus, the route, the number of students to be on board, and the driver details. The system uses ETA (estimated time of arrival) algorithms to calculate the location and speed of the bus. These algorithms use information about the location and speed of the bus to estimate its arrival time at different locations along its route. Overall, the proposed system aims to provide more accurate and up-to-date information about the location and status of the bus, helping to make the college journey more efficient and convenient. By tracking the location of the bus in real-time and providing updates to users, the system helps users to better plan their transportation and reduce the risk of missing the bus. It also provides important information to the driver and administrator, allowing them to more effectively manage the bus route and schedule.

B. *Methodology*

The design of the current location college bus monitoring and notification system consists of two main components: IoT-based hardware devices and an android application. The hardware devices are connected to an Arduino NodeMCU, which is a microcontroller board that can be programmed to interact with the Internet of Things (IoT). The NodeMCU is used to communicate with the GPS module and the android application, which is used to track the location of the bus in real-time.

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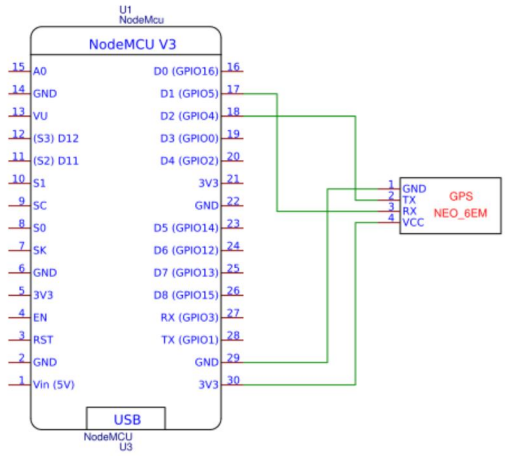
The android application uses the Google Maps API to display the location of the bus on a map. The GPS module is used to obtain the position coordinates of the bus, and the NodeMCU is used to transmit this data over WiFi to the local server. The user can access this information by opening a webpage on their computer or mobile device, which will contain a link to Google Maps with the location coordinates of the bus. When the user clicks on this link, it will open Google Maps and show the location of the bus.
Overall, the current location college bus monitoring and notification system uses a combination of hardware devices and software to track the location of the bus in real-time and provide this information to the user through an android application. By using GPS, WiFi, and the Google Maps API, the system is able to provide accurate and up-to-date information about the location and status of the bus, which can help to make the college journey more efficient and convenient for users. In addition to tracking the location of the bus in real-time, the current location college bus monitoring and notification system also provides notification services to users. For example, if the bus is running late or is experiencing delays, the system can send a notification to the user to let them know. This can be especially helpful for students who are planning to catch the bus at a specific time, as it allows them to adjust their schedules accordingly. Additionally, the notification feature can also be used to alert students when the bus is approaching their stop, so they can be prepared to board the bus when it arrives. Overall, the notification feature of the current location college bus monitoring and notification system helps to improve the efficiency and convenience of the college bus system by providing users with real-time updates and alerts.

1) Components

a) Arduino Node MCU 8266: The NodeMCU is a development board that is based on the ESP8266 WiFi chip. It allows you to program the ESP8266 chip using languages like C++, making it possible to use the chip for a variety of applications that require internet connectivity. The ESP8266 chip is a low-cost chip developed by Espressif Systems that has built-in support for TCP/IP protocols, which are necessary for internet communication.One of the main benefits of the NodeMCU is that it can be programmed like an Arduino, making it easy to use for individuals who are familiar with the Arduino platform. It can be connected to a PC or Mac and programmed using the Arduino Integrated Development Environment (IDE). The NodeMCU also has more GPIO pins than the ESP8266 breakout board, which makes it easier to connect to various sensors and other peripherals. In addition to its programming capabilities, the NodeMCU also has a number of hardware features that make it useful for a wide range of applications. For example, it can support PWM, I2C, and 1-wire interfaces, which can be used to communicate with a variety of sensors and other devices. The NodeMCU is an open-source platform, which means that its hardware configuration is open to modification and customization. This allows individuals and organizations to customize the board to meet their specific needs and requirements.

b) Ublox 6m GPS Tracker: Speed is a measure of how quickly an object or vehicle is moving. It is calculated by dividing the distance traveled by the time it took to travel that distance. Speed is usually expressed in units of distance per time, such as miles per hour or kilometers per hour.To determine the speed of an object using GPS, two GPS points (locations) are used to measure the distance traveled. The clock inside the GPS receiver is then used to measure the time it took to travel between these two points. By dividing the distance traveled by the time it took, the speed of the object can be calculated.GPS transceivers are used to perform various tasks related to speed measurement. They can convert the difference between two latitudinal/longitudinal locations into a unit of distance, and they can use this information along with the time it took to travel between these locations to calculate the speed. GPS transceivers are also able to synchronize with the atomic clocks on GPS satellites, which allows them to provide highly accurate time measurements that can be used to calculate speed.In addition to calculating speed, GPS can also be used to track the movement of an object or vehicle over time. By continuously measuring the position of the object using GPS and recording this information, it is possible to create a detailed record of its movement. This information can be useful for a variety of purposes, such as analyzing the efficiency of a vehicle's movement or studying the patterns of animal migration.

c) *Arduino Piezo Speakers (Buzzers):* A piezo buzzer is a small speaker that can be connected directly to an Arduino or other microcontroller. It works by using the piezoelectric effect, which is a phenomenon that occurs in certain solid materials when they are subjected to pressure or strain. When these materials are compressed, they produce an electric charge. This charge can be collected by placing a metal plate in contact with the piezoelectric material. Piezoelectric materials are used in a variety of applications, including sensors, actuators, and generators. Some examples of piezoelectric materials include PZT (lead zirconate titanate), barium titanate, and lithium niobate. These man-made materials are more effective at producing piezoelectricity than natural materials like quartz.Piezoelectricity is a type of electricity that is generated by pressure or temperature changes.



PIN Diagram for GPS Module

2) System Architecture

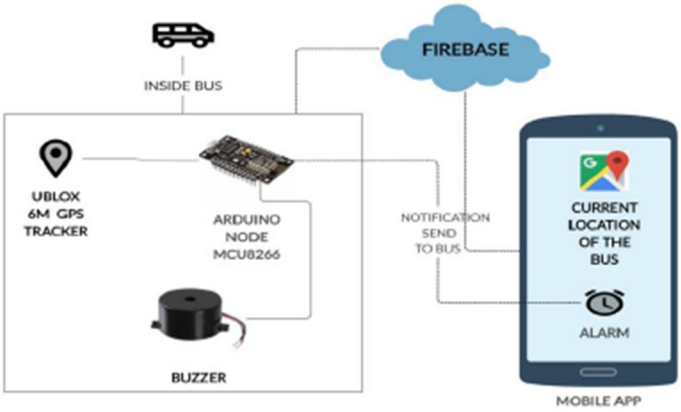


Figure 3.2 Proposed System Architecture

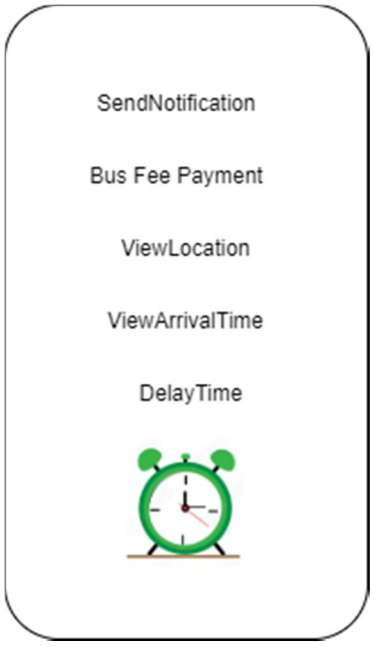


Figure 3.3 Architecture of Mobile App

C. Software Requirements

1) *Flutter:* Flutter is a free and open-source mobile application development framework created by Google. It allows developers to build cross-platform mobile applications for Android and iOS using a single codebase. Flutter is written in Dart programming language and uses the Skia graphics engine to render applications.
2) *Firebase:* Firebase is a cloud-based platform for building mobile and web applications. It provides a range of services such as real-time database, cloud storage, authentication, and hosting, among others. Firebase is a popular choice for building modern applications due to its wide range of features and ease of use. It is also well-integrated with other Google services and tools.

D. Hardware Requirements

1) *Arduino NodeMCU 8266:* The Arduino NodeMCU 8266 is a microcontroller board based on the ESP8266 WiFi chip. It allows developers to build connected applications using WiFi and other internet protocols. The NodeMCU 8266 has built-in support for Arduino programming language, making it easy to use for those familiar with Arduino development.
2) *Neo 6M GPS Module:* The Neo 6M GPS module is a GPS receiver that can be used to track the location of a device. It uses the Global Navigation Satellite System (GNSS) to determine its location and can provide latitude, longitude, and altitude information. The module is compatible with a range of microcontrollers, including Arduino, and can be used in applications such as tracking the location of a vehicle or building a GPS-based navigation system.
3) *Arduino Piezo Speakers:* Arduino piezo speakers are small speakers that can be used to produce sound or music with an Arduino microcontroller. They are based on the piezoelectric effect, which allows them to generate sound waves by changing their shape when an electrical current is applied. To use an Arduino piezo speaker, you will need to connect it to the Arduino using wires and write a program using the Arduino programming language. The program should include instructions for generating the desired sound or music, such as the frequency and duration of the notes. You can then upload the program to the Arduino and use it to control the piezo speaker. Overall, Arduino piezo speakers are a useful and versatile tool for producing sound and music with an Arduino microcontroller. They are easy to use and can be a fun and creative way to enhance your Arduino projects.

IV. RESULT

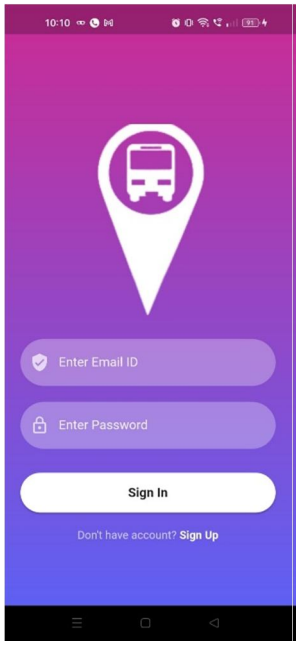


Fig 4.1 Login Page

Fig 4.2 Admin UI

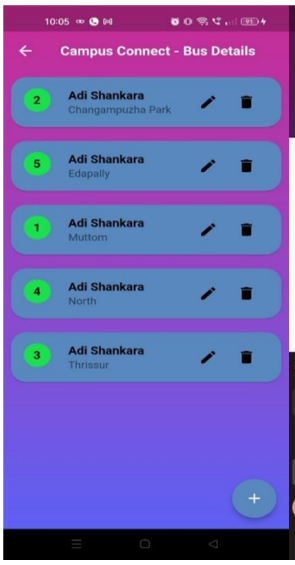


Fig 4.3 List View

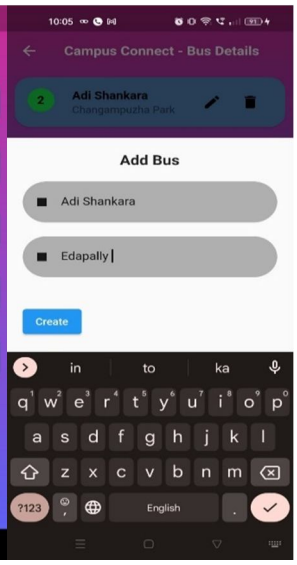


Fig 4.4 Add Details

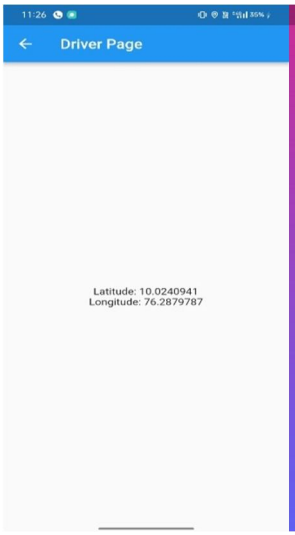


Fig 4.5 Bus Location

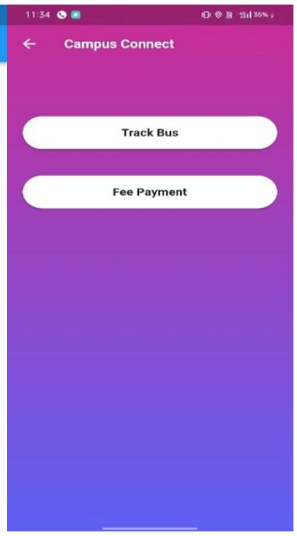


Fig 4.6 User UI

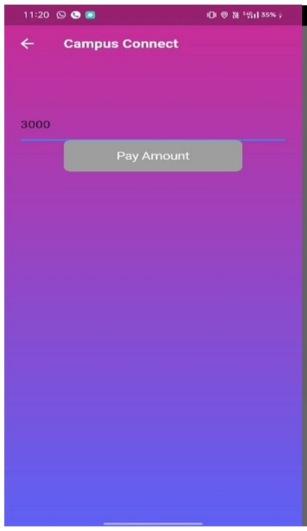


Fig 4.7 Amount Entry

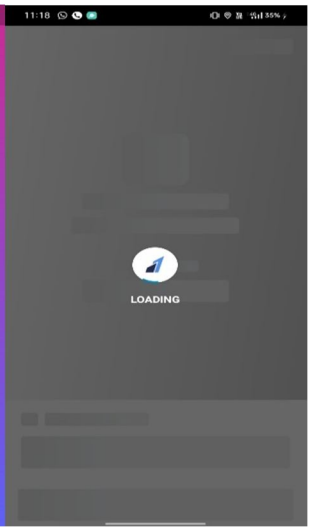


Fig 4.8 Razorpay

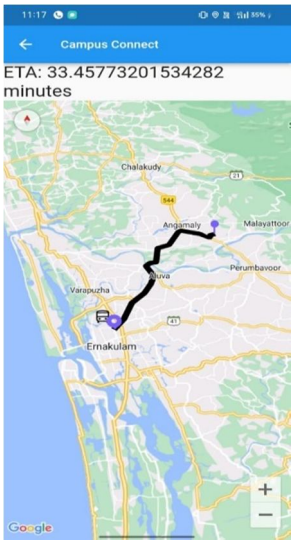


Fig 4.9 Bus Tracking

V. CONCLUSION

The college bus monitoring and notification system consists of two main components: IoT-based hardware devices and an android application. The hardware devices are connected to an Arduino NodeMCU, which is a microcontroller board that can be programmed to interact with the Internet of Things (IoT). The NodeMCU is used to communicate with the GPS module and the android application, which is used to track the location of the bus in real-time.The android application uses the Google Maps API to display the location of the bus on a map. The GPS module is used to obtain the position coordinates of the bus, and the NodeMCU is used to transmit this data over WiFi to the local server. The user can access this information by opening a webpage on their computer or mobile device, which will contain a link to Google Maps with the location coordinates of the bus. When the user clicks on this link, it will open Google Maps and show the location of the bus. Overall, the college bus monitoring and notification system uses a combination of hardware devices and software to track the location of the bus in real-time and provide this information to the user through an android application. By using GPS, WiFi, and the Google Maps API, the system is able to provide accurate and up-to-date information about the location and status of the bus, which can help to make the college journey more efficient and convenient for users. The notification system of the college bus monitoring system can be triggered by the android application or by the hardware devices on the bus itself. For example, if the bus is running late or if there is a delay, the system can send a notification to the user through the android application, alerting them to the change in schedule. The notification can be sent as a push notification or an SMS, depending on the user's preference.

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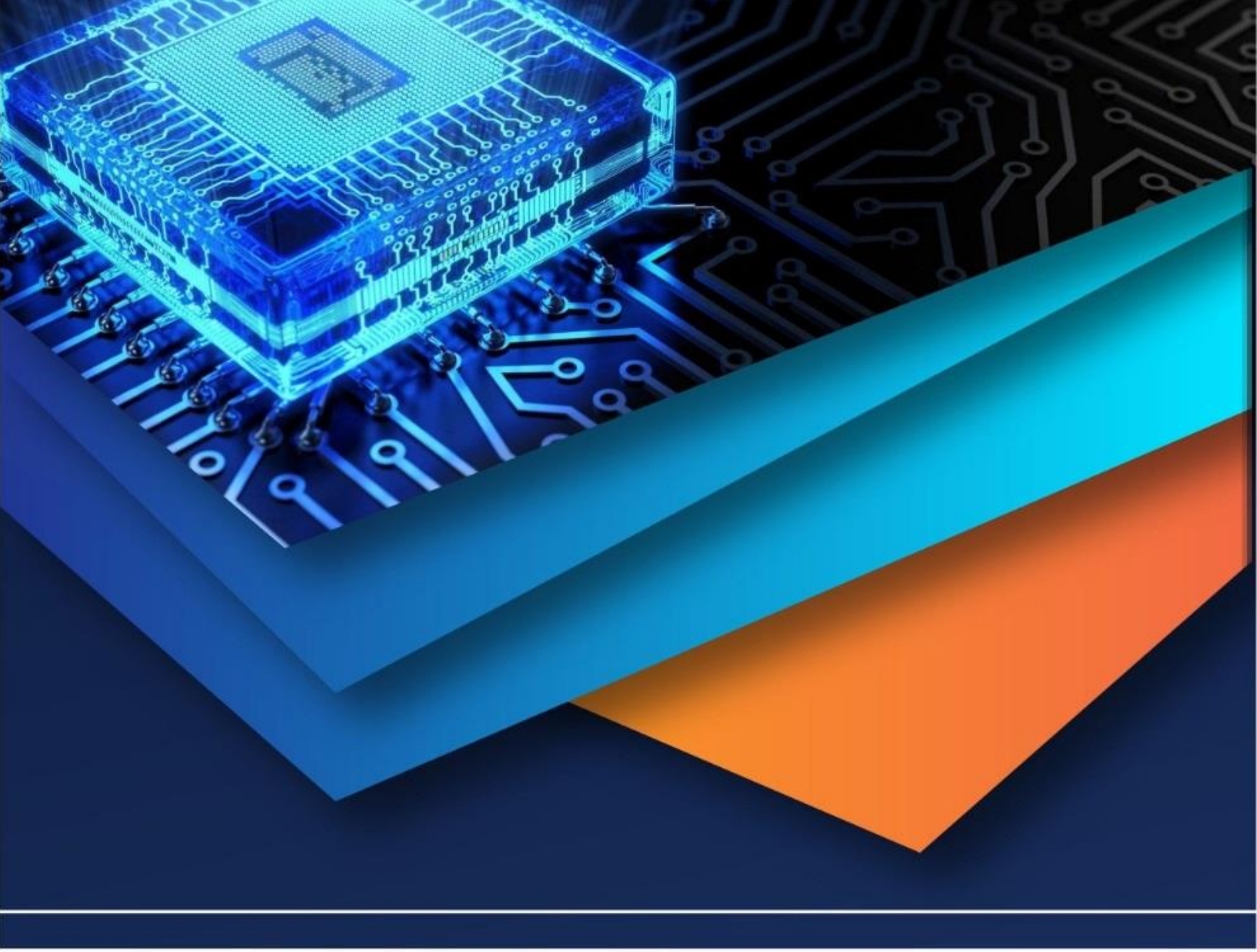

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