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School bus boarding, deboarding, and location notification system based on GPS and the internet of things

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ABSTRACT:

Parents and school officials are increasingly concerned about the safety and need for a way to monitor school buses in real-time. Inefficient monitoring of bus whereabouts, student boarding, and deboarding is a result of traditional techniques' lack of automation. In order to better manage transportation and ensure the safety of students, this project presents a state-of-the-art system for monitoring school buses that uses buzzers, RFID, the internet of things, and GPS. The Internet of Things (IoT) technology allows school administrators and parents to watch the whereabouts of buses in real time using online dashboards and mobile apps. To prevent unapproved boarding and ensure correct attendance, RFID technology is used to record when students enter and leave the building. In the event of an emergency or to remind students and drivers of upcoming stops, a buzzer system is in place. All of these parts work together to provide a real-time monitoring system that is easy to use, which makes school buses safer, helps with communication, and gives parents and school administrators more peace of mind.

EMBEDDED SYSTEMS

A computer system that is purpose-built to carry out a single or limited set of tasks, often under the restrictions of real-time computing, is known as an embedded system. As with other physical and mechanical components, it is often integrated into a whole device. A personal computer or other general-purpose computer, on the other hand, may be programmed to do a wide variety of functions. These days, many of the everyday items we use rely on embedded systems to function. Design engineers may improve the embedded system to decrease product size and cost while boosting reliability and performance since it is devoted to certain functions. Because of their mass production, certain embedded systems are able to take advantage of cost savings. From small, handheld gadgets like digital watches and MP3 players to massive, permanently installed systems like those managing nuclear power plants, traffic lights, and industrial controls are all examples of physically embedded systems. From simple systems using a single microcontroller chip to complex systems housing several modules, peripherals, and networks in a massive chassis or enclosure, complexity may range greatly. The phrase "embedded system" lacks a precise definition because the majority of systems have programmability in some form. While they share some components with embedded systems, such operating systems and microprocessors, handheld computers are not technically embedded systems as they enable the loading of multiple programs and the connection of peripherals. Computer hardware and software, either fixed in capability or programmable, particularly intended for a certain sort of application device—this is what's called an embedded system. Embedded systems may be found in a wide variety of objects, including but not limited to: vehicles, medical devices, cameras, home appliances, aircraft, vending machines, toys, and, of course, cellular phones and personal digital assistants. A programming interface is given to programmable embedded devices, and programming for embedded systems is a niche field in and of itself. Embedded Java and Windows XP Embedded are two examples of embedded-specific operating systems and language platforms. On the other hand, certain budget consumer goods include integrated application and operating system components, employ very cheap microprocessors, and have limited storage space. Instead of being loaded into RAM (random access memory), as applications on personal computers are, in this situation the program is written permanently into the system's memory.

CHARACTERISTIC OF EMBEDDED SYSTEM

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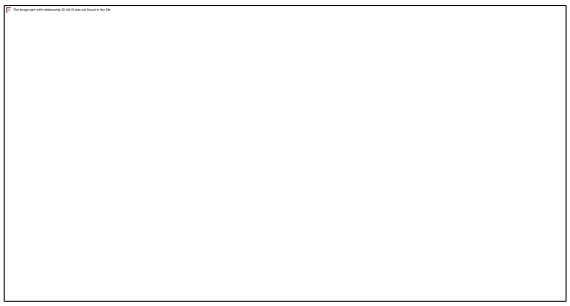
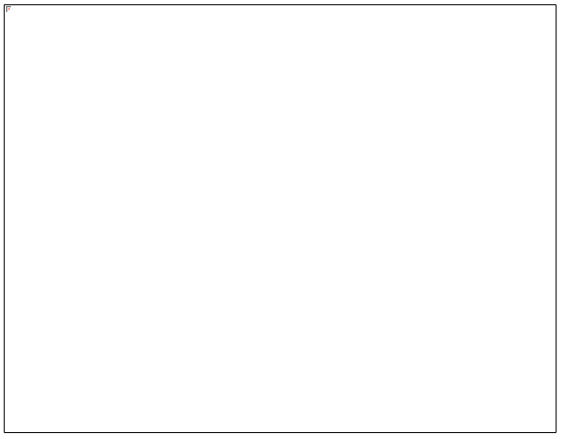


APPLICATIONS OF EMBEDDED SYSTEMS

Here, in the Embedded World, we are living. The smooth operation of the various embedded goods that surround you is crucial to your day-to-day existence. In your living room, you have a TV, radio, and CD player; in your kitchen, you have a washing machine or microwave oven; and at your office, you have card readers, access controllers, and palm devices that let you do a lot. In addition to all of this, your automobile has a plethora of built-in controls that handle functions between the bumpers, most of which you probably don't give a second thought to.



MICROCONTROLLER VERSUS MICROPROCESSOR

When comparing microprocessors and microcontrollers, what are the key differences? Any general-purpose microprocessor, such an 8086, 80286, 80386, 80486, or a Pentium from Intel, or a 680X0 from Motorola, etc., is considered a microprocessor. In addition to lacking on-chip I/O ports, these microprocessors also lack random-access memory (RAM). Because of this, they are often called general-purpose microprocessors. Designing a working system around a general-purpose CPU like the 68040 or Pentium requires the addition of extra components like as RAM, ROM, I/O ports, and timers. Though these systems are more costly and cumbersome due to the inclusion of external RAM, ROM, and I/O ports, they provide the benefit of being versatile in that the designer may choose the quantity of RAM, ROM, and I/O ports required for the work at hand. Microcontrollers are an exception to this rule. On a single chip, you'll find a microprocessor, random access memory (RAM), read/write (ROM), input/output (I/O) ports, and a timer in a microcontroller. So, since the CPU, random access memory (RAM), read/write memory (ROM), input/output (I/O) ports, and timer are all integrated into a single chip, the designer is unable to include any more memory, I/O ports, or timer into the product. Because of its set quantity of on-chip ROM, RAM, and number of I/O ports, microcontrollers are perfect for many applications where space and cost are important considerations. It is not necessary to have a 486 or even an 8086 CPU for many applications; for instance, a TV remote control. Typically, these programs will need some kind of input/output function in order to read signals and toggle bits.

INTRODUCTION

In today's fast-paced society, parents and teachers are increasingly worried about the reliability and safety of children's bus transit to and from school. Students may have to wait for quite a while if the bus is late. On sometimes, children accidentally disembark from the incorrect bus stops. The parents are irritated even when the bus is late for minor reasons. There have been many complaints of missing school buses recently. The inexperienced driver didn't know the routes, which caused the bus to be late on one occasion. Parents in Kolkata were understandably alarmed when three school buses vanished from a school near Salt Lake. Each bus carried about forty kids, and the three drivers made sure to turn off their phones. The upshot was that many worried parents went to the school to find out why their children weren't coming home at the regular time. Thanks to contemporary technology, however, this baffling problem has a solution. Students are far better protected when school bus monitoring systems are in place. You may find a few of these things on store shelves right now. Nevertheless, the proposed system outperforms its competitors due to the use of the Arduino UNO microcontroller.

Furthermore, it communicates with other devices with the NODEMCU(ESP8266)IOT module, NEO-6M GPS module, and MFRC522 RFID Reader. Because of how fairly priced the aforementioned components are, overall cost is reduced. A Global System for Mobile Communication (IOT) module tracks each student's arrival and leave using their RFID-tagged school IDcard, and it notifies parents

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of their children's whereabouts. If a parent's kid has boarded the bus, they will get a notification. Furthermore, the parent is notified of the bus's current position by SMS using the Global Positioning System (GPS) module. By keeping tabs on its whereabouts, they may find out whether it is stuck in traffic. In the event that a student is unable to board the school bus on the way home, the parent will still be informed in a timely manner. This Bus Boarding-Deboarding and Location Notifying System is useful for preventing such scenarios and easing the minds of parents. As a result, they are better able to arrange their work around all of the issues that arise. Here is the layout of the remaining paper: In Section II, we may get a synopsis of the previous research. In Section III, the suggested system is defined and explained in detail. The findings are detailed in Section IV, while the planned project is summarized in Section V. The References Section contains all of the cited sources.

LITERATURE SURVEY

The article [1] introduces an Internet of Things (IoT) driven school bus monitoring system that could help parents keep an eye on GPS-equipped buses all the time. The system updates them on any issues along the way so they can plan their work accordingly, and it tracks the vehicle throughout [2]. The article proposes a method that uses radio frequency identification tags to detect goods in order to eradicate misplacement. An RFID reader mounted on the vehicle reads the tags that are attached to each item. Utilizing GPS and IoT, the shipment's whereabouts and details are regularly communicated back to the provider. The article states that the college bus is monitored by the Internet of Things (IoT), which triggers an alert if the bus surpasses the speed restriction [4]. The reader picks up information about individual students from each RFID tag. Thanks to IoT, their parents get the right information. You may find out where you are right now by using the GPS receiver [5]. The vehicle's position can be transmitted to a remote location via the IoT modem by means of the GPS tracking system. Only the microcontroller can receive data from the modem. Contrarily, the GPS modem does not send any data to the satellite; all it does is receive signals. The service mentioned in the work [6] can be used by the educational institution and guardians to track the school bus as it arrives and departs from the school. This ensures the safety of the students whether they are being picked up or dropped off. Parents can also get real-time updates on their whereabouts in case of emergencies like flooding or heavy rain. The article [7] demonstrates thatRFID-based competent secure school bus technology is aviable option for monitoring and overseeing children ontheir journey back and forth to school. It is possible to communicate with the main server fromthe vehicle unit by using the IOT module which isconnected to the GPS module [8]. The parent will receive atext message displaying the location of the student whenhe/she boards the bus as well as alights the bus. Utilizing thelatitudeandlongitude from the SMS, the position is tracked[9]. The precise location of the destinations as well as thebest route to take from the user's residence can be foundusing Google Maps. Using the RFID reader, the student scans his card [10]. The Internet of Things (IoT) Module notifies the student's parents.

EXISTING SYSTEM

The current system for monitoring school buses is based on the often-inefficient and unreliable practice of drivers and school administrators communicating with one another manually. Students often have to wait in uncertainty because their parents phone schools or drivers to confirm when the bus will arrive. While some systems use GPS tracking, they don't have the Internet of Things (IoT) capability to keep tabs on things in real-time or get automatic updates. It is also impossible to guarantee correct boarding and deboarding on traditional school buses since they do not have RFID-based student identification. Another limitation is that there isn't a buzzer system to notify drivers and students of impending stops or emergencies. These drawbacks emphasize the need of a unified system that improves student security, tracks them in real-time, and automatically notifies administrators and parents.

PROPOSED MODEL

An intelligent school bus monitoring and alarm system is suggested to be created by integrating GPS, RFID, the Internet of Things (IoT), and a buzzer. The GPS module keeps constant tabs on the bus's whereabouts and sends that information to a cloud platform that is based on the internet of things, which the school administration and parents may access. To provide safe student monitoring, RFID tags are issued to each student and their boarding and deboarding are registered using an RFID reader. Through the use of smartphone apps and SMS alerts, the Internet of Things (IoT) system provides real-time updates about the whereabouts of the bus, the arrival of stops, and any unforeseen delays. For easier boarding and disembarking, the bus has a buzzer system that alerts both students and drivers when it reaches certain stops. By accurately updating kids' whereabouts, boosting their security, and simplifying communication

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between parents, students, and school officials, this method greatly improves school transportation.

BLOCK DIAGRAM

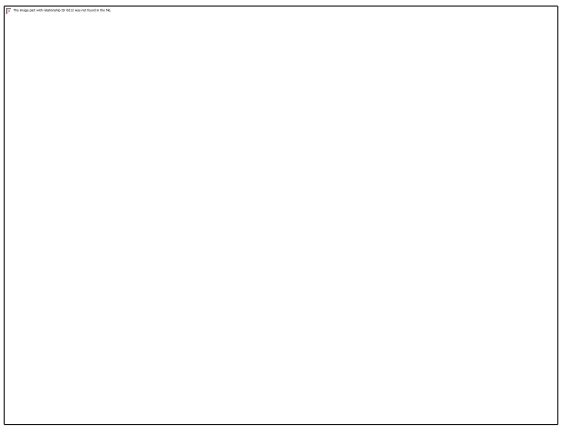

Figure 1: Block Diagram

Microcontroller:

A tiny controller, or microcontroller, as the name implies. Often used as a processing or controlling unit, they are similar to single-chip computers. For instance, microcontrollers that do decoding and other regulating operations are likely integrated into the control you are using. They find further use in vehicles, home appliances, microwaves, toys, and any other area requiring automation.

Arduino Uno Microcontroller:

One such microcontroller board is the Arduino Uno, which uses the Atmega328 (datasheet). It has a 16 MHz crystal oscillator, 6 analogue inputs, 14 digital input/output pins (6 of which may be used as PWM outputs), a power connector, an ICSP header, a reset button, and a USB connection. All you need is a USB cable, an AC-to-DC converter, or a battery to get it going; it comes with everything you need to support the microcontroller.

A key difference between the Uno and all previous boards is the absence of the FTDI USB-to-serial driver chip. Rather of that, it has an Atmega8U2 that has been configured to convert USB to serial. To celebrate the impending release of Arduino 1.0, the name "Uno"—which means "One" in Italian—has been chosen. The Uno and Arduino version 1.0 will serve as the foundational versions for future Arduino releases. For a comparison with prior generations, see the index of Arduino boards. The Uno is the newest in a series of USB Arduino boards and the standard model for the Arduino platform.

ARDUINO UNO BOARD:

One board that uses the Atmega328 microprocessor is the Arduino Uno. A 16 MHz ceramic resonator, 6 analog inputs, 14 digital I/O pins (including 6 PWM outputs), 1 USB port, 1 power connector, 1 ICSP header, and 1 reset button are all part of it. All you need is a USB cable, an AC-to-DC converter, or a battery to get it going; it comes with everything you need to support the microcontroller.

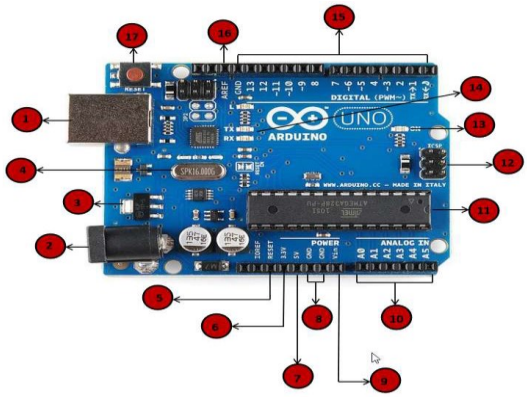

Figure 2: Arduino uno board

In contrast to all of its predecessors, the Uno does not have the FTDI USB-to-serial driver chip. As an alternative, it makes use of USB-to-serial converters coded into the Atmega16U2 (Atmega8U2 up to version R2).

HARDWARE COMPONENTS

POWER SUPPLY UNIT

The power supply for this system is shown below.

Figure 3: power supply

Diodes:

Only one path of electrical current may pass through a diode. Current may flow in either

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direction, as shown by the arrow in the circuit symbol. Originally termed valves, diodes are essentially an electrically enhanced version of the mechanical component.

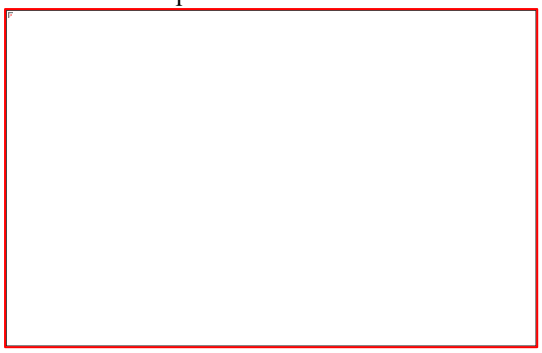

Figure 4: Diode Symbol

One kind of electrical component that restricts current flow is the diode. A voltage loss of around 0.7V will be the sole influence on the signal when the diode is "forward-biased" in this way. No current will flow through a diode that is "reverse-biased" when the current is applied in the other direction.

Rectifier

A rectifier's job is to change the phase of an alternating current (AC) waveform so that it appears as a direct current (DC) waveform. Both "half-wave" and "full-wave" rectifiers are used for rectification. Diodes are used in both devices to convert AC current into DC current. The Half-Wave Resettable The graphic shows that the half-wave rectifier is the simplest rectifier type since it only employs one diode.

Figure 5: Half Wave Rectifier

LIQUID CRYSTAL DISPLAY

An array of color or monochrome pixels arranged in front of a light source or reflector makes up a liquid crystal display (LCD), a thin, flat display device. Two polarizing filters, with their polarity axes perpendicular to one other, and a column of liquid crystal molecules hanging between two transparent electrodes make up each pixel. Light would not be able to travel through them if the liquid crystals weren't interposed. To make light flow through two filters, the liquid crystal changes the polarization of the light entering the first filter.

A program's ability to communicate with the outside world depends on its input and output devices, which in turn rely on human communication. An LCD display is a typical accessory for controllers. 16X1, 16x2, and 20x2 LCDs are among the most popular types of displays that are often linked to the controllers. Which works out to sixteen characters on a single line. The first set has 16 characters on each line while the second set has 20 characters on each line. The use of "smart LCD" displays allows for the visual output of information by many microcontroller devices. Affordable, user-friendly, and capable of producing a readout utilizing the display's 5X7 dots plus cursor, LCD displays built on the LCD NT-C1611 module are a great choice. They use mathematical symbols and the usual ASCII set of characters. The display needs a +5V power and 10 I/O lines (RS, RW, D7, D6, D5, D4, D3, D2, D1, D0) for an 8-bit data bus. The only additional lines needed for a 4-bit data bus are the supply lines and six more (RS, RW, D7, D6, D5, D4). The data lines are tri-state and do not affect the microcontroller's function when the LCD display is disabled.

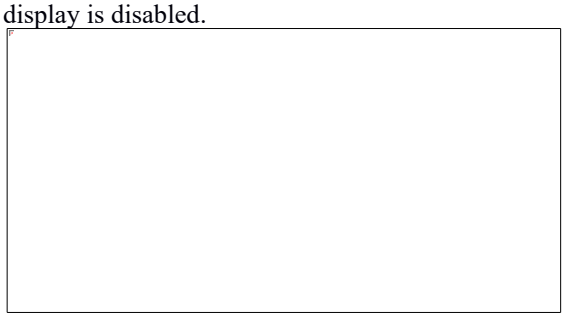

Figure 6: 2x16 LCD Display

BUZZER

In a magnetic transducer, the circuitry includes an iron core, a yoke plate, a wound coil, a permanent magnet, and a vibrating diaphragm that can be moved. The magnet's field gently draws the diaphragm up nearer the core's surface. A positive alternating current (AC) signal causes the diaphragm to move up and down, which in turn vibrates the air. This is achieved by the current passing through the excitation coil, which forms a

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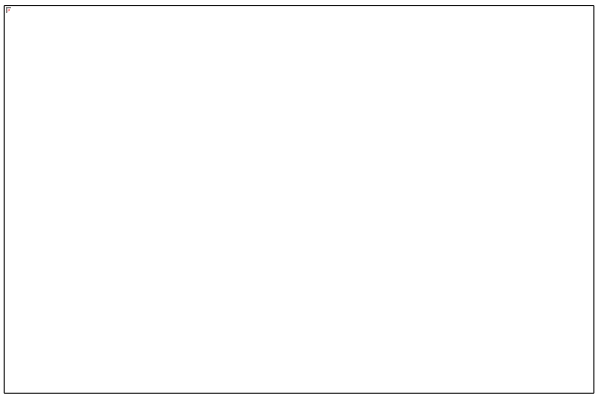
fluctuating magnetic field. A resonator, which is composed of a cavity and one or more sound holes, may amplify vibrations in order to generate a loud sound.



ESP8266 Wi-Fi Module

This project revolves on this. Because the project relies on WIFI control of appliances, the module is a crucial part of it.
One remarkable feature of this tiny board is the integrated MCU (Micro Controller Unit), which allows for the control of I/O digital pins via a simple programming language that is almost pseudo-code like. Another benefit is that the ESP8266 Arduino compatible module is a low-cost Wi-Fi chip with full TCP/IP capability. The Chinese company Es press if Systems is situated in Shanghai and makes this gadget.
In August 2014, this chip made its debut in the ESP-01 version module manufactured by the third-party company AIThinker. The MCU can establish basic TCP/IP connections and connect to WiFi networks with the help of this little module. He was His tiny size and cheap pricing (1.7–3.5$) enticed a lot of hackers and geeks to look into it and utilize it for all sorts of projects. Because of its enormous success, Espressif now offers a wide variety of models with varying size and technological specs. Its replacement includes ESP32.

RELAYS:

Industrial controls, automotive systems, and home appliances all make extensive use of electrically controlled switches called relays.
By using a relay, two independent voltage sources may be isolated from one another; in other words, a little quantity of voltage or current on one side can manage a big amount of current or voltage on the other side, and vice versa.

Inductor

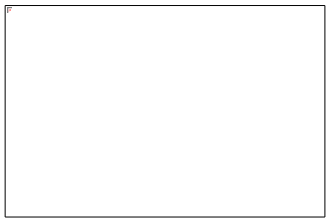


Fig7 : Circuit symbol of a relay

DRIVING A RELAY:

Two of the SPDT relay's five pins are used by the magnetic coil, one serves as the common terminal, and the other two are typically closed and normally connected. The coil is activated when a current passes across it. At the beginning, when the coil is deenergized, the usually closed pin and common terminal will be connected. A new connection will be formed between the common terminal and usually open pin when the coil is activated, breaking this connection. Therefore, the relay will be activated whenever the microcontroller sends an input signal to it. You may drive the loads connected between the common terminal and typically open pin while the relay is on. Consequently, the high-current loads are driven by the relay, which receives 5V from the microcontroller. This means the relay may be used as a means of isolation.
The microcontroller and digital systems do not have enough current to operate the relay. In contrast to the 10 milliamps required to activate the relay's coil, the microcontroller's pin can only provide 1 or 2 milliamps. This is why the microcontroller and the relay are separated by a driver, like ULN2003, or a power transistor. By connecting ULN2003 to the relay and microcontroller, it is possible to activate many relays simultaneously.

SOFTWARES

The Arduino platform is an open-source, user-friendly hardware and software environment for prototyping. It is comprised of a programmable circuit board (also called a microcontroller) and an Integrated Development Environment (IDE) called Arduino that is pre-made for writing and uploading code to the physical board. The main characteristics are: • Many sensors can send signals in digital or analog formats to Arduino boards, which may then be used to activate motors, control LEDs, establish connections to the cloud, and much more. • The Arduino IDE (also called "uploading software") allows you to command your board's operations by communicating with the microcontroller on the board. • A separate device,

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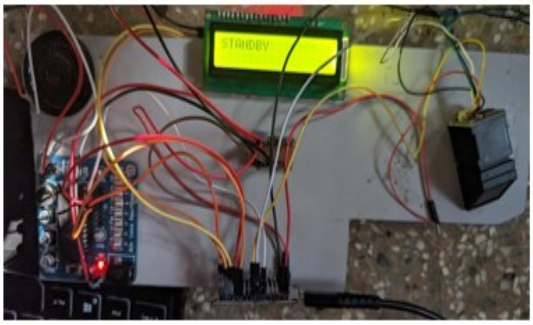
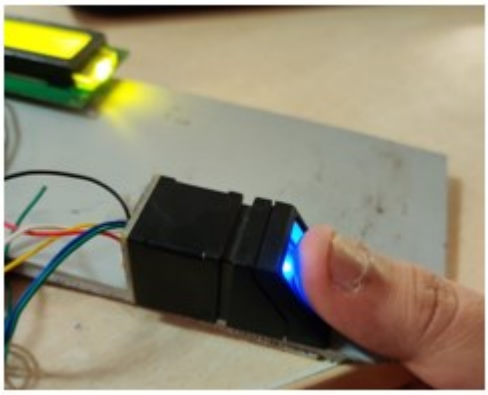
known as a programmer, is not required to load fresh code into an Arduino board, in contrast to most prior programmable circuit boards. The usage of a USB connection is all that is required. • The Arduino IDE employs a streamlined version of C++, which facilitates programming learning. Last but not least, Arduino offers a standardized form factor that simplifies the microcontroller's tasks. Now that we know what the Arduino UNO board is and how it works, we can go on to setting up the Arduino IDE. As soon as we figure this out, we can upload our software to the Arduino board.

RESULTS



Model



Scan the finger

Resut

CONCLUSION

A safe, dependable, and efficient transportation system is created when school bus monitoring incorporates GPS, RFID, the Internet of Things, and buzzer technologies. The system's real-time monitoring of bus whereabouts, computerized verification of kid attendance, and quick notifications to parents and school officials set it apart from previous tracking systems. By alerting both students and drivers when a stop is approaching, buzzers increase safety, while radio frequency identification technology prevents unapproved boarding. Smart traffic analysis, AI-based route optimization, and predictive arrival alerts are all potential future upgrades that might greatly boost efficiency. The safety of school transportation is greatly improved by this comprehensive and scalable system, which is a priceless benefit for everyone involved: parents, children, and school officials.

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