

BUS SAFETY SYSTEM FOR SCHOOL CHILDREN USING RFID AND BY USING ARM

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ABSTRACT

This paper presents a system to monitor pick-up/drop-off of school children to enhance the safety of children during the daily transportation from home to school. The system consists of two main units, a bus unit and a school unit. The bus unit the system is used to detect when a child boards or leaves the bus. This information is communicated to the school unit that identifies which of the children did not board or leave the bus, Issues an alert message accordingly and gives information of allotted seat numbers to the students. The system has a developed web-based database-driven application that facilitates its management and provides useful information about the children to authorized personal. A complete prototype of the proposed system was implemented and tested to validate the system functionality. The results show that the system is promising for daily transportation.

Keywords—Hardware Components:

Microcontroller (ARM7)RF ID Card Audio Speaker Driver Circuit

Software: *Kiel U vision Embedded 'C' Express PCB ISP*

1. INTRODUCTION

Children safety is of utmost importance to their parents. Despite the best safety measures, children, due to their lack of skills to protect themselves, may end up in a situation that endangers their life (e.g. crossing the road without paying attention to traffic). In this paper, we focus on a particular risk associated with the daily bus trip to and from school. There have been previous incidents where a child is forgotten in the bus and eventually die because of suffocation To improve transportation safety, some schools employ a bus supervisor to look after the children inside the bus. Nonetheless, human oversight or supervisor absence may still lead to a heartbreaking ending as in the previously cited stories.

This paper presents a system to monitor the daily bus pick-up/drop-off of children to enhance the overall safety of the daily bus transportation to/from school. The system aims at automatically detecting when a child boards or leaves the bus and issue an alert message when a child does not board or leave the bus to reduce the parents' concerns about using the bus for the daily transport of their children without being lost or forgotten.

The rest of this paper is organized as follows. Section 2 reviews the most relevant work to the

theme of this paper. In section 3, the overall system design is presented. Section 4 gives a detailed description of system implementation and testing. Finally, section 5 concludes the paper.

2. RELATED WORK

This section presents the most related work to the problem addressed by this paper. In a system is proposed to track the children using a child module that transmits the tracking information to a database and a mobile device. The disadvantages of this system are that the module may not be convenient for children and wide-scale deployment is expensive. Authors in report a tracking system that utilizes Android terminals that communicate among themselves using Bluetooth technology to form clusters. The clusters communicate the relevant information using WLAN. The major drawback of this system is that the deployment cost is high. There are commercial systems for tracking children such as Bluetooth-based tracking devices which are designed to be worn by children as a bracelet or a necklace. In this type of tracking, these devices can be connected with a mobile application and can alert the parents if their child went outside a range specified by them. If the child walked outside this range, the device will send an alert to the parent. In addition, the application sends the location of the child by using a geographical map. One disadvantage of this type of applications is that they work only in a limited range.

Other products may rely on biometric features such as the Kid track biometric system in which the children scan their palms across a palm reader when they enter the bus. It uses an infrared light to image the palm unique pattern. It uses green and red LEDs to ensure the scan works. Then, the scans are sent for cross-referencing against a secure database of pre-registered users' patterns. Based on this, the administration can find the information of that bus, where and when it tracked the child, and where the bus was at that time. The disadvantages of this approach is that it is not automatic and difficult for young children to place their palms correctly on the scanner. This may lead to inaccurate data if the scanner did not detect a child's palm.

3. SYSTEM DESIGN

3.1 System Engineering Requirements

Our system is designed with the following engineering requirements:

1. The system should recognize each child and detect when every child boards or leaves the bus.
2. The system should have a database to store student's information.
3. The system should be easy to re-configure.

3.2 Design Constraints

The constraints are the restrictions on the design. They are imposed by the environment and the customer. The constraints considered in our system are:

1. The system should not be harmful for human beings or the environment.
2. The device should hurt the child in any way.
3. The system should provide an option to choose between different Languages.

4. Children's information should be available for authorized personal.

3.3 Top Level Description of the Proposed System

The system is divided into two main units: bus unit located inside the school bus, and a school unit located inside the school. The bus unit is responsible for detecting the child when he boards or leaves the bus and then this information is sent to the school unit. The school unit is the central unit where it collects data from all the buses, adds them to the system database, checks if there are missing children, and it sends a text message notification to their parents. The proposed architecture is shown in figure 1.

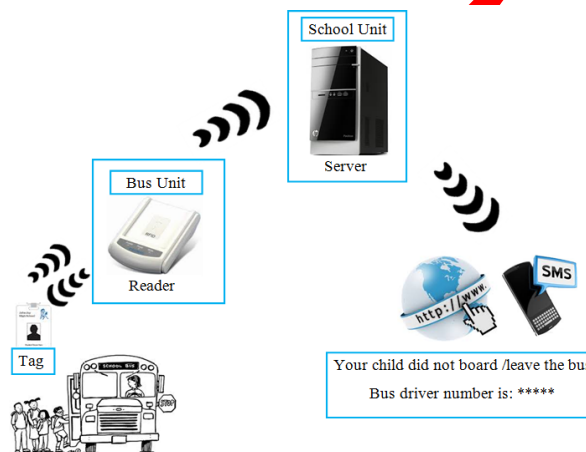


Figure.1: The Proposed System Architecture

Our proposed system provides the following advantages:

- 1 The system uses RFID tags for children detection which is not harmful since it uses frequency ranges that are safe and legally approved.
- 2 The deployment cost is reasonable.
- 3 The system is automatic and user friendly.

A. The Bus Unit Description

The bus unit will detect the children when they board/leave the bus. It will use RFID technology to achieve this purpose. This technology consists of a reader and tags. There are three types of RFID readers based on their frequency ranges, low frequency, high frequency and ultra-high frequency. We chose to use UHF RFID reader, because it has a faster data transfer than the others. The RFID reader will be located inside the school bus by the entrance. It will be positioned where it will only detect the children when they are inside the bus. But if the child was outside near the bus, the reader will not detect him. Each child will wear a card with RFID tag attached to it. The bus unit is responsible for sending relevant tag information to the school unit where it will be stored and processed. Based on the received information, other related child's information can be retrieved from the database for further processing (e.g. texting the parent).

There are two types of RFID tags, passive and active tags. We chose passive RFID tags since they have a short reading range which fit our requirement to detect the child when he is close to the reader (i.e. when s/he boards or leaves the bus). Moreover, they are cheaper than active RFID tags and need no maintenance in contrast to active tags that need maintenance and regular replacement of battery

B. The School Unit Description

The school unit consists of a server interfaced with GSM modem to receive data from the bus. The server simultaneously acts as database server and web server to host the web-application developed to manipulate the system setting, update, and query the system database. In addition, the server communicates with an SMS gateway to send notification in case a child is detected missing.

C. System Database

The database of the system has to meet certain business rules. A business rule is “a brief, precise, and unambiguous description of a policy, procedure, or principle within a specific organization” [9]. It helps to determine entities, attributes and relationships of the database. The business rules of the database of our system are:

- 1 A child can be in only one bus, but a bus may have many children.
- 2 A child has one or many relatives.
- 3 A relative may have many children registered at the school.
- 4 A bus may be driven by one or more drivers, but a driver can drive only one bus.
- 5 A child may have many attendance records, but an attendance record has one child.

The Entity-Relationship (ER) diagram of the database is shown in figure 2.

D. The System Web-based Application

One essential part in our system is the database-driven web-based application to manipulate the system, update, and query the database. There are two options to log into the website, as a parent or as an administrator. The administrator can add, modify, delete or view information about students and their relatives, buses and drivers. On the other hand, each parent can view the status of his/her children if they board/leave the bus in the morning and afternoon.

4. RESULT

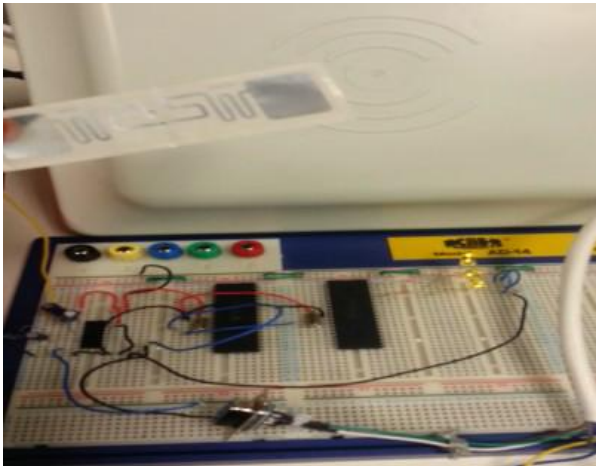


Figure:4 Reader-microcontroller interface circuit

#	Relative Name	Relative Type	Phone Number	Student Name	Bus ID
1	Shaikha Al-Jahdhami	Aunt	96897252277	Mohammed Al Jahdhami	b0002
2	Shaikha Al-Jahdhami	Aunt	96897252277	Ilaf Al-Jahdami	b0002
3	Salim Al-Jahdhami	Father	96896339229	Mohammed Al Jahdhami	b0002
4	Salim Al-Jahdhami	Father	96896339229	Ilaf Al-Jahdami	b0002
5	Alya Al-Lawati	Mother	96899356218	Hussain Al-Lawati	b0001
6	Anwaar Al-Lawati	Aunt	96892592019	Areej Al-Lawati	b0001
7	Anwaar Al-Lawati	Aunt	96892592019	Taha Al-Lawati	b0001
8	Ala Al-Lawati	Father	96898050105	Areej Al-Lawati	b0001

Figure4.1: Accessing existing information

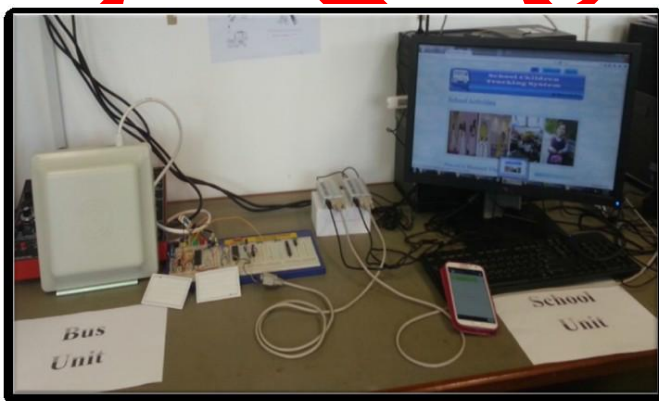


Figure.4.2 The full integrated system

6. CONCLUSION

This paper presented an RFID-based system that aims at enhancing the safety of children during the daily bus trip to and from the school. RFID-based detection unit located inside the bus detects the

RFID tags worn by the children. the relevant data to the system database server. The system checks and detects which child did not board or leave the bus and issues an alert message to this effect. In addition, the system checks the children attendance and updates the database. The parents can log into system website and monitor the details of their children

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