School Children Transportation and Safety Enhancement System Based on RFID

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***Abstract* -School uses transfer millions of children daily in various countries around the world. Now a days due to increase in number of kidnapping and road accident cases, Parents always worry about their children. Many children need to commute between homes to school every day. To overcome this security issue we have proposed system which employs a microcontroller to persist the complete task. First the RFID – Reader reads the information of the children who entered the bus at the boarding point and then forwards the information to the microcontroller, the microcontroller then forwards a message to the GSM modem informing about the arrival of student in the school bus and the GSM Module forwards that information to the respected child's parents. This process does not require any additional action by the student and drivers. This system we can also use for public/private transportation.**

***Index Terms* - GSM, RFID, Security, Bus Transportation**

I INTRODUCTION

School buses transfer millions of children daily in various countries around the world. While there many issues that might disturb the parents regarding the travel safety of school going children, the paper intends to look into introducing access safety in respect of school buses through bus tracking system that will help the school children's transportation in a secure and safer way. The supervision of the regularity of students during their entry and exit from the bus is difficult to be controlled by drivers, which led to endangering child safety. The phenomenon of forgetting kids on the bus is one of the problems suffered by the children, which has increased significantly in recent years. This has often led to the death of many students on account of suffocation due to the lack of attention of derivers. This project, through entry and exit recordings, aims to create a suitable environment by following certain set of criteria of security and safety for school bus that will have a positive impact on the student and their family. The paper proposed a bus safety system which was designed to control the entering/exiting of students from the bus. This system does several tasks, including identifying personal information of each student using RFID tag, which will exchange the data with the RFID reader via radio waves and displaying each student name into LCD display. This will let the driver to know the number of students inside the bus and the students who departed from the bus. Moreover, the system has an emergency system that will alert in case if there is a child inside the bus after the bus stops at the destination by sending an SMS to the school management via GSM modem. In addition, if the bus depart and arrive successful from the source to destination, it will inform the management through an SMS about its successful departure and arrival. The key novel feature of the proposed methodology is the use of energy efficient systems to support the tasks. Though not within strictly in the scope, the same data can be used to assess the time of departure and arrival, number of students travels each day.

II LITERATURE REVIEW

A literature review has showed there are many studies made use of Radio Frequency identification (RFID) as a system that transmits the identity of an object using radio waves by Kumar [1]. This identity is transmitted in a form of serial number that distinguishes each object from others. The RFID system consists of an RFID reader and an RFID tag. The tag consists of the microchip that is connected to an antenna; microchip can store a maximum of 2 KB of data, which may include data and information about the product, manufacturing date, and destination. Further, the author also observed that the ability of the reader field decreases quickly with increasing distance, which defines the area of reading to 4-5 meter distance using VHF 860-930 MHz. Another research Ben & Abdullah [2] introduced a system that monitors children inside the bus in a safe manner. It uses a combination of RFID, GPS (Global Positioning System), and GPRS (General Packet Radio Service) technologies. Each student carries a unique RFID card. The card is embedded in each of the student's school bags. Whenever a student enters or exits from the bus, the reader records the time, date, and location and then transfer the data into a secure database and this does not require any action from the drivers and students. The system enables parents to receive instant SMS alerts within 10 minutes of the designated pick up and drop off points, reducing the time the child spends on the street. The system will also notify the parents via SMS when the student boards from the bus or when entering and leaving the school, this will make the parents take the appropriate action because they have precise answers to boarding statue and times. If the child is still inside the bus for a predetermined period after running the bus engine, and bus's doors are closed, a message will be sent to school management, and the system will display the location of the bus.

Anon [1], presented a system which is called, Smart School Bus Architecture. The student swipes the card at the RFID reader while boarding the bus, when the RFID reader transmits the student identification to mobile DVR, which will transmit student

identification to the CMS server using 2G/3G/WIFI network. The CMS server will send SMS to assigned parents mobile, then the parents will receive the message and then the bus will depart. During the bus is moving, the mobile DVR will record (video/audio) the various school bus spots that will be shown in the CMS server through 2G/3G/WIFI network as well as there is a GPS used for tracking and monitoring the smart bus location at the central monitoring site. School management permits and allows parents to access the monitoring system that enables them to monitor their children via the internet using browse/CMS client. In case of incidents, urgent communication or alarm trigger on the CMS server by the driver and then the CMS administrator will communicate directly with the driver using a mobile DVR system through 2G/3G network.

V. Sivasankaran [2], et.al proposed a RFID –GSM technology to provide the security to the school children. The RFID tags are attached to the children bags for tracking and GSM is used to send the messages to the parents [2].

M. Navya [3], et.al Proposed GSM-GPS technology to track the children students. GPS is used for identifying the student location. GSM is used to send the information to the parent android mobile. Monitoring database is provided at the control room of the school [3].

Zonar [4], has designed the Z pass specifically for school buses for monitoring and tracking the students in a safe manner. Z pass provides accurate and immediate answers. This system uses RFID with a small card carried by the student containing passive RFID technology that records each student's entry or exit automatically when the student passes from the scanner device that located in the school bus. Through that, parents can receive information from the student through the mobile phone or computer browser with Z pass+, which gives parents a new level of comfort and confidence, using the information that is collected from Z pass, simple notifications send directly whenever the child gets on or gets off from the *school b*us through SMS to the parent's mobile phone.

III EXISTING SYSTEMS

The existing technology over school transportation and child safety system do not exercise any advance technological in electronic devices that may acknowledge the child parent about the arrival of their child to school, the parents are unaware about the information whether their child has attended the school or not, so to eliminate this problem , we design a RFID Based System for school children transportation and safety enhancement that confer an acknowledgment message to the respected parents about the child's arrival to the school at the boarding point itself.

Proposed Design:

The proposed system utilizes RFID Technology, GPS Technology and GSM Technology and all together integrated into a single system which results in advanced and sensible implementation. This system would be much flexible and reliable with respect to its functionality, since the design includes both RFID and GSM systems for communication.

Hardware Requirements:

1. Microcontroller
2. RFID – Reader, Tag.
3. GPS Module
4. GSM Modem
5. LCD
6. Power Supply

GSM Modem Software Requirements:

1. Keil IDE
2. Embedded 'C'
3. ORCAD

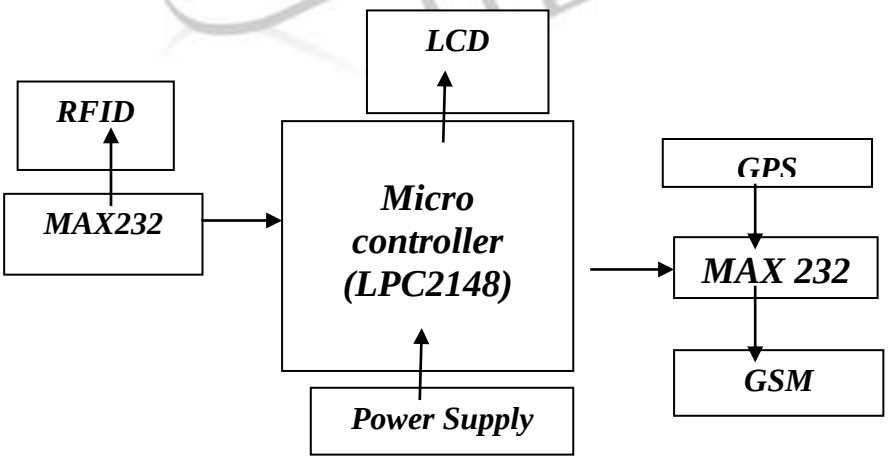

Figure: Block Diagram

IV SOFTWARE

Overview of KEIL CROSS C COMPILER:

It is possible to create the source files in a text editor such as Notepad, run the Compiler on each C source file, specifying a list of controls, run the Assembler on each Assembler source file, specifying another list of controls, run either the Library Manager or Linker (again specifying a list of controls) and finally running the Object-HEX Converter to convert the Linker output

file to an Intel Hex File. Once that has been completed the Hex File can be downloaded to the target hardware and debugged. Alternatively KEIL can be used to create source files; automatically compile, link and covert using options set with an easy to use user interface and finally simulate or perform debugging on the hardware with access to C variables and memory. Unless you have to use the tolls on the command line, the choice is clear. KEIL Greatly simplifies the process of creating and testing an embedded application.

Microcontroller:

The famous families of microcontrollers are AVR, and PIC. PIC18F45K22 is one type of the PIC that has been chosen for this experiment. PIC18F45K22 introduces and offers design enhancements that make it the best choice for most applications. Low power, high performance, high computational performance, high endurance, and flash program memory are some features of this PIC.

LPC2148 microcontroller board based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine microcontrollers with embedded high-speed flash memory ranging from 32 KB to 512 KB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30% with minimal performance penalty. The meaning of LPC is Low Power Low Cost microcontroller. This is 32 bit microcontroller manufactured by Philips semiconductors (NXP). Due to their tiny size and low power consumption, LPC2148 is ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale.

RFID – Reader, Tag:

The function of the RFID reader is integrated with RFID tags. It contains the reader module, which works as both the transmitter and receiver of radio frequency signals. The transmitter consists of an oscillator to create a carrier frequency, a modulator that impacts on data commands, and amplifier to enhance the signal enough to awaken the signal. On the other side, the receiver has a demodulator to extract the restored data and it contains an amplifier to strengthen the processed signal. The microcontroller forms a control unit that stores data and then sends it to the network. They have three series set ID3, ID12, and ID20 and these all are LA series. The experiment uses ID20LA innovation as it is the biggest kind of ID. It can be read any RFID card within range, and any microcontroller can easily read it.

Figure: RFID reader and vibration sensor at the entrance of the bus

Each student is housed with RF identity card. The indentifying information stored in the microchip transmits to the RFID reader using an antenna. RFID reader is equipped at the entrance and exit gate of the bus. The reader will communicate to the ARM7 microcontroller serially using the line driver MAX 232 to verify the threshold value. Fig.3.1 shows EM 18 used as a RFID reader. FIG 3.2 shows the controlling circuit of the bus.

Figure: Control circuit view of school bus

RFID tag stores unique digital identity codes that can be scanned from a distance and as well as to capture the signals and send them to the reader. RFID comes in different forms such as a label card, which can have a barcode printed on it. RFID tags are used in many industries, where it can be used to track by suspending it in the automobile during production or it can be injected

into animals that allow identifying the animals. In addition, it can be attached to clothing or even implanted in people to determine the identity of the person. RFID tags can be active, passive, or semi-passive.

GPS Module:

A GPS navigation device is a device that accurately calculates geographical location by receiving information from GPS satellites. Initially it was used by the United States military, but now most receivers are in automobiles and smart phones.

It stands for Global Positioning System. GPS are a satellite data to calculate an accurate position on the earth. These calculation can be relates to the user position. It provides the accuracy to search the exact location. In GPs it is important that the receiver giving the data which is required.

Figure: GPS device

GPS devices may be able to answer:

- The roads or paths available,
- Traffic congestion and alternative routes,
- Roads or paths that might be taken to get to the destination,
- If some roads are busy (now or historically) the best route to take,
- The location of food, banks, hotels, fuel, airports or other places of interests,
- The shortest route between the two locations,
- The different options to drive on highway or back roads.

GSM Modem:

SIM900 GSM modem is used in this implementation as it allows sending SMS to the management of the school via internet. This modem is a type of modem that accepts SIM card, and operates through a subscription to a mobile operator. It works like a mobile phone for sending and receiving SMS or MMS through radio waves. It is slim and compact, the main advantage of choosing this particular modem is, it has low power consumption. This modem has a GPRS feature that allows transmitting the data via the internet in different methods such as SMS, GPRS, or CSD.

The GSM network is divided into three major systems: the switching system (SS), the base station system, and the operation and support system (OSS). The basic GSM network elements are shown in fig.

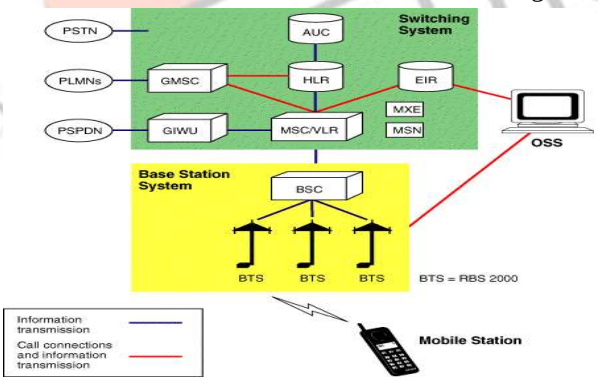

Figure: GSM Network Elements

The Switching System:

The switching system (SS) is responsible for performing call processing and subscriber-related functions. The switching system includes the following functional units.

- **Home Location Register (HLR)**—The HLR is a database used for storage and management of subscriptions. The HLR is considered the most important database, as it stores permanent data about subscribers, including a subscriber's service profile, location information, and activity status. When an individual buys a subscription from one of the PCS operators, he or she is registered in the HLR of that operator.
- **Mobile Services switching center (MSC)**—The MSC performs the telephony switching functions of the system. It controls calls to and from other telephone and data systems. It also performs such functions as toll ticketing, network interfacing, common channel signaling, and others.

- **Visitor Location Register (VLR)**—The VLR is a database that contains temporary information about subscribers that is needed by the MSC in order to service visiting subscribers. The VLR is always integrated with the MSC. When a mobile station roams into a new MSC area, the VLR connected to that MSC will request data about the mobile station from the HLR. Later, if the mobile station makes a call, the VLR will have the information needed for call setup without having to interrogate the HLR each time.
- **Authentication center (AUC)**—A unit called the AUC provides authentication and encryption parameters that verify the user's identity and ensure the confidentiality of each call. The AUC protects network operators from different types of fraud found in today's cellular world.
- **Equipment identity register (EIR)**—The EIR is a database that contains information about the identity of mobile equipment that prevents calls from stolen, unauthorized, or defective mobile stations. The AUC and EIR are implemented as stand-alone nodes or as a combined AUC/EIR node.

The Base Station System (BSS):

All radio-related functions are performed in the BSS, which consists of base station controllers (BSCs) and the base transceiver stations (BTSs).

- **BSC**—The BSC provides all the control functions and physical links between the MSC and BTS. It is a high-capacity switch that provides functions such as handover, cell configuration data, and control of radio frequency (RF) power levels in base transceiver stations. A number of BSCs are served by an MSC.
- **BTS**—BTS handles the radio interface to the mobile station. The BTS is the radio equipment (transceivers and antennas) needed to service each cell in the network. A group of BTSs are controlled by a BSC.
- **GSM interworking unit (GIWU)**—The GIWU consists of both hardware and software that provides an interface to various networks for data communications. Through the GIWU, users can alternate between speech and data during the same call. The GIWU hardware equipment is physically located at the MSC/VLR.

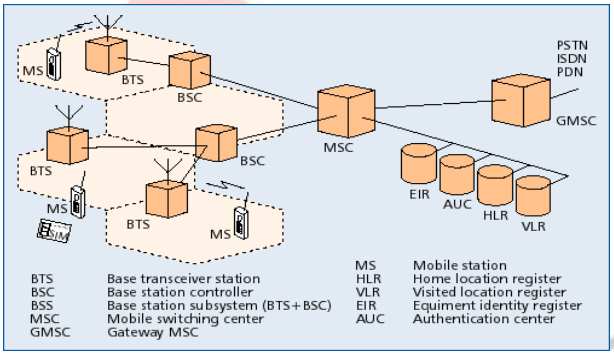

Figure: GSM interworking unit

GSM Security:

GSM was designed with a moderate level of security. The system was designed to authenticate the subscriber using a pre-shared key and challenge-response. Communications between the subscriber and the base station can be encrypted. The security model therefore offers confidentiality and authentication, but limited authorization capabilities, and no non-repudiation.GSM uses several cryptographic algorithms for security.

LCD:

The experiment used 16x2 LCD as it is economical, and easily programmable. 16x2 LCD means that it is able to display 16 characters per line on two lines. This LCD has two resisters. Liquid Crystal Display (LCD) is an optical device consisting crystals arranged on a thin surface. LCD has certain features such as; its size is much less than the regular screen, light and easy to transport, does not need high voltage of electricity like in the regular screens, comfortable for the eyes compared to regular screen, their shape is much better than normal screen, and its quality is higher than normal screens in terms of colors.

V CONCLUSION

The proposed system utilizes RFID Technology, GPS Technology and GSM Technology and all together integrated into a single system which results in advanced and sensible implementation. This system provides various advantages to student as well as management. Because the message is send to both parent as well as school authorities after entering in bus. So safety point of view this system resolve the all problems which are present in previous because here we use the various latest technology like GPS , RFID which gives the exact position of bus. RFID Technology is one of the best solution to eliminate all types of problems.

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