

REVOLUTIONIZING SCHOOL SECURITY: RFID-BASED ENHANCEMENTS

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Abstract: *In an era marked by an alarming rise in kidnapping, missing children, and road accidents, parental concerns for the safety of their children have heightened. With parents often burdened by demanding work schedules, there is a growing need for schools to assume responsibility for their students' well-being. This paper explores the implementation of an advanced RFID-based system to address this pressing issue, enabling schools to proactively monitor and secure their students' daily commutes.*

The proposed system deploys technology to automatically track students' movements, including their bus rides. In the event of a student boarding the wrong bus, the system triggers alerts through mechanisms like buzzers and light-emitting diodes (LEDs), ensuring prompt intervention. Moreover, a programmed SMS notification system promptly informs parents if their child is absent at the commencement of the school day. The system incorporates RFID-based detection units within school buses, each equipped with RFID tags for individual students, which allows real-time tracking and database updates.

This paper outlines the RFID system's design, its role in fortifying school security, mitigating illicit activities, and reducing parental stress. It also discusses the relevant literature, presents an analysis of the system's effectiveness, and offers research findings and insights. The paper concludes by underlining the significance of this technological solution in enhancing student safety and overall school security.

Keywords: *RFID-Based System, Student Safety, Parental Concerns, School Security, Automated Notification System*

I. Introduction

Nowadays with the increment number of kidnapping, missing children and road accident cases, parents become worry about their children. However, parents usually has a long working hours, which mean they don't have enough time to take care and look after their children. In this case, it is the duty regarding the school to deal with their students. This will help them to know everything may occur to students in-time and sending warning message to their parents in case of children are not at the school when the time of school start.

However, it's so difficult and time consuming to try and do this manually. The school administration cannot check their students one by one and or even notify their parents too. So, in this case the best is by using a technology or system that will notify the student like ringing buzzer or by light-emitting diode (LED) in case of student entering wrong buses [1]. In addition, a programmed SMS sending system will

be used in order to inform student's parent in case if any children won't arrive school at school beginning time. RFID -based detection unit placed within the bus which detects the RFID tags for each students. Additionally, the system will check the children absence and updates the information database. However, the parents can easily access system web site and check or modify details of their children. This paper presents RFID system and how it enhanced security system for school by avoid crime, illegal activities by students and reduce stresses among parents. The rest of this paper is organized as follows. Section 2 present the overall system design. Section 3, reviews literature work. Section 4 discuss analyze and result. Section 5, research discussion findings. Finally, section 6 concludes the research.

II. Details of the System

Table I. Components used in the system

Components	Specifications
RFID reader	MFRC522 13.56 MHz (high frequency) Reading Range (10cm – 1m)
RFID tag	Passive tag S50 IC Card 1kbyte EEPROM
Controller	Arduino Mega 2560 Clock Speed (16MHz) EEPROM (4KB) SRAM (8KB) Flash Memory (256KB)
GSM Module	SIM900A

- RFID reader: Electronic a device used to transmit signals from RFID tag
- RFID tag : ID system which contain information about the object .
- GSM module Unit: used for sending SMS message and transferring data .
- Controller/ Host computer: receives tags data from a reader.

RFID system has two main components: bus unit and school unit. The first unit is located inside the school bus, and the second unit located inside the school. The bus unit function is tracking the child whenever he loads up or leaves the bus and then sending this information school unit. The school unit is the focal unit where it gathers information from all buses, adds them to system database, checks if there are missing any student, and it sends an instant SMS notice to their parents [2]. Figure.1 shown block diagram of the system. This Block Diagram comprises of RFID (radio frequency identification),

Controller (Arduino Mega 2560) , SD card module , Buzzer and GSM Module (SIM900A) and webpage [1].

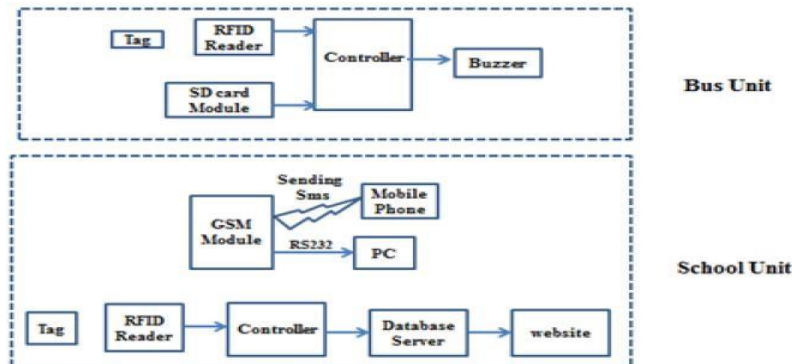
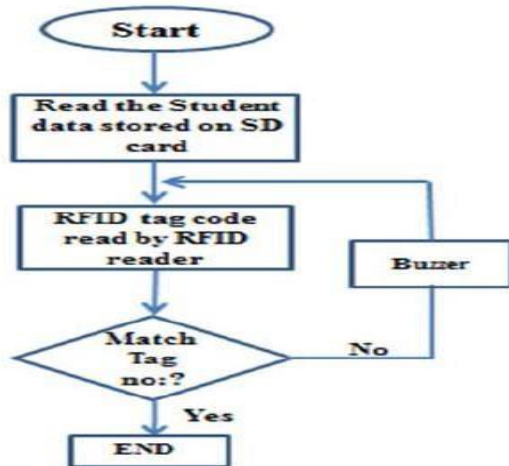


Figure1. Block Diagram of the system

a. Bus Unit Description

This unit is used to recognize the students when they load up/leave the bus. To accomplish this purpose, it will use RFID technology. This technology has two main components, which are the reader and tags. Usually, the controller will check if the ID tag is matched with the student list recorded on the SD card. However, the alert will send a notification alarm if there is an ID mismatch. There are three different types of RFID readers available based on their frequency ranges: low level frequency, high level frequency, and ultra-high level frequency [3]. However, it is better to use UHF RFID reader, because it transfers data in a quick time than the others [3]. One of the RFID features is the ability to control distance as required. The RFID reader will be located at the entrance of the bus. It will be positioned where it will just distinguish the children when they are inside the bus. However, in case of a child was outside close to the bus, the reader will not be able to detect him. Each student will have an ID card and each card will contain an RFID tag attached to it. The school unit is the central unit where it will collect information and data from the bus unit to be stored and processed. Other related student's information can be recovered from the database based on the received information for further use such as sending SMS to parents [2]. RFID tag is an ID system that uses for identification and tracking purposes. For RFID tags, there are two types, passive and active tags [3]. Most tracking applications use passive RFID tags because they have a short reading range which is suitable for school administrative requirement to detect the student when he is near to the reader (i.e. whenever s/he coming or leaving the bus). Also, this kind of tags are less expensive in contrast with active RFID tags and do not need maintenance or regular replacement of battery like active tag. The Flow Diagram of the controller is shown in Figure.2. Firstly, the student list that is stored on the SD card will be read by the controller. Then, the RFID tag code will be read by the RFID reader. All data will be sent to the SP controlled device in byte form. The controller will check if the read tag ID matches with the stored ID [1].

Figure.2. Flow chart of Bus unit

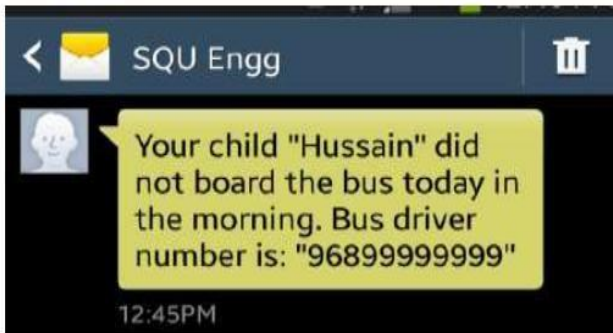


b. School Unit Description

The school unit consists of two main parts which are a server and GSM module [4]. The Server is connected with all RFID readers which works as database server to collect data. In addition, the server has direct connection with SMS Module to send automatically warning notification in case of student detected missing as shown in figure 3.

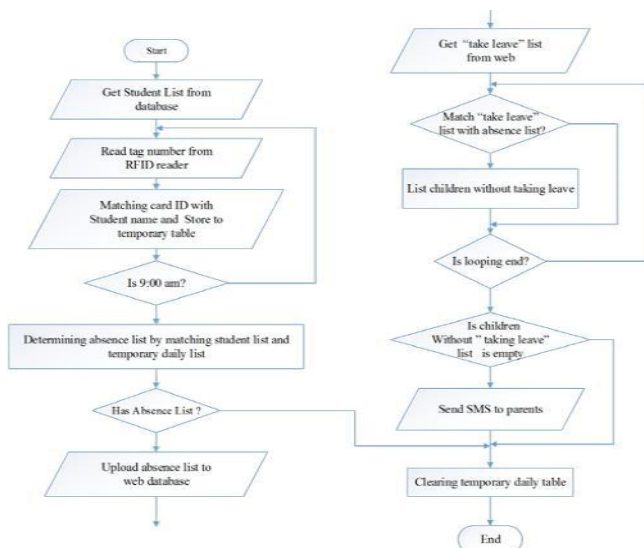
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Figure.3. SMS notification message send to parents.



The flow chart of the school unit is shown in Figure.4. First, attendance list is stored in temporary table. In order to decide the absence, the system will match attendance list with absence list. The new list will be uploaded to the system website. Notification SMS will be automatically sent to parents if any of their children has detected missing.

Figure.4. Flow chart of School unit



c. The RFID Reader

A RFID Reader is electronic device used to collect data from a RFID tag, which track any movable items and objects. Radio waves are transfer from the tag to a reader. RFID reader is incorporated with RFID tags. It has two functions and work as both the transmitter and receiver of radio frequency signals [5]. The RFID reader sends set of radio waves to the tag and waiting for the tag's response. The tag detects this energy and transmit feedback signals to reader which contains the tag's serial number and perhaps some related data too.

d. GSM Modem / SMS Notifications

The GSM module is usually connected to the PC .It use to send SMS messages to the administration of school by internet. This modem is a sort of modem that can accepts SIM card [6].

In addition, Itused like a mobile phone in order to send and receive SMS or MMS through radio waves. It is responsible for notifying the parents in case of any problem by inform them using SMS messages as shown on Figure.5.



Figure5. the parent notification message

e. Web-based Application

For Web-based the server is implemented in PC. There are three modules, absence list, roll call and services . The pages are created and developed using scripting language which should be compatible with all major web browsers. The website accept request and responds back from the user's browser . Only Parents can have permission to log in to website. Also they can use mobile phone to get access to web site. Figure.6. shown Only the approved individual can get access to absence list or anyother services.

Figure.6. In order to take leave for their children ,Parents should fill absence form.



III. Literature review

A recent literature review on this area has showed that many studies made use of (RFID) system for tracing identity of an object using radio frequency waves by Kumar [7]. The identity of any object is transmitted in a form of serial number that recognizes and distinguishes each object from others. The system has two main components, RFID reader and RFID tag. The tag has small microchip that is connected to an antenna. The microchip can keep a maximum of 2 KB of data, this data contain all information about the product and other related data. Moreover , the author also notice that the ability of RFID reader affectedby the object distance, which mean that the distance of reading should be between 4-5 meters.

Another research study by Khaled Shaaban [3] propose a system that monitor children inside the bus. The system work with combination of three technology's such as GPRS (General Packet Radio Service) RFID and GPS (Global Positioning System). Every student should have a unique RFID card and it should be embedded in their bags. The reader records ID number , time, date, position and location information when the student enters or exits from the bus, and then transfer this data into a secure database and this does need any action from the drivers or students. The parents will get SMS notification alerts within 10 minutes .In addition, the system will notify the parents two times ,when the student load up from the bus and when entering / leaving the school. By this way the parents will take the appropriate action if any case happen . However, If bus's doors are closed and bus engine start running and student still inside the bus, Automatic SMS message will be sent to school administration, and the system will display and identify location of the bus. Also, the system contain a web -based reporting for getting accurate Information and reports for all activities of students and bus.

Another research presented a system which is called, FRID imparted student monitoring device [5]. The system includes observing the child's movement to and from school.

The Implementation of system using RFID (Radio Frequency Identification Reader) can offer additional security application for children since it has good accuracy and security. One of the main

benefits of using that system is to provide access to real-time information, enhancing the effectiveness, efficiency and safety, significantly reducing management cost.

IV. Analyze and Result

Many studies proposed RFID (Radio Frequency Identification) for schools attendance system and bus tracking system to ensure Child-safety. RFID technology can achieve a lot of advantages for schools such as its easy to track student movement inside the school. And this can be work if RFID readers are well installed school. It became easy to track students location and position whether they getting off at the right stop. The RFID system allow sending warning message to student parents to inform them whenever child has boarded the bus/reached the school. RFID make it easy to take attendance and save time so no need for teachers to take attendance manually and also generate attendance reports.

V. Dissection

The case of missing students on the school bus has increased significantly in recent years and this is consider as one of the most problems suffered by school administration. RFID technology is play as a practical option for tracking students whenever they travel and still acts as one of the best solution to enhance the security and safety in school. School administrators are encouraged to have the RFID attendance system because it ensures only accredited people entering the school premises. Despite the advantages of using RFID Attendance System there are some limitations. Although RFID system is secured there is a chance of abusing the cards. One student can give someone else's student in the case that he/she had RFID card. If card was passed for more than once, the system giving attendance for next days and if code is not written correctly.

VI. Conclusion

The Safety and security purpose System for School Children Using RFID is very important nowadays due to increase number of accidents and cases of missing children. RFID system used for so many purposes such as tracking position and monitoring children during their trip also it's a good system solution for getting an accurate attendance information.

The Research showed that RFID tracking technology is consider as one of the best solution for school security enhancement, which will reduce the number of accidents and cases of missing students inside the bus.

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