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An Android Application of School Bus Tracker Based on RFID Technology

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Abstract*— Tracking of schoolchildren to ensure their safety is one of the major concerns facing parents and school administrators in the world and Sudan is not an exception. The aim of the proposed system is to eliminate the phenomenon of losing schoolchildren with lower cost, easy to use mechanism, and less human error. Radio Frequency Identification (RFID) technology is used to identify the schoolchildren ID and Global Positioning (GPS) technology to provide real time coordinates of the school bus. The system is a Client Server based system where an android application represents the client side and a local host server XAMPP contains the database for the server side. The proposed system is tested using real case scenarios and the results through Google Maps proved to be accurate and easy to use.

Keywords*— android application, school bus tracker, RFID, GPS, XAMPP

I. INTRODUCTION

The safety of the schoolchildren is one of the main concerns for parents and school administrators around the world including Sudan. To ensure their safety especially in their daily journey between homes and schools. Tracking system is the needed solution to avoid forgotten them inside school buses or kidnaped them. The proposed system is an interactive android application for tracking developed mainly to be used in Sudan. The system is based on RFID passive technology with real-time GPS tracking and a database located in a server.

The structure of this paper consists of five sections. In section II, related work is provided. In section III, the methodology is presented. Section IV contains the results and discussion. Finally, section IV shows the conclusion.

II. RELATED WORK

Various school bus tracking systems was developed in the past. The most common hardware used is RFID technology to identify and track schoolchildren and GPS for the coordinators. The notification is delivered offer several technologies including SMS via GSM network. SMS has limitation not only from a technical perspective but also from content and cost effectiveness as well. The proposed system proved cost effective, it costs 50% less than other systems because it eliminates GPS, GPRS modules, and LCD. Moreover, the proposed module is proved to be suitable for Sudan.

Table 1. Summary of Related Works

Authors	Proposed Work	Technologies Used	Tracking Model	Result
Al-Ismaili, et al [1]	Bus safety system for school children.	RFID technology & GSM module.	GSM based Model	An SMS message is sent to the management of the school whenever a remaining student inside the bus.
Al-Lawati, et al [2]	Web-based database-driven application.	RFID technology, GSM module, & website.	GSM based Model	The system checks which of the children did not board or leave the bus and issues an alert message accordingly.
Ghareeb, et al [3]	Tracking System for School.	Mobile application & website.	GSM + Client-Server based Model	Enables parents to track their kids while they are in the bus and notifies them before bus arrival to their houses.
Khalid & Rosli [4]	KidBus.Tracker	RFID technology, GPS function, & website	Client-Server Model	Enables Parents to monitor the school vehicles movement while their children are on board through the website.
Sha'aban [5]	Applicability of RFID technology in tracking school buses.	RFID, GPS, & GPRS technologies.	GPS + GPRS based Model	Safeguard the children from wrong identification of their destination location or being left behind in the bus.
Shah & Singh [6]	SMS-based solution to assist parents tracking their children's real-time location.	RFID, GPS, & GSM technologies.	GPS + GSM based Model	The system is capable of notifying parent's through SMS once the child leaves the varsity, enabling parents to trace the bus.
Raj & Sankar [7]	Smart monitoring system for buses based on IOT (Internet of Things).	RFID, GPS technologies, & mobile application.	GPS + Client-Server based Model	The system has student identification and real-time tracking.
Sujatha, et al [8]	Mobile-based bus tracking system.	GPS, GSM technologies, website, & android application.	GSM + GPS + Client-Server based Model.	Web-based that provides the registration process for users and buses with an android application for tracking.

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III. METHODOLOGY

A. System Discription

Fig.1 shows the main infrastructure that used to implement the proposed system. It is a client (Android mobile application) server (local host XAMPP) system with an extra RFID reader circuit.

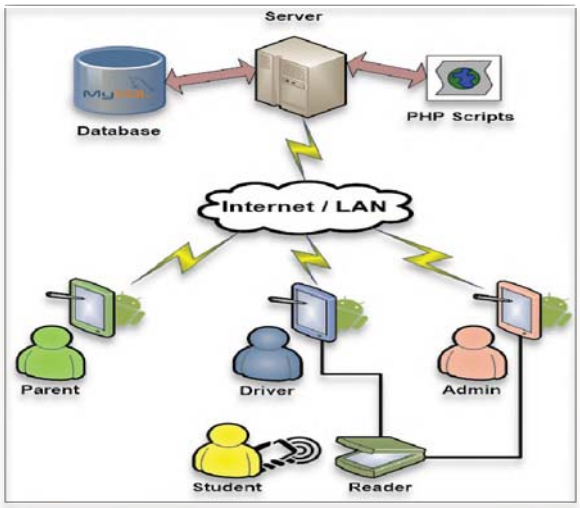

Fig. 1. Main system infrastructure

The system infrastructure consists of three parts; the client side (Android application) which is developed to be used by the school administration, the parents, and the drivers. While the second part is, the server side which is a local host XAMPP server containing database for users (schoolchildren) and PHP scripts to connect with the client part. The third part is the passive reader circuit to identify the schoolchildren ID using RFID technology. Since the client sever topology is used communication between system physical modules is achieved over internet protocol (IP).

In the server side, an MYSQL database in the local host XAMPP server environment is created to store the children and user's information. The PHP scripts are used to connect users to system database and to exchange data between system database and application user's. The system database ER diagram is shown in Fig. 2.

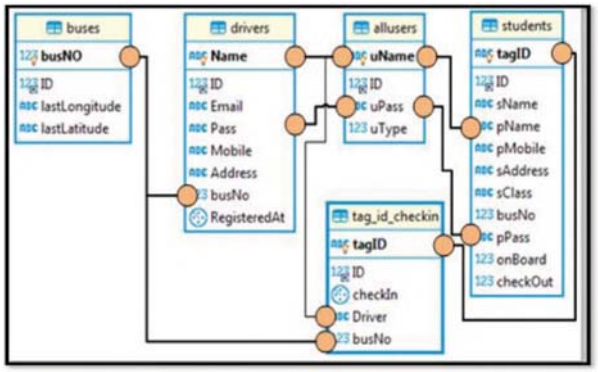

Fig. 2. System database ER diagram

Fig. 3 shows the Use Cases Diagram for the three primary system users with their corresponding functions that each can use.

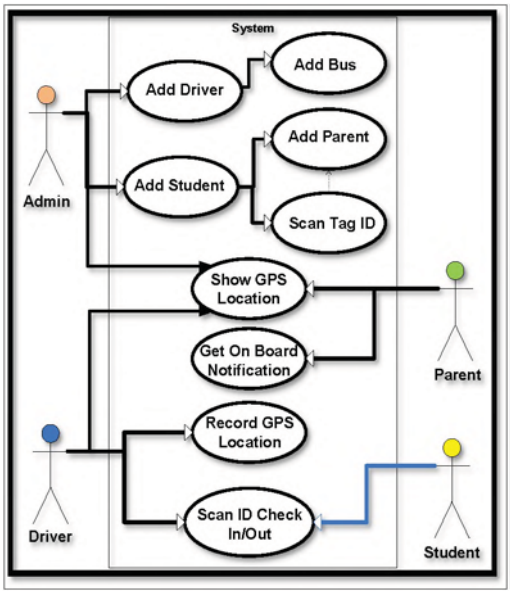

Fig. 3. Use cases diagram

B. Hardware Components

The reader circuit consists of RFID reader (RC552 module), Arduino pro mini, and USB converter interface. A serial communication SPI is used to provide communication between the Arduino and reader. Fig. 4 shows full set-up of the hardware used.

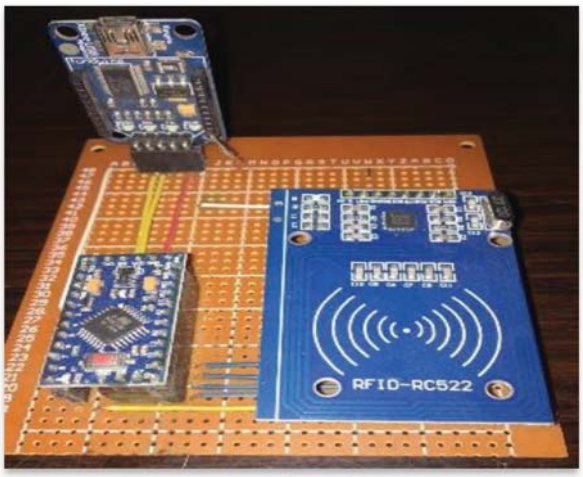

Fig. 4. Reader circuit

IV. RESULTS AND DISCUSSIONS

The Android application has three users; Admin, Driver, and Parents. The services provided by the application are:

A. Students and Drivers Registeration.

B. Report Panel.

C. Location Panel.

D. Check-In Check-Out Panel.

E. Parents Interface.

A. Student Registeration Panel

Through this panel administrators are able to push the students information to the database including the reader tag ID. Fig. 5 shows the student registraation panel.

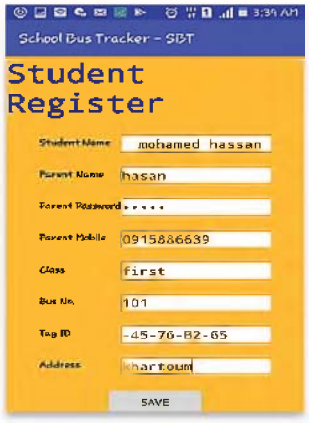

Fig. 5. Student registaration

B. Reports Panel

This panel contains all the essential data students, drivers, and buses data. By clicking on a bus or student the map activity will be opened and shows the latest location of the selected bus or student. “Fig.6” shows the report panal, while Fig.7. shows the selected driver or student panels.

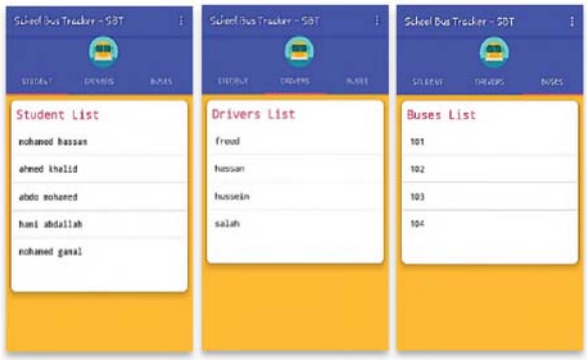

Fig. 6. Reports panel

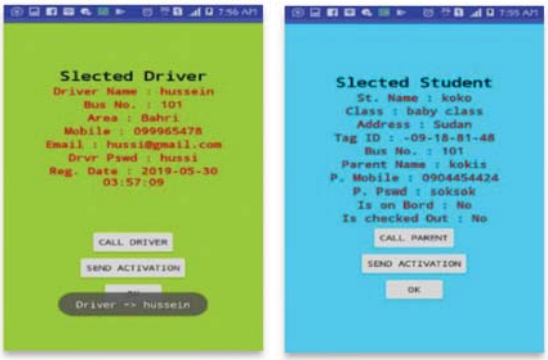

Fig. 7. Selection of Driver or Student

C. Location Panel

This panel is used by the drivers to update the status of the students inside their buses by providing time to time update for their records and finally by clearing the database after ensuring all students are arrived safely to release space in the database. Fig. 8 shows the location panel.

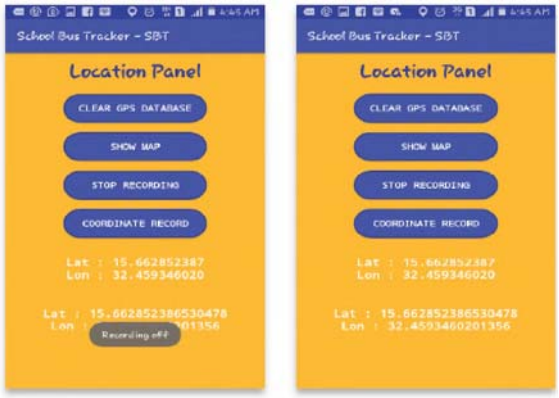

Fig. 8. Location panel.

D. Check-In & Check-Out Panel

This panel is used to update the status of the availability of the students inside the buses. It is used by the drivers to upload students data to the server. Fig. 9 illustrates the Check-In & Check-Out Panels.

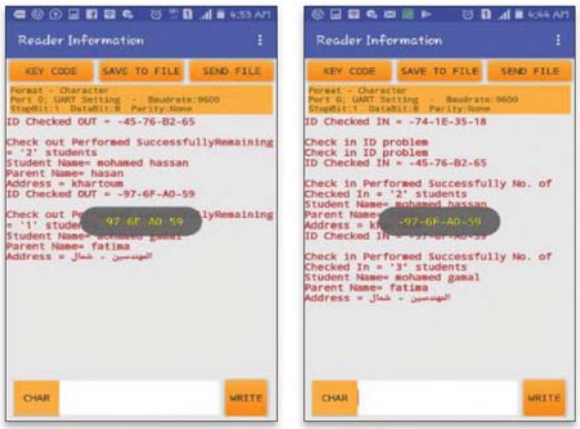

Fig. 9. Check-In and Check-Out panel

E. Parent Interface

In this panel parents are able to check their child updated journey through Google maps along with the bus and driver information. “Fig. 10” shows the parent interface. The Maps is usable for all users Admin, Drivers, Parents

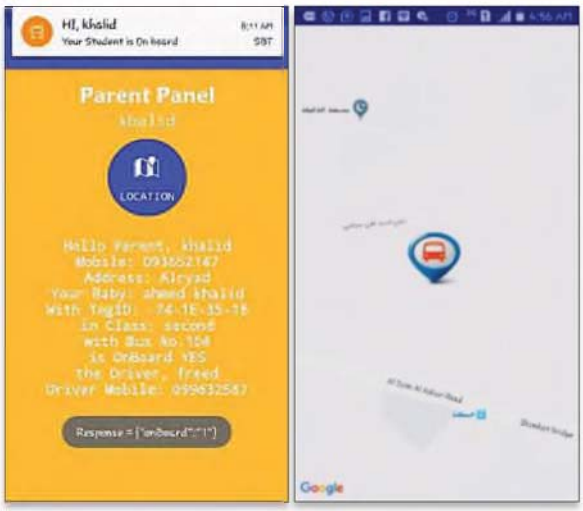

Fig. 10. Parent interface

V. CONCLUSIONS

The proposed system describes a method to track school buses and provide interaction in more efficient and effective way resulting in greater reliability by providing real-time updates of school bus location, reduction of manmade errors in check-in and check-out operations, and notifying parents about the status of the student on-board the school bus. The proposed system showed that RFID tracking technology is a practical and cost-effective option for monitoring and tracking children during their journey on school buses.

Improvements to the application may include allowing for manual check-in and check-out in case of forgotten or destroyed ID tag, introducing online server for capturing data, and integrating the application within a developed web-site interface for the school to be accessed with log-in credentials.

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