

TRACKID – A LOCATION TRACKING APPLICATION FOR CHILDREN ON SCHOOL TRANSPORT

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ABSTRACT

Education does not only entail children sitting in class to read books and study, but it also involves activities outside the classroom such as co-curricular activities, transport system, religious activities, and cleaning but unfortunately, they are not given as much thought as anticipated. In the school transport sector specifically, there has been a growing concern among parents on the safety of their children when they are on their way back home to school. Some parents are not able to take their children to and from school due to work demands and frequent traffic snarl-ups, therefore they choose to enroll their child into the school transportation system to cushion them of that burn.

The problem however is that even with the school transportation, parents are not able to track the movements of their children while they are on transit to and from school and this has brought about many cases of children getting lost and not arriving home and this results into a blame-game between the school and the parents. The school, in this case, the drivers and the teachers are unable to account for the children and this brings further mistrust, and hence the parents are forced to either bear with the situation or pull out their children from the program altogether and look for alternative options.

This paper provides a solution that uses a web application enabling the school, parents and drivers to be accountable for the children while on transit in the school transportation system. This will allow all the stakeholders to communicate efficiently and in turn ensure children's safety.

KEYWORDS

Tracking, Location Tracking, School Children, School Transport

1. INTRODUCTION

Most primary schools in Kenya have invested heavily in their transport system. They purchase huge fleets of buses, vans, and minivans to cater for the needs of those children who live both far and near the schools. These children are taken to and from school and this is usually convenient for the parents who leave early to go to work and therefore are not able to take their children to school and pick them up from school at the end of the day. Moreover, it provides a safer way for transporting school children to and from school as it is easier for a parent to call the driver or supervisor of the children to enquire about their child and whether they arrived at school safely [1].

Usually, the process of picking up school children to and from school is that in the morning, the vehicles depart from the school at six o'clock and each bus has the specific destination of where it is going to pick the students from. The bus then passes by the homes of the school children and normally, the school children are standing outside the houses and if not, the bus driver hoots to alert the student to get out and board the vehicle. Once most of the children have been picked within a certain area, the bus then heads back to school. Then later in the evening, the school

children board the vehicles depending on where they live, and they are usually accompanied by a teacher who will be responsible for the children [2]. Once most of the children have boarded the assigned bus, the teacher counts the children to make sure that all the children who are supposed to have boarded have done so and once that is confirmed, the bus departs from school and takes the school children to their respective homes.

As demonstrated above, there is no way to record that a student has been picked from home and has been taken to school or if the student has been picked from school and has been dropped off at their home. It solely depends on the ability of the driver to remember which child boarded and alighted from the vehicle. The teacher is also tasked with remembering the children who boarded a particular vehicle and if they did, where they were dropped off at their destination [3].

The challenge that arises with this arrangement is that there is no system in place that records these events as they take place either manually or digitally. The teacher or the driver is burdened with the task of having to remember all the children who are in a certain bus even with vehicles that hold a capacity of 80 children. This process is very faulty as the driver or the teacher supervising the school children is prone to forget and when there is no record of the students, it is difficult to track the students in case something happens to them. This has in turn led to many cases of children getting lost, children not being picked up to go to school by their respective buses and the blame usually lies on the school because there is lack of accountability for the children.

Another major challenge with the current events is that there is no system that records the details of the children once they are picked up from school such as the date, day and time the child was picked, the name of the student, where they live, contact details of the parents(s), contact details of the driver in case of any hiccups or changes, and contact details of the teacher responsible for students in a certain vehicle, especially in the evening. Therefore, there is no sense of accountability, and this leaves a lot of parents in anguish and worry whenever their school children do not get home from school and vice versa.

Hence, there is a need to create a system that has a record of all the students who use the school transport to commute to and from school, details of all the vehicles the school owns and the drivers to those vehicles. When the children are boarding the bus, the bus driver starts a trip and the parents can see the location of the bus as it heads to their respective homes. The parents are then able to track the location of their children as they head to their respective homes. The parent will also be able to call the driver in case of any issues and receive alerts when their child is about to reach home. Once the child has been dropped home safely, the driver is able to confirm on his application that the child has reached home, and an alert is sent to the parent to confirm the same. This will help the school in becoming more accountable for the students and have records of the students in case something happens to them. Moreover, the parents will have the real-time location of their children which is updated after every few minutes to keep the parents updated.

2. LITERATURE REVIEW

This section discusses the challenges faced with the current school transportation and the importance of having a system for location tracking of children while they are using school transportation. Finally, it analyses some of the existing solutions that have already been created to address this problem and the gaps in these existing solutions.

2.1. The Importance and Challenges Faced by Current School Transportation

Education does not only entail children sitting in class, reading books, and doing exams. It also involves the process of taking them to and from school in the morning and evening. This has led to an increase in schools buying buses to cater for the transportation of the school children. School transportation happens to be one of the better alternatives that parents use to take their children to and from school as compared to hiring private vehicles, parents taking their school children to school or using public transportation. However, it does have its own challenges such as child safety, traffic snarl ups, high cost and lack of enough technologies that automate the process of school transportation.

Child safety is of the utmost importance and is an issue that is heavily considered by parents when choosing to use school transportation. Statistics from the World's Children Organization show that 27% of human trafficking victims are children [4]. However, this system is not full proof as there have been cases where children do not return home when using the school transportation and this usually leaves parents in a lot of anguish. Parents have no way of knowing whether their school children are when on transit to and from school.

In addition to that, traffic snarl-ups happen to delay children from reaching home or school on time and when this happens, it is difficult for the driver to keep updating the parents where their children are since he/she is supposed to be concentrating when they are driving and is quite inconvenient.

Furthermore, school transportation is quite expensive and has been on the rise in recent years according to an article by Business Daily [5]. Parents end up paying more money for the school transportation because they want their school children to feel safe as it has more benefits than other alternatives [2], interact with other school children and lift off the burden of the parents having to take them to and from school.

There are also some cases whereby schools do not hire competent or skilled drivers who have had experience with driving school children therefore this puts the lives of the children using school transportation at risk and makes the school extremely liable and compromised in case anything happens to the children. Some parents also choose to use privately owned school transport services as it is much cheaper than the school transportation and can be used even after the children have moved schools. The problem comes in when these privately owned school transportation services carry excess children, and it poses a danger to the children as it is not easy to trust anybody to take care of children [2].

2.2. Existing Solutions used in Tracking School Children

2.2.1. MyShule App

This is a system that consists of both a web application and an android application. Figure 1 shows the *MyShule* App Dashboard.



Figure 1. MyShule App Dashboard [6]

The web application is used by school administrators. It has a dashboard where the school administrators create, update, delete and retrieve details about buses, children and their parents and the name of the school. The android applications are two, for the parent and the driver. The parent android application is used by parents to track the movements when on the school bus and can receive notifications from the driver application to notify them when the bus is about to arrive. The driver application is used to login in the location of the driver and the bus when they leave school and sends notifications to the parents to alert them when their child is about to arrive home [6].

One of the advantages while using this application is that the dashboard has a simple design and is easy to create drivers, parents, and buses. The disadvantage however is that the application is not open source and therefore logging in to the two android applications is not possible. One also cannot view the maps and therefore cannot enter the location of the school.

2.2.2. School Bus Tracker App

This application is an android application and is used to monitor bus location, speed, bus route and location alerts. The landing page of the School Bus Tracker App is shown in Figure 2.



Figure 2. School Bus Tracker App [7]

It allows parents to track their school children in a school bus and manage their daily routines. It provides the current location bus with current speed and a location alert on Pick and Drop location according to end user choice. Moreover, the application provides traffic and route plans of the bus when on transit and includes the stoppage time or arrival time of the bus [7].

2.3. Gaps in the Existing Solutions

Some of the gaps in the existing applications include the inability for one to register a school in the School Bus Tracker Application. One is not able to select a country and login requires use of phone numbers that are limited to India, Oman, Nigeria, and China. Therefore, it is not possible to log in using a Kenyan phone number as it has not been included as one of the acceptable logs in credentials.

Moreover, for the *MyShuleApp*, it requires one to pay for one of their many packages offered on the website meaning that the application is not open source and is therefore not possible to log in until a package payment is completed to be registered and get full access to the admin portal, parent, and the driver application. In addition to that, when one tries to log in, a request timeout error is displayed on the screen and hence cannot access the application altogether which discourages one from using the application.

3. DEVELOPMENT METHODOLOGY

This refers to the structured processes when working on a project. It entails a set of rules that need to be followed when designing a particular software to produce high quality programs [8]. The software development methodology that will be implemented in this project will be Agile Methodology, specifically the Scrum Methodology. Scrum is a type of methodology that breaks down a project into small milestones that need to be achieved in sprints. It focuses on working on one sprint at a time while incrementing the features as during software development [9].

Moreover, it enables delivery of software at each incremental stage and can be fine-tuned to fit the requirements of the users. In case of any changes much later in the project, it is possible to add or update those changes without affecting the whole project. In addition to that, there is constant communication with the customers who provide feedback that will be used to make the customer satisfied with the product. Figure 3 shows the phases in Scrum Methodology.

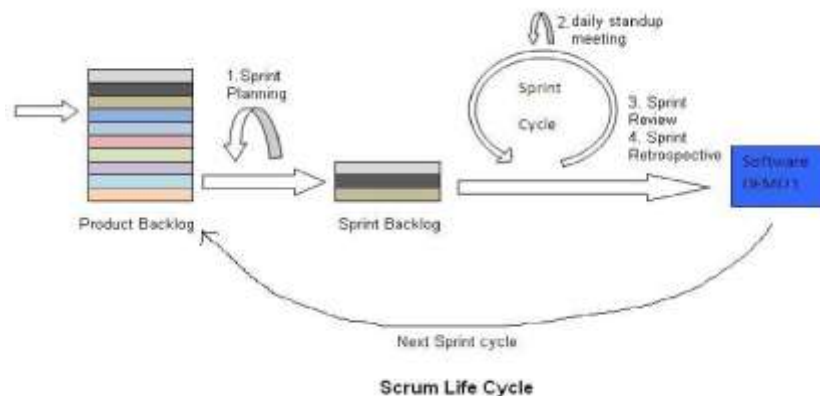


Figure 3. Scrum Methodology Phases [9]

The product backlog creates user stories for the users of the system and outlines the activities that they can perform in the system. For example, a school administrator is one of the users of the system and they need to be able to add, retrieve, update, and delete details of the parents, school children, buses, and drivers. A parent is also another system user, and they need to be able to track their children while they are on transit and receive notifications when their child is picked from school.

The tasks involved were broken down into sprints whereby one sprint is worked on at a time within two to four weeks, for example, one sprint can include creating the super admin module of creating, deleting, retrieving, and updating driver details. Then once that sprint is done, another sprint is worked on for example creating, retrieving, updating, and deleting bus details.

Once a sprint is completed, for example, the super admin module, the progress is presented to the customers i.e., the school, and they give their feedback on the solution that has been created then it is analyzed.

3.1. System Development Tools and Techniques

3.1.1. Vue JS

This is a front-end framework for JavaScript. It is used in designing user interfaces and consuming the application API's written in the backend. This framework will be used to create the interfaces and pages for the school, the parents, and the drivers.

3.1.2. Bootstrap

This is a framework that is also used for styling the interfaces for example colors, buttons, tables etc. The interfaces created for the school, parents and drivers will be styled using this framework.

3.1.3. Laravel

This framework will be used to create the back end of the application i.e., the logic and processes of the application which is basically the API that will be consumed on the front end.

3.1.4. Git

Git will be used to create a local repository for the project and track changes made in the repository while GitHub will be used to store the remote repository and modify the code in the project.

4. SYSTEM IMPLEMENTATION AND TESTING

4.1. The Implementation Environment

4.1.1. Hardware Specifications

This application runs on an Intel(R) Core™ i3-8130U CPU Processor and 4.0GB of RAM. During deployment on any other device, the device should be of higher specification than the developer's device specification. This is to enable optimal functionality of the system. There is no need for storage as the system is real time.

4.1.2. Software Specifications

The application was launched and run in the Chrome Browser therefore it is required that the application be installed to access the system. Other common browsers can also be used such as Microsoft Edge, Firefox, and Safari. All one needs is to type the URL of the application on the browser's address bar and click enter.

The application can be run on devices running on Linux, MacOS and Windows Operating Systems however this application was run in a Windows 10 laptop, but it can be run in the mentioned operating systems.

4.2. System Implementation – Drivers Module

4.2.1. Authentication Module

This module is shared among all the users in the system. This is the entry point to the system, and they do so by providing their credentials i.e., email address and a password. If they do not have an account, they are redirected to the registration page. Once login is successful, each user is redirected to their respective module. Figure 4 shows the authentication module.

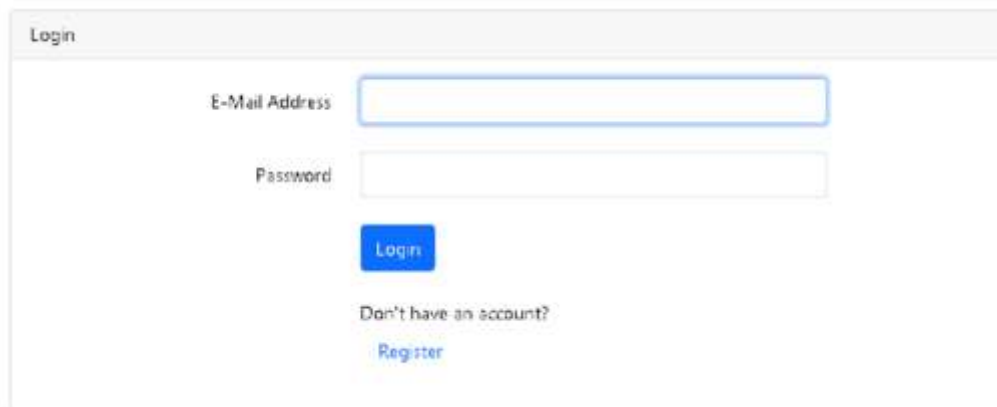


Figure 4. Authentication Module

4.2.2. Driver Module

This module shows the map of the driver, inbox module and profile module. Figure 5 shows the driver dashboard.

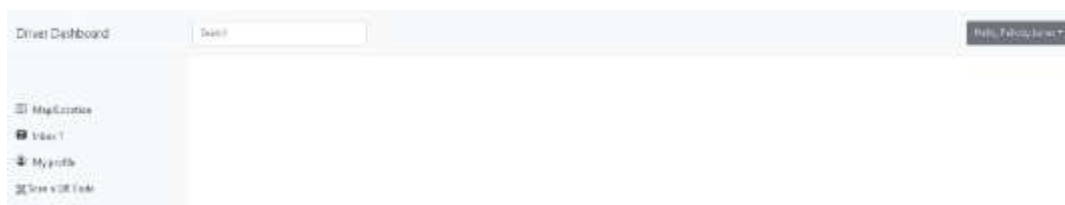


Figure 5. Drivers Module

4.2.3. Driver Map Module

This module displays a map to the driver with the location of the student's addresses which is represented by the beach flags and the driver's current location which is represented by the red marker. It also has an Update Location button which updates the location of the driver in case location tracking stops, and a Start Trip button which sends a notification to the parents notifying them that their children have left school. The red marker updates every time the current location of the driver changes and when the driver reaches the destination of a student, a notification is sent to the parents notifying them of their arrival. Figures 6, 7, and 8 show the location of the driver and their location updating and sending notifications to the parents when driver leaves the school and when a student arrives home.

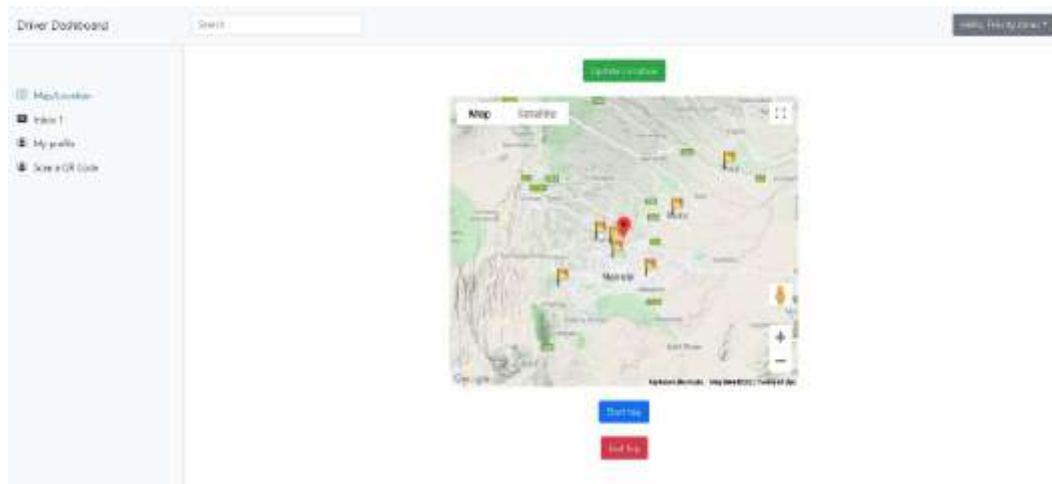


Figure 6. Driver Map Module

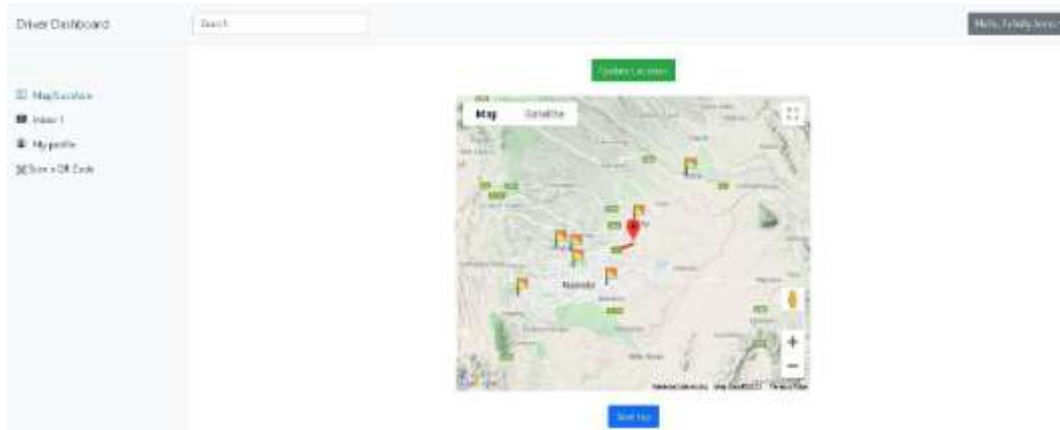


Figure 7. Updated Driver Location



Figure 8. Notification sent when destination is reached

4.2.4. Driver Notifications Module

This module shows the notifications sent by the driver. Figure 9 shows the notification module for the driver.

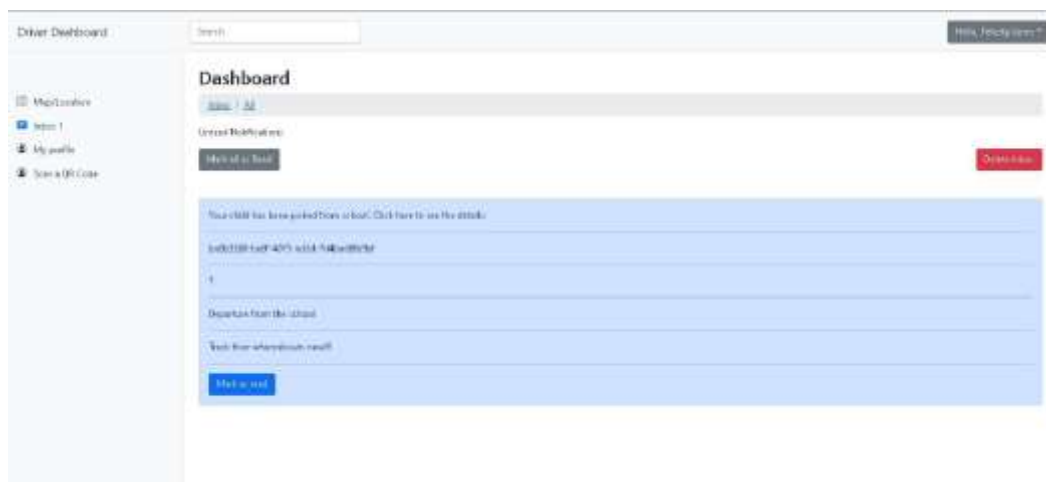


Figure 9. Driver Notifications Module

4.3. System Implementation – Parents Module

This module shows the map for the parent with their home address represented by the beach flag and a red marker which shows the location of the driver once the driver allows tracking, notification module, my profile module, and children profile. Figure 10 shows the parent map module.

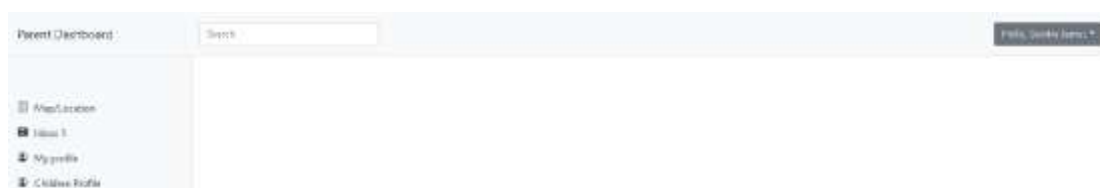


Figure 10. Parents Module

4.3.1. Parents Notifications Module

This module shows the notifications received by the parent from a driver. When a driver starts a trip, a notification is sent to the parent notifying them of the child's departure from school. Moreover, when the child arrives to the destination represented by the flag on the map, the parent is notified of the same. The parent clicks the Track their location here button and they will be directed to the map module which has the location of the driver. Figure 11 shows the notifications module for the parent.



Figure 11. Parent Notification Module

4.3.2. Parents Map Module

This module shows a map which has the address location of the parent which is represented by the beach flag and the location of the driver which is represented by the red marker. When the driver is in motion, the red marker will update its position and the parent is able to track their location. Once the driver has arrived at the destination, the parent will receive a notification of the same. Figure 12 and Figure 13 show the current location of the driver and the address location of the parent and the updated location of the driver.

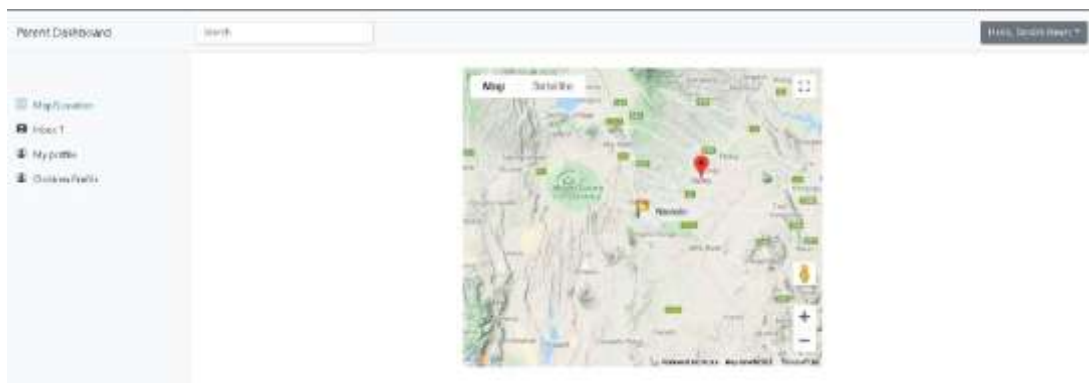


Figure 12. Home and Driver Locations

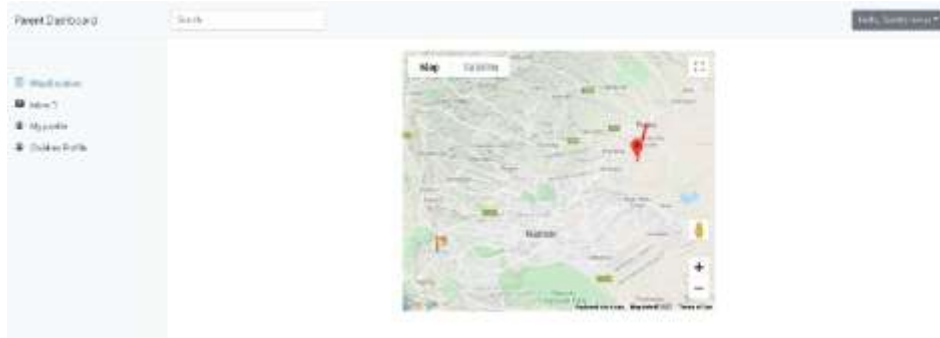


Figure 13. Updated Driver Location

5. CONCLUSIONS

There are not enough systems and applications that address this issue of parents being able to track their school children while on transit to and from school using the school transportation. Therefore, the developed application will hopefully be implemented by schools who want to keep an extra eye on their students. It will also go a long way in giving parents an easier time as far as keeping their children safe is concerned.

There is a need to develop systems that are specifically catered for use by schools and the parents since the applications mostly used are for tracking the fleet of vehicles which does not involve the parents at all. Moreover, the users of the system should have consistent access to the internet and a browser application to be able to access the application. The devices that the users use should also have location services to enable location tracking.

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