Development of Smart location tracking system based on GPS GY-NEO-8M module, RFID and Online GIS Technology

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ABSTRACT

The development of technology has increasingly sophisticated and has a positive influence on human life. The location tracking system that is currently overgrowing in the world of technology is required to be able to serve consumers until consumers can benefit from the technology. The case study of this research is to apply for a smart school bus tracking system. Not only has a location tracking system been developed but RFID technology also has developed.

This research has designed the school bus tracking system by creating work into 2 systems which are 1) GPS system and 2) RFID system. In which students will receive RFID tags via smart cards when students get on and off the shuttle bus, students must scan the card. Information on when and where the students board the car will be sent via the LINE application. On the guardians mobile phone via wifi board to be used to verify that students have boarded the vehicle at the specified time and place safely. Then, designing a website for administrators (schools) and applications for general users (parents), while traveling to school, parents can track the location of the school bus where the location is installed. GPS through the application in real-time and the school will have a website to monitor the system, facilitate the management, and provide useful information about the students and the school bus. The mobile application prototype can increase the safety standards of students who are more likely to use school bus services in the future.

1. INTRODUCTION

Nowadays, the problem of traffic accidents is one of the problems that significantly cause lives and properties. Those accidents affect several groups of people; however the group that deeply affects the society every time it occurs is "the group of student", especially "school-bus accidents". School bus is one of the transportations of the students to schools. Some schools do not have many school buses while some other schools have almost a whole school that uses buses. The situation tends to be more school buses. There are several cases of school bus accidents; for example, a student falls from the bus along the way because there is no caretaker on the bus; or a kid is left in the car until dead. In all mentioned cases, the Department of Land Transport reiterates Provincial Transport Offices to verify safety and services of the school bus. It is identified that school buses must have complete control parts, registered rightly. This safety standard only relates to the vehicles and drivers, which only protect physically and does not cover the students' safety or technical safety. Therefore, the researchers have an idea to improve the safety standard for students so that the parents can track their children's movement during the transportation with school buses via a mobile application.

It is currently obvious that sensor technology has been very popular for systems development, especially Smart City which will happen in the Thailand 4.0 era. Sensor technology has been continuously developed. One of the factors that significantly causes the progression includes the application of sensor technology. Furthermore, WiFi on smartphones is continuously improved with the ability to receive and transfer real-time data. The other important technology for the area is GIS or Geographic Information System, which is the currently used information technology for any tasks in a number of organizations in Thailand.

In conclusion, this study integrates sensor technology study, WiFi on smartphones technology study, and GIS study with IoT, Special Database Management, Web Map Application, and RFID. This study aims to improve the mobile application model of smart school-bus tracking systems in order to improve the safety standard to those students who go to school by school buses, and to parents' confidence to choose student-transportation service more than before.

The aim of this research is 1) to study and analyze the accident problems in case of school buses, and to analyze the standard of the vehicle's safety as indicated by the Department of Land Transport. 2) to develop the low-cost sensor for real-time tracking and notifying the vehicle's and children's status, e.g. going school and going back home, and to design an application model for tracking school buses via Internet GIS and Web Map Application. And 3) to develop the low-cost sensor for real-time tracking and notifying the vehicle's and children's status, e.g. going school and going back home, and to design an application model for tracking school buses via Internet GIS and Web Map Application.

2. METHEOLOGY

2.1 Study Area

The research chooses the area around Naresuan University, Phitsanulok Province, or surroundings to test the mobile application model for smart school- bus tracking. It is proposed to examine the performance of the mobile application model for smart school- bus tracking, in order to improve the safety for students with IoT, RFID, and Open Source Software

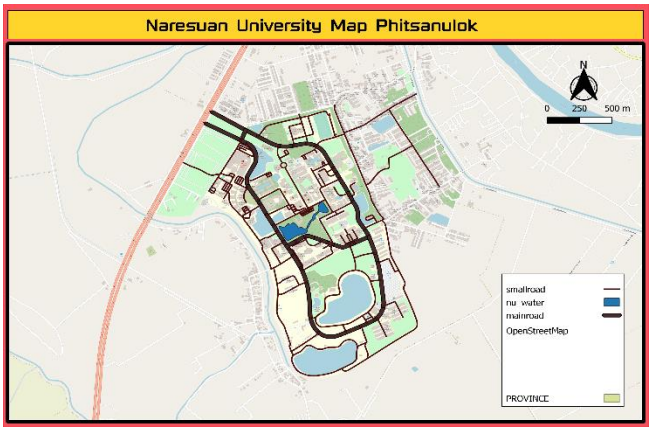

Figure 1 *Naresuan University Map Phitsanulok Province*

2.2 Data

The data include cases of school bus accidents during 2015 - 2017, GPS data, and students' data.

2.2.1 School-bus accidents data management occurred during 2015 - 2017.

The data of accident cases are collected by each identified year, and then are analyzed to be statistical data. According to the data collection, there were 17 cases of accident, 212 cases of injury, and 7 cases of death in 2015. There was no case of accident in 2016 while cases of injury are 386 and cases of death are 7. In 2017, there were zero cases of accidents, 386 cases of injury, and seven cases of death. Comparing between 2015 and 2016, even though the cases of death reduces, the cases of injury increases. Types of the vehicle that cause accidents are pick-up trucks, followed by vans, buses, and trucks (AIP, 2018).

2.2.2 GPS data management

The GPS data are collected to create a database on phppgadmin, which the GPS data are from the sensor (Ublox Neo M8N). The sensor collects the data of latitude, longitude, and speed; and transfers these data to display on the real-time map and graph of the website speed and application on Leaflet map. The map displays an icon of a vehicle to represent the vehicle's location. When the icon color is blue, it means that the vehicle is moving. On the other hand, when the icon color is red, it means the vehicle is parked.

Figure 2 *The map displays an icon of a vehicle and data from Sensor*

2.3.3 RFID data management

RFID is designed only as a model in which responses are just one set of data. These data are a lot related to the GPS information, they are only the designed system for message conveying when the students scan their cards. It starts with the examination of RFID cards for each card's code. After the examination, the result comes with UID values and completed code, then the

conditions commands are input so that RFID can scan the cards. If the card is scanned one time, it will notify the parents that the students are online; while two times scanning means they are offline.

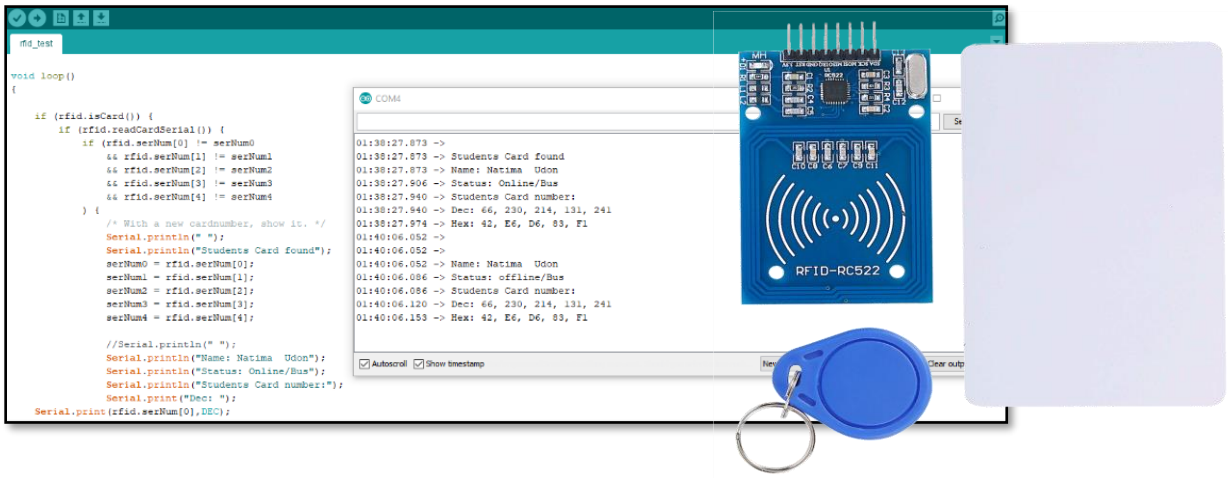

Figure 3 *Code+Serial Moniter skewed from RFID terms.*

2.3 Data management

The data of accident cases in Thailand during 2013 - 2018 are analyzed into statistical data in order to summarize the students' death rate from school bus accidents. The data are proposed to compare with the safety standard of school buses indicated by the Department of Land Transport, that whether the accident cases are less or not.

2.4 Research process and data analysis

First, the data about school-bus accident cases in Thailand during 2013 - 2018 are collected. Including i) the safety standard data for school buses are identified by the Department of Land Transport and ii) the school-bus accident cases during 2013 - 2018 are analyzed into statistical data. The safety standards for school buses as identified by the Department of Land Transport are analyzed whether there are errors or it reduces the accidents or not, comparing to the number of accident cases before indicating the safety standard. The tools information is collected for the development of both RFID and GPS Tracking sensors. Databases are designed and developed for creating an application and website for 3 groups of users: schools, school buses, and parents. Both RFID, GPS tracking and SMS Message systems tools are tested and installed in a school bus to check the sensor's working system. An application to display information through a smartphone and computer are designed. The system is installed on the model vehicle and tested its working system with the mobile application, School-bus smart tracking system, within Naresuan University in order to investigate the errors. The infographic is created in order to present the mobile application about School-bus tracking system model information.

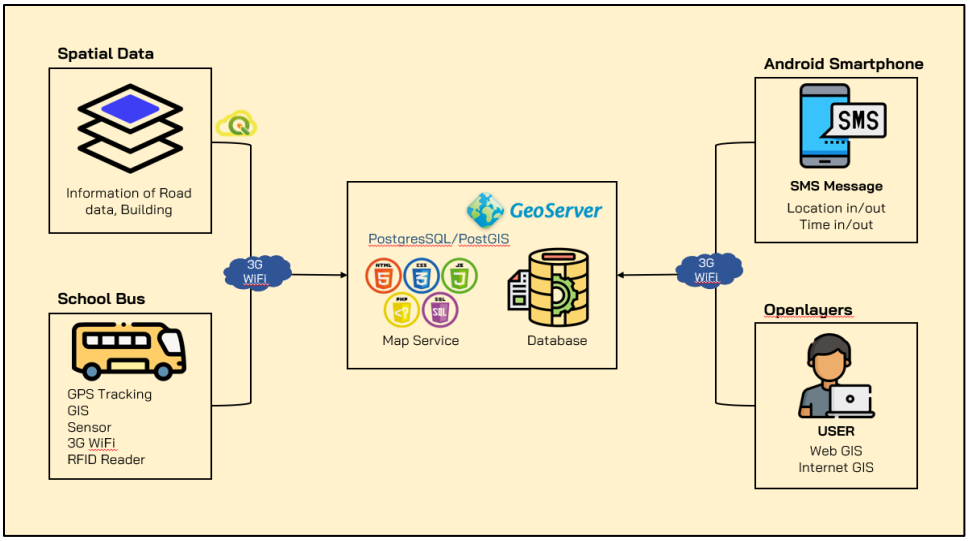

Figure 4 *Conceptual Framework*

3. RESULT

According to the study, it becomes the "model of smart school-bus tracking system on a mobile application for the students' safety, with the technologies of IoT, RFID, and Open Source Software". The results from the development of GPS tracking in conveying the real-time current location and displaying the location information on a map to test for the location and GPS deviation are revealed as follows.

The result of the RFID test reveals that it is the model system that is tested with only one user. When the system is activated (all systems are active when the vehicle is started), the system will send a message to the parents' LINE application immediately. If the students scan their cards the first time, the system will send the message that their children already get on the bus; whereas if the cards are scanned for the second time, the message sent is that the students already get out of the bus.

Figure 5 *RFID Viewing Alert System*

The students' data controlling website for the admins

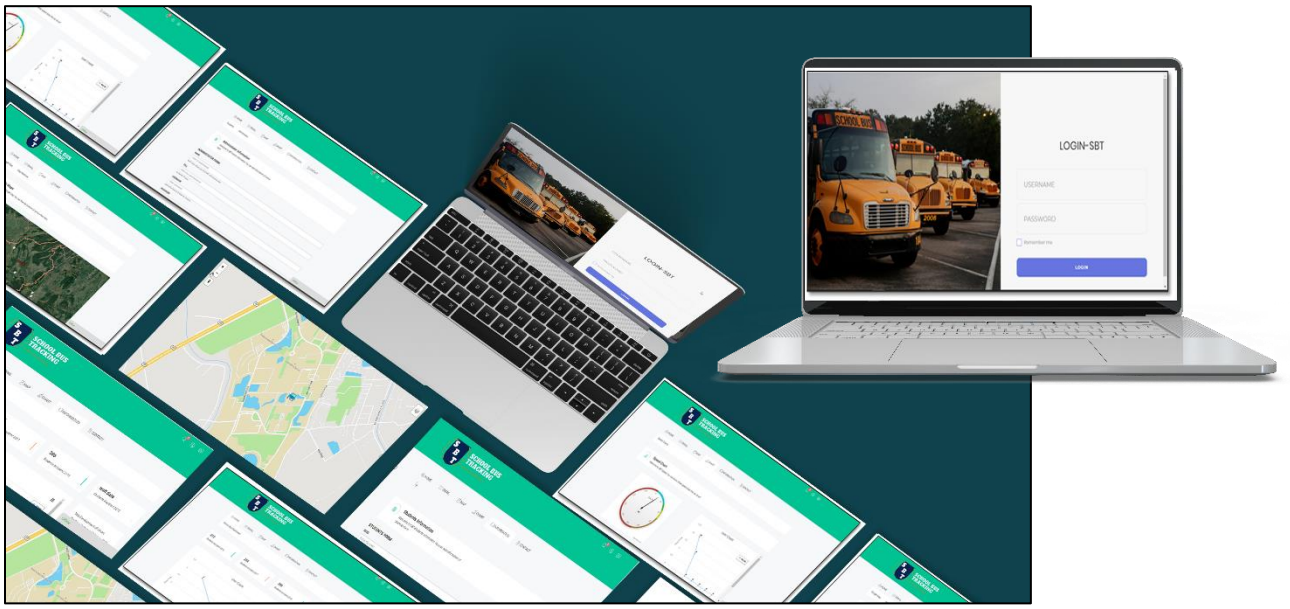

Figure 6 *website for the admins*

The website is designed only for the admins, which they have to login and register through this website.

Web application for general users

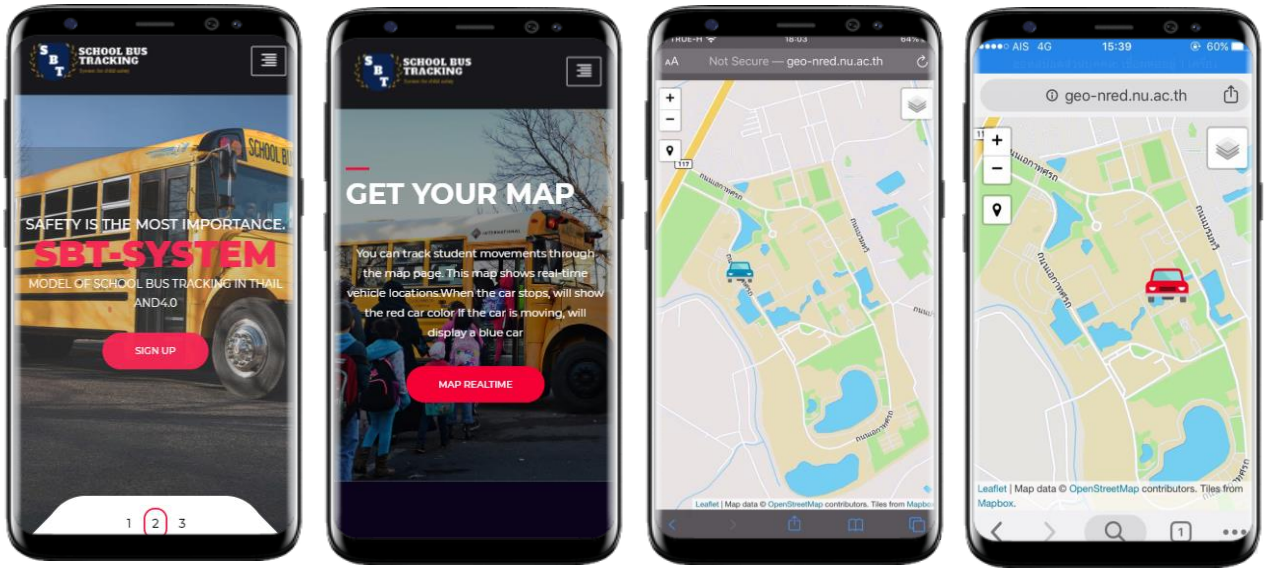

Figure 7 *Interface Of Web Application for general users*

This web application is designed for the users to know the real-time location as well as the real-time speed. This application is just a model application.

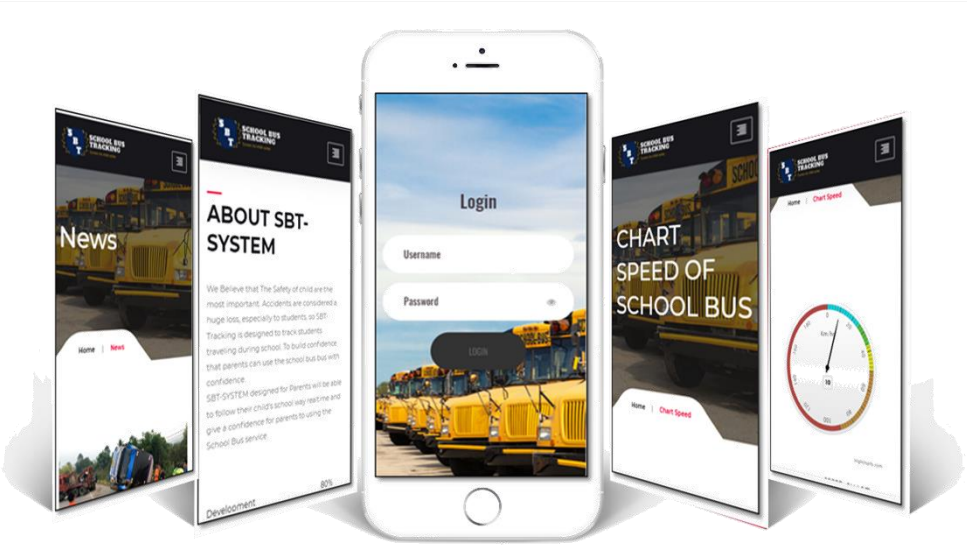

Figure 8 *Web Application for general users*

4. DISCUSSION AND CONCLUSION

The development of a smart school-bus tracking system on application model for the safety of the students with the technologies of IoT, RFID, and Open Source Software is proposed to improve the system of GPS tracking to be able to convey the driver's real-time location data to the server. The notification system is developed by writing codes through Arduino IDE to be able to notify on the user LINE application. When the vehicle starts, all systems are working, and the RFID will send the message to the parents LINE application that the system is online. While the vehicles are moving, the GPS sensor will send the data into the database every five minutes and display the location on Leaflet Map real time. When the vehicle is moving, the icon color is blue; while the red icon means that it is stopped. The parents can check whether the vehicle is moving or stopped, where it is parked. In case the students get on the bus, they scan the RFID card before getting on, so the system will send a message to the parents' LINE application that the students are online. In the meantime, when the students are getting out of the bus, they will scan the card again and the system will send a message that the students are offline. For the website and application, this smart school-bus tracking system has been designed in the patterns of both website for the admins and application for the users. SBT-Website for the admins include real-time map, real-time speed standard, register page for admins, register page for students, and contact information. The users of this website must be those who already registered into the system. SBT-Application for general users includes real-time map, real-time speed standard, and general information. The application works only with Android operation.

This system development applies the knowledge and understanding from document students and related studies The researcher investigates and collects the data from school-bus accident cases to analyze the statistics and create the solutions by creating Smart school-bus

tracking system model. This system design and development employs major languages including Javascript, php, and html; and retrieves the data from server to display on the leaflet map via PostgreSQL/PostGIS as the major program to manage databases to analyze data with SQL language. When the current location of the driver is developed by GPS Tracking system as well as the notification of the student's card scanning via Arduino IDE is improved, this system can be improved in the real server. According to the experiment of the system in the real route by driving around the university and activating a notification system, it reveals that the system can notify with sound when going into a risk area. The system stops notifying when going out of that risk area. In conclusion, this system can be developed and applied with other routes.

5. REFERENCE

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