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School Bus Safety using Arduino ATmega2560

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Abstract: Nowadays, the safety and security of a school going children is important. Safer transportation of school children leads to critical issues such that, kids find themselves locked in the school bus at the bus stop after going to school, they miss the bus, or ride the wrong bus with no way to track them. Parents are always worried about safety of their children during commuting to and from their schools. This paper presents an Arduino RFID based intelligent system which is having Arduino Mega 2560 as a main microcontroller and RFID and GPS module is used in order to identifying the children and to track the location of the school bus in real time. In this project, safety systems are also implemented such as drunk and drive prevention system by using an alcohol sensor (MQ-3), accident alert with location by using vibration sensor, and detection of hand movements through the window by using IR sensor. The status information of the children will be send by an SMS using GSM to the concerned authorities. In this way the system will allow the parents to know their children location in real time. By including all those above characteristics, we can ensure the school children's security and safety during their travelling.

Keywords: Arduino, RFID (Radio-frequency identification) Technology, GPS, GSM, Security, Sensors

I. INTRODUCTION

In the Developing country like India, child safety and security is the most difficult task to achieve. Daily lots of students are travelling to and from school through school bus. School buses are always considered as the safest means of transportation for the children. While there are many issues related to the school bus safety that might bother the parents regarding the travel of school going children. On the regular basis, monitoring the students during their entry and exit from the bus is difficult for the drivers, which led to endangering child safety. Apart from education, as a parent we are concerned about our child security. A missing child is a parent's worst nightmare. In recent time, also school management has understood the security measures to be implemented, but in a slower rate. These are the serious hazards to child safety and needs to be deal with it.

The proposed work overcomes these issues and it will help the student transportation in a controlled environment. This model implements an embedded system to monitor the everyday embark/disembark of children in the school bus to enhance the overall safety of the bus commute to/from school. The goal of this project is to join the gap between parents-child and school authority in ensuring security. The system incorporates automation for almost all the key features; the most important of these are accident alert, location tracking and sending messages and bus unit also consists of sensors (MQ-3 sensor, vibration sensor and IR sensor) which will alert the driver during trip and give useful information about the children to the respected parents and school management.

II. LITRATURE SURVEY

Shraddha shah et al. [1] proposed RFID based school bus tracking and security system, this paper gives an SMS based solution which helps parents to track their children location in real time. To track the location GPS module is used and for identity of a child a RFID card is used which will be read by the RFID reader present in the bus and send a text message to the parents. The model also having two safety measures such as drunk and drive prevention system and speed control mechanism. This model implemented in a PIC18F25K22 microcontroller with infra red and alcohol sensor.

Nitin shyam et al. [2] developed an SMS based kids tracking and safety system by using RFID and GSM. This system will have two different modules for tracking the children. One module is carried by a child consisting of GPS, GSM and RFID tag and the other module having RFID receiver fitted in the bus. It increases operational cost of the overall system and also not feasible for a child to carry an extra kit every time he/she goes to school.

III. PROPOSED DESIGN METHODOLOGY

This system consists of Arduino mega 2560, RFID module, GPS module, GSM module, Infra red (IR) sensor, Alcohol sensor, Vibration sensor, LCD (20X4) module, Buzzer, DC motor. Arduino controls the sensors and other components and carried out relevant operations. RFID, GSM and GPS communicate with the microcontroller through serial ports. The ignition system of the bus is also associated with the microcontroller. Sensors sense the condition and send the signal to microcontroller through which

important information will be send to the parents and school authority via GSM. System will be turn on by giving power supply to it. The RFID reader is installed at the bus door, once a child boards/leaves the bus it senses the RFID tag present in the child's identity card and this information shows on the LCD and a message with location will be send to the school authority and parents, if the invalid RFID tag detected then system gives an alarm to notify that the wrong student entered into the bus, at the same time microcontroller records the number of student in the bus or empty the bus by increment/decrement the counter and at the end this information would be send by driver to the school management via pressing a switch. Whenever an accident occur, it will be sensed by vibration sensor and both parents and school management are informed through send an SMS via GSM and drunk driver will be sensed by alcohol sensor and bus will be stop automatically and school authorities get this information through a message send by GSM. IR sensor is used for detecting movement through window which alerts the driver by buzzer.

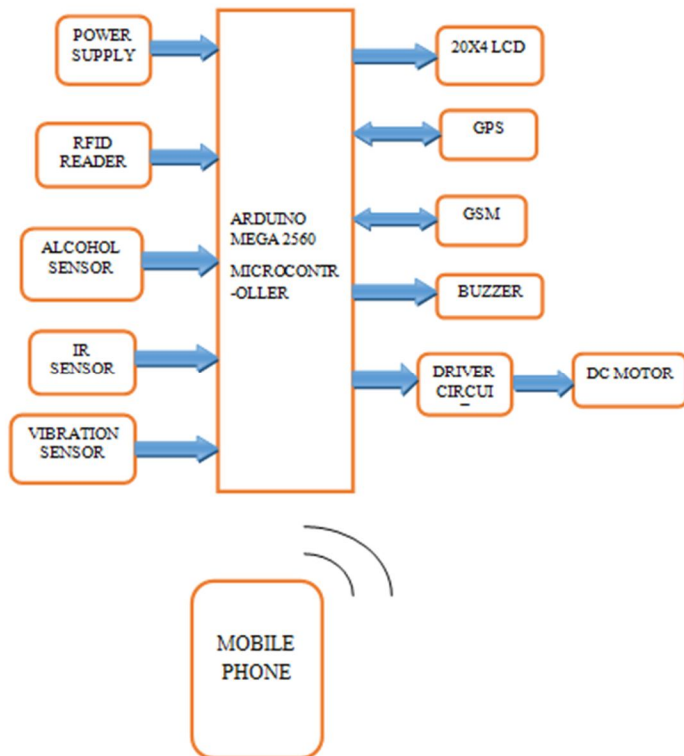


Fig. 1 block diagram of proposed system

IV. HARDWARE IMPLEMENTATION

A. Power Supply

This model works on DC power supply. Firstly, a step-down transformer is used to transform 230V to 12VAC supply and diodes convert it into 12V DC. Capacitor filters 12V DC voltage and further it will be regulated through IC 7805, which will give 5V DC power supply.

B. Arduino Mega 2560

This proposed system uses Arduino mega 2560 microcontroller board based on ATmega2560. It consists of 54 digital pins, 14 analog pins, a 16MHz crystal oscillator, a USB connection, and a reset button. Arduino software is used to program the Arduino mega 2560. Arduino mega has boot loader due to which we does not required an external hardware to burn the new code in the board.

C. Liquid Crystal Display (LCD 20X4)

Liquid crystal display (LCD) is an electronic display module. It has a material that combines properties of both liquids and crystals. It can display 20 characters per line and there are 4 such lines. LDC's are economical, consuming less power, and easily programmable.

D. RFID Technology

RFID is an acronym for Radio frequency identification technology uses radio waves for automatic identification of RFID tags attached to the object.

The RFID reader identifies the object without direct line of sight. RFID technology consists of two basic components: an RFID tags and RFID reader.

The tag exchange information with the reader within the reading range using radio waves that are adjusts over same frequencies. There are two types of RFID tags; an active RFID tags which requires an internal power supply continuously emits radio frequency signal and passive RFID tags do not required an internal power supply, it releases RF signal only in response to a query from a tag.

E. GSM

GSM stands for global system for mobile communication; it is a mobile communication modem through which computer or any other processor can communicate over a network. GSM is an open cellular system which is commonly used in almost every part of the world for transferring mobile voice and data services.

It will be operated through SIM card. It can be connected to a computer through serial, or USB connection. It is a cell phone without display because it receives, send messages and make, reject calls also. Modem can be control through Attention (AT) commands and every command line starts with "AT".

F. GPS

Global positioning system (GPS) is a satellite based radio navigation system used to find the ground position of an object. It consists of network of 24 satellites located into the orbit and can be used to determine longitude and latitude position and trace the movement of an object.

G. Alcohol sensor

MQ-3 sensor is an alcohol sensor that has a good sensitivity to alcohol gas at concentration from 0.05 mg/L to 10mg/L. MQ-3 having SnO₂ sensitive material whose conductivity is lower in clean air, when alcohol concentration in air increases its conductivity increases. Change of conductivity can be converted into output signal of gas concentration. It is a low cost semiconductor sensor and can be easily interfaced with controllers/processors. It consists of both analog and digital data output pins. It works on 5V DC supply and simple to use.

H. Vibration sensor

A vibration sensor has the ability to detect vibrations in particular area where it is kept. In vehicles it is used to observed the collision which is sensed due to vibration and shocks This can be used to help someone against problem with a system, such as accident detection.

I. IR sensor

Infra red sensor is an electronic device that consists of three pins; supply voltage, ground and data pin. It is having led transmitter which emits light in the range of infrared frequency (700nm – 1mm), ranging from few centimeters to several kilometers, another one is photodiode receiver which is drives in reverse bias so it conducts when light fall on it.

J. DC motor

DC motor operates on 3-12V DC supply; it is any of a class of rotary electrical machine which converts Direct current electrical energy into mechanical energy, this is called principle of electromagnetism.

K. Driver circuit (L293D)

L293D is a typical dual H-bridge motor driver integrated circuit which allows DC motor to run on any direction. It consists of 16-pins which are used to handle a set two DC motors separately and simultaneously in any direction. This circuit work based on H-bridge's principle that allows voltage to be flowing in any direction. DC motors required current above 250mA but when they are connected to the controllers cannot obtain this much of current and might be damaged. This problem can be overcome by using driver circuit which acts as bridge between DC motor and controllers.

L. Buzzer

Buzzer is an audio indicator device which converts electrical energy into sound energy. It may be mechanical, electromechanical or piezoelectric. It has operating voltage of 4-8V and resonant frequency of approximate 2300Hz. It has two pins only negative and positive.

V. EXPERIMENTAL SETUP AND RESULT

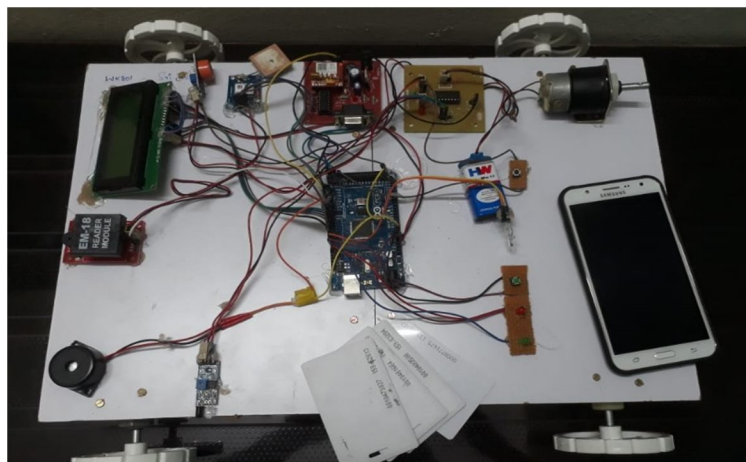


Fig. 2 Experimental setup of the project



Fig. 3 Initiate the system

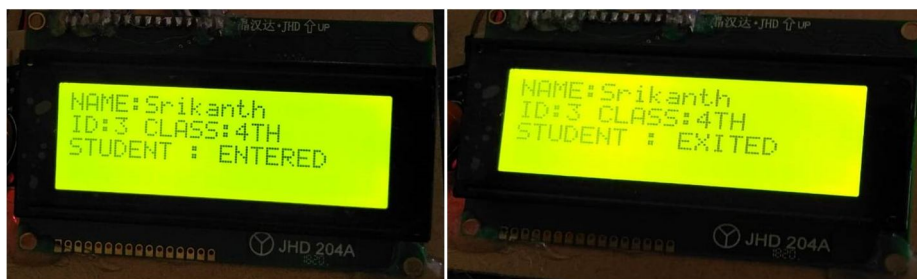


Fig. 4 child entry/exit information



Fig. 5 Student's strength in bus

Fig. 6 Accident alert information



Fig. 7 Alcohol detection



Fig. 8 hand movement detection

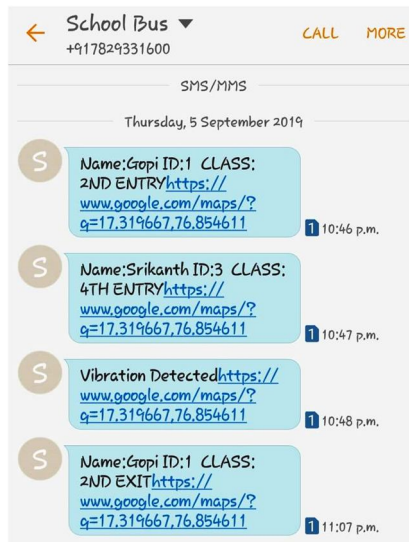


Fig. 9 Text message to the parents

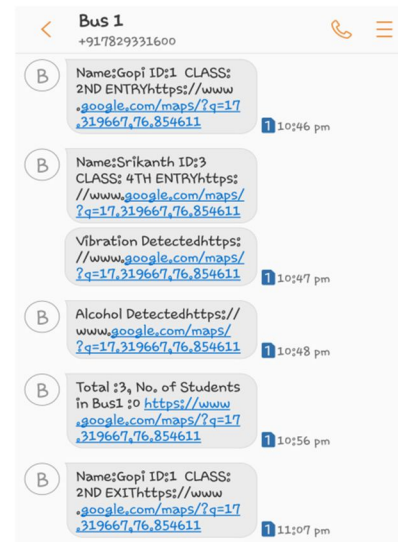


Fig. 10 Text message to the school authority

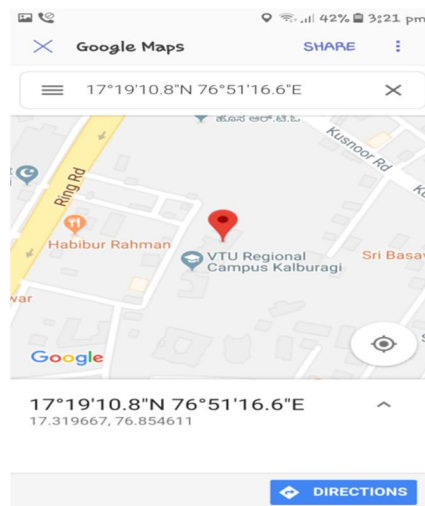


Fig. 11 Bus location information

VI. RESULTS

It is evident that with the use of this system the critical problems related to the security and safety of the students travel to or from school through school bus has been reduced significantly. The proposed model provides the latitude and longitude details of children entry and exit from bus via text message to the parents and school management using RFID and GSM technology. RFID tags given to the students provide unique identification to every child. In addition to location tracking, this system gives indication of an accident and automatically stops the engine when drunk driver is detected and also alert the driver about hand or head movement through window by using different sensors.

VII. CONCLUSION

The proposed model is the best option for monitoring and tracking the children during their drive to and from school on school bus, because it improves safety and security of children going to school. The entire hardware and software components are designed and implemented effectively. Furthermore, expense associated with this intelligent system is nominal. The proposed system acts in an intelligent way by notifying the parents of the children through a message once the child boards/leaves the bus, thus they could track the location of the bus on knowing longitude and latitude information, also the alcohol sensing system, the accident detection and alert system and head/hand movement around bus window perform a significant role towards safe travelling of students, resulting in secure and better rides.

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