School Bus tracking system (SBTS)

A graduation project document submitted to
the department of Software Engineering as partial fulfillment
for the requirement for the degree of B.Sc. in Software Engineering

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COMMITTEE REPORT

We certify that we have read this graduation project report as examining committee, examined the student in its content and that in our opinion it is adequate as a project document for B.Sc. in *By Specialty.*

Chairman :
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  Date: ……/……/…………………….

Committee member :
  Name: …………………………….

  Signature: ………………….……

  Date: ……/……/…………………….

Supervisor:
Name: …………………….………

Signature: ………………….……

Date: ……/……/…………………….

Abstract

Students are one of the most important members in the society and this program was designed to address the issue of school buses and children transportation.

The problem was the lack of real time monitoring method for the buses to assure the safety of the children and to know the exact time the bus arrives to the house.

The solution was making two android application; one for the parents and the other one for the drivers, to connect the parents with the bus by GPS (Global Positioning System) to know the real time bus arrives to their home and to enable school from monitoring the bus movements by maps.

The team worked on scrum methodology during the development of the project.

The main reason for this project is making children transportation more safe and efficient by implementing modern technology to school transportation.

And finally the result was two android application and an admin website that work on firebase services.

Dedication

This project is wholeheartedly dedicated to our beloved parents, who have been our source of inspiration and gave us strength when we thought of giving up, who continually provide their moral, spiritual, emotional, and financial support. To our supervisor, friends, and classmates who shared their words of advice and encouragement to finish this project.

Acknowledgment

We would like to express our thanks and gratitude to our supervisor Dr. Issam Jebreen for continuous guidance and encouragement throughout the project, you inspired us for being creative, you opened our minds, you are more than a supervisor, an active person who never stand still, a great teacher who has a respond to any question a student asks, THANK YOU from the bottom of our hearts.

We also want to thank our parents who kept supporting us all the time, and nothing will repay what they have done for us, I can't say anything else, so just TAHNK YOU for everything!

Finally, we would like to thank our respectful doctors for these lovely four years of our life, and hope they would be proud of us, and of our project.

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List of Symbols

Symbol	Meaning
SBTS	School bus tracking system
CSS	Cascade style sheet
UAT	Users acceptance testing
JS	JavaScript
HTML	Hypertext markup language
GPS	Global Positioning System
JAD	Join application design

Chapter 1

Introduction

1.1   Introduction

Nowadays, there are a lot of varieties application in our life. One of the applications is vehicle tracking applications. School bus tracking system using GPS and Android based smart phone is a system that can track school buses in real time.

School transportation systems play an increasingly important role in the way students move around.
Here, we describe the team efforts to increase the safety of current school transportation users by making the system and help motivate more schools to use it.

1.2   Motivation

The team motivation is the Dead Sea accident that took place on October 25, 2018 in the Wadi Maqreen valley at the shores of the Dead Sea. The incident resulted in 21 casualties and 43 injuries, mostly students who were on a school trip to the area, in addition to the collapse of a closed bridge for some time.

And that inspire the team with the idea of bus monitoring system with low cost for schools to help with the application seared.

1.3   Project objectives

- Ensure the safety of the children so that their parents can know their places accurately.
- Allow the school to track their bus movements live at all time.
- Design an -easy to use- admin page to add and delete users
- Provide a way for the parents to know when the bus arrives to their home.
- Provide a way for the parents to contact the school in emergencies.
- Focus on the Integration, Cost and Scope aspects of the project.

1.4   Problem

Schools transportation system is an old system and this system have a lot of flows like the lack of real time monitoring method to assure the safety of your children and to let you know if something happened to the bus or something happened during the sift or it was delayed. Also there is no way for the parents to know the exact time the bus arrives to the house and this will waist there time waiting outside.

1.5   Project scope

(Parent android application) allow the parent to login in the application by user name and password, and allow to see their children profile, and access to their live location and get notification when the bus is nearby also, allows the parents to contact the school when emergent situation happens.
For now the admin uses the parent's application to track the buses.

(Driver android application) allow the driver to access his application by using the bus number and round number and see his current location.

(Admin website) allow the admin to register a new user and delete users in easy way for android application user's account.

1.6   Proposed solution

The team made two android applications one to the parents and school and the other one to the drivers to solve the previous problems by linking the bus to GPS (Global Positioning System) and give the parents and the school the ability to monitor the buses movement, and we will make a website for the admin to add and delete users.

And to minimize the wasted time during wait the bus arrive to your home the application will send a notification to you when the bus is near your home.

1.7   Scrum methodology

Scrum is an agile and incremental software development methodology designed to build products faster, Scrum uses short time boxed development cycles (called sprints), with each sprint resulting in potentially shippable functionality delivered [1].

Scrum and other agile methods were inspired by its shortcomings. Scrum emphasizes collaboration, functioning software, team self-management, and the flexibility to adapt to emerging business realities.

Scrum Roles:

Scrum has three roles and they are (Product Owner, Scrum Master, and Team).

a) Product Owner: The Product Owner should be a person with vision, authority, and availability. The Product Owner is responsible for continuously communicating the vision and priorities to the development team.
b) Scrum Master: The Scrum Master acts as a facilitator for the Product Owner and the team. The Scrum Master does not manage the team. The Scrum Master works to remove any impediments that are obstructing the team from achieving its sprint goals.
c) Team: According to Scrum's founder, "the team is utterly self-managing." The development team is responsible for self-organizing to complete work [2].

The figure bellow describes the scrum methodology stages.
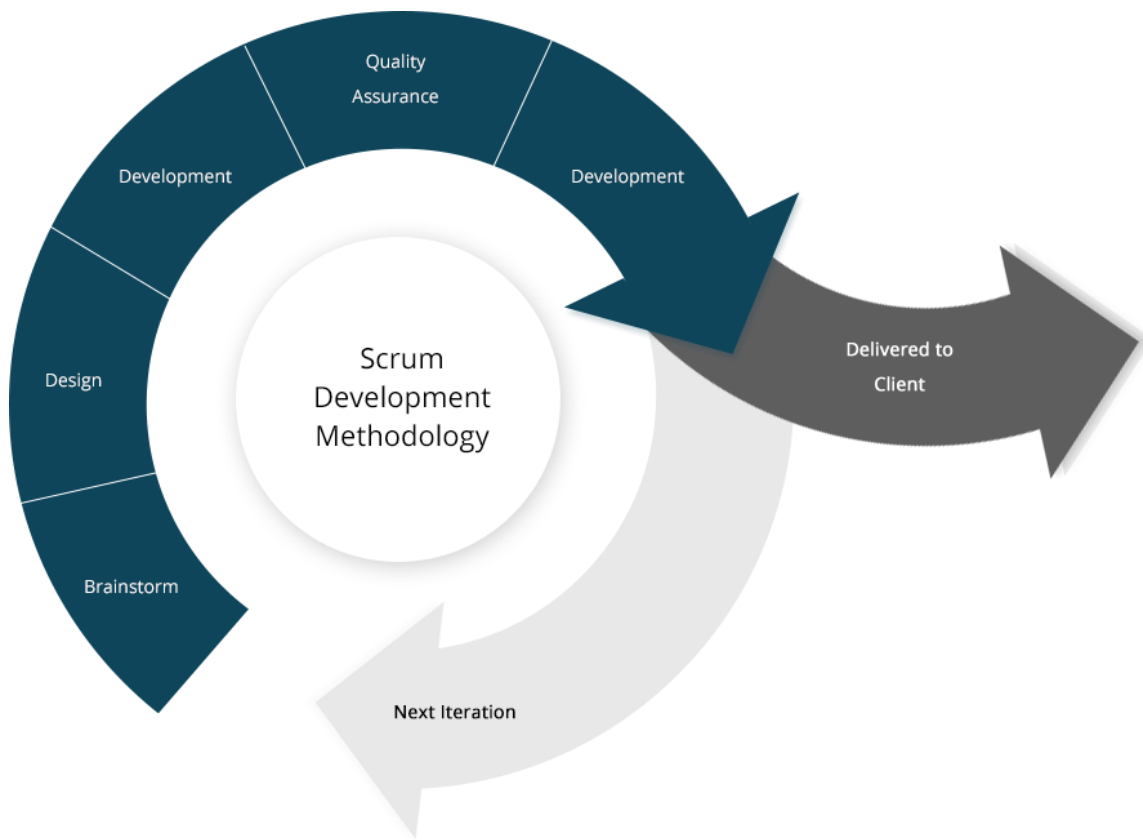
Figure (1-1) Scrum framework [3]

Nothing is perfect, and the Scrum methodology is no exception. In some cases, Scrum is combined with other project management techniques that can help resolve some of these drawbacks:

- Scrum often leads to scope creep, due to the lack of a definite end-date

- The chances of project failure are high if individuals aren't very committed or cooperative

- Adopting the Scrum framework in large teams is challenging

- The framework can be successful only with experienced team members

- Quality is hard to implement, until the team goes through aggressive testing process [4].

Chapter 2

System Planning

2.1   Introduction

Assume the team wish to take a trip to somewhere, the team have prepare the equipment and tools needed to do the journey, as well as some of the commands and tasks handed over to some of the people for the success of the journey and to enjoy it properly. This was done by planning from the simplest to the most difficult.

In representing the planning of the system, the team have taken into account the implementation mechanism. System planning is divided into a communication plan, testing plan and issue log problem in plan.

2.2   Communication Plan

Is a step-by-step process to ensure that the intended message is received, understood and handled by the system users.

At this stage, after the team studied and analyzed the system requirements as user stories and based upon identify the expected time to complete some tasks (sprints), for example, the Creating the android application task has initially been given more than a month to be completed, depending on Gantt chart.

2.3 Technology

A description of the selected techniques used by the team in the project, from the choice of language, platform and tools.

2.3.1 Languages

1) Html

HTML is the standard markup language for creating Web pages.

It stands for Hyper Text Markup Language, HTML elements are the building blocks of HTML pages and its elements are represented by tags, Browsers do not display the HTML tags, but use them to render the content of the page [5].

2) CSS

Cascading Style Sheets (CSS) is a style sheet language used for describing the presentation of a document written in a markup language like HTML.

CSS is a cornerstone technology of the World Wide Web, alongside HTML and JavaScript [6].

3) JavaScript

JavaScript is a high-level, interpreted programming language that conforms to the ECMAScript specification. JavaScript has curly-bracket syntax, dynamic typing, prototype-based object-orientation, and first-class functions.

Alongside HTML and CSS, JavaScript is one of the core technologies of the World Wide Web [7].

4) java

Java is a general-purpose programming language that is class based, object oriented, and designed to have as few implementation dependencies as possible. It is intended to let application developers "write once, run anywhere" meaning that compiled Java code can run on all platforms that support Java without the need for recompilation [8].

2.3.2   Tools

1) Android Studio

Android studio is the official integrated development environment for Google's Android operating system, built on Jet Brain IntelliJ IDEA software and designed specifically for Android development. It is a replacement for the Eclipse Android Development Tools as the native Android application development [9].

The team used android studio to create a driver and parent's applications.

2) Firebase

Firebase is platform which allow to build web and mobile applications without server-side programming language. You can store user's data on its real-time database which sync data among user's data in no time.

Firebase is a google product which offers so many useful features Like (Real time database, Push notification, Firebase Analytics, etc.)[10].

The team used firebase to manage a database and used it as a server for the application.

3) Visual studio code

Visual Studio Code is a lightweight but powerful source code editor which runs on your desktop and is available for Windows, macOS and Linux. It comes with built-in support for JavaScript, TypeScript and Node.js and has a rich ecosystem of extensions for other languages (such as C++, C#, Java, Python, PHP, Go) and runtimes (such as .NET and Unity) [11].

And the team used it to build the admin page.

2.4   Project Planning

Project planning is part of project management, which relates to the use of schedules such as Gantt charts to plan and subsequently report progress within the project environment.

Project planning can be done manually or by the use of project management software[12].

2.4.1   Testing Plan

To ensure the success of the test plan, the team made some reports.

The team conducted an acceptance test model to determine the success of the plan.

2.4.2 Sprints

Sprint 1.0:

Creating Data Base

Start in 27/03/2019

Estimated time: 10 days.

Sprint 2.0:

Creating admin's page.

Start in 09/04/2019

Estimated time: 10 days.

Sprint 3.0: Creating the android application.

Start in 19/04/2019

Estimated time: 30 days.

Sprint 4.0:

Designing the user's interface.

Start in 19/05/2019

Estimated time 14 days.

Sprint 5.0:

Real world testing

Start in 02/06/2019

Estimated time 10 days.

2.4.3 Gantt chart

A Gantt chart is a type of bar chart that illustrates a project schedule. This chart
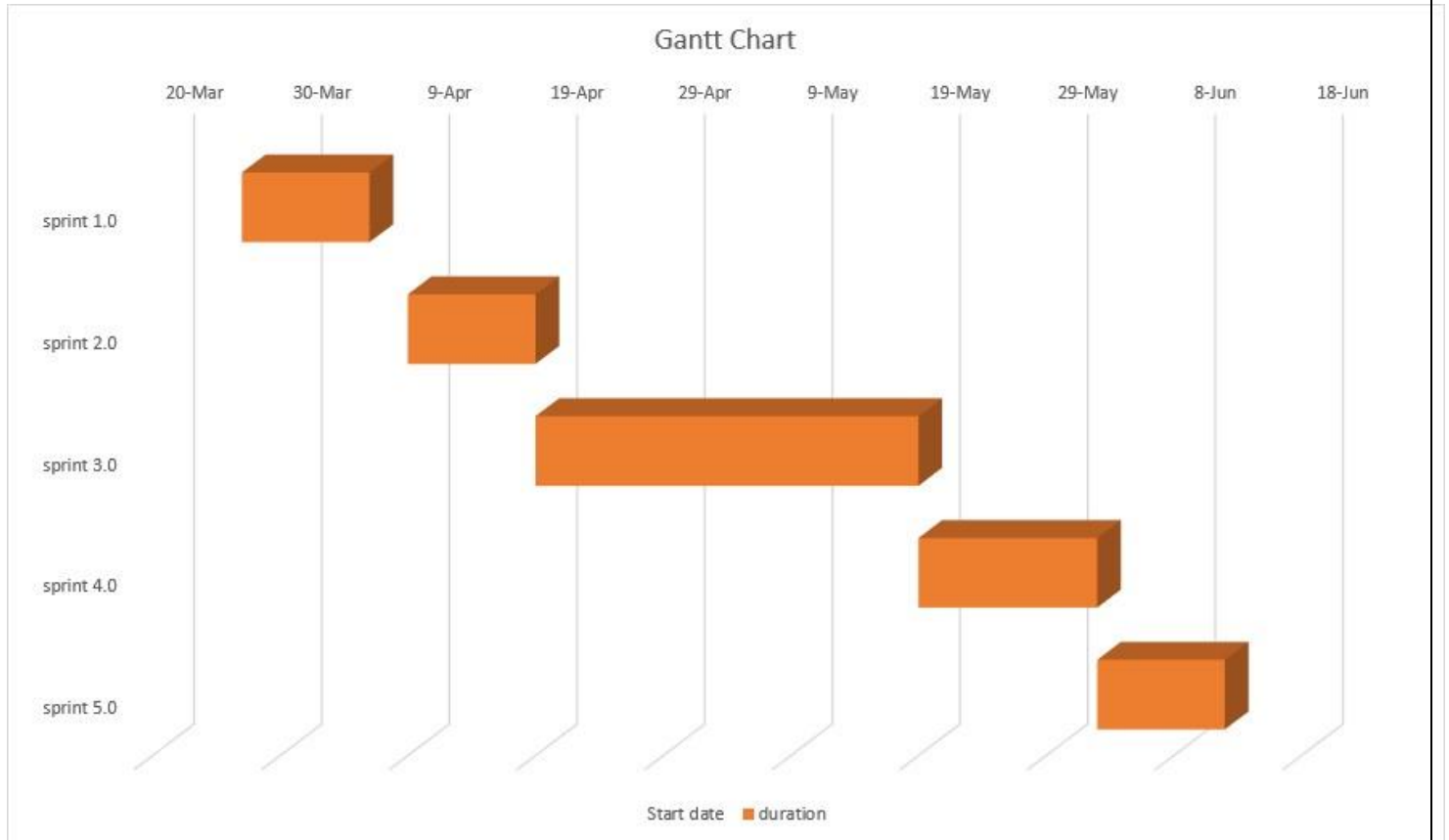
Figure (2-1) Gantt chart

Chapter 3
System Analysis and Design

3.1   Introduction

After gathering information by using join application design (JAD) and JAD is a highly structured group meeting in single place for an extended period of time 4-8 hours per day and over a period from one day to couple of weeks, and writing user stories (another way to write the function requirements) for system, the team started working on the application development, as part of the plan set and scheduled at the beginning of the project. And because the system complexity, and the need of fast decision making, the team decided to work on Scrum methodology.

Following this methodology the team represented the gathered information as a list of user stories, and afterwards, divide the development process into several sprints.

3.2   User stories

- Parent's user stories

US 1.0

As a parent, I want to view the bus location that my child took in the application so that I can check on my child.

US 2.0

As a parent, I want to get notified when the bus is near to my home so that I could know when to get my child ready.
US 3.0

As a parent, I want to have a user name and password from the school so that I can access the application.
US 4.0

As a parent, I want to have a way to contact the school so that I can inform them if something not wanted occurred.

US 5.0

As a parent, I want to see my profile in the application so that I can check on my information.

US 6.0

As a parent, I want to view the live distance from my house to the bus so that I can expect when the bus arrives to my home.

- Admin user stories

US 7.0

As an Admin, I want to view the bus location so that I can monitor the ride.

US 8.0

As an Admin, I want to add and remove parents from the system.

US 9.0

As an Admin, I want to add and remove drivers from the system so that I can change drivers if something happened.

US 10.0

As an Admin, I want to have a user name and password from the school so that I can access the application.

US 11.0

As an Admin, I want to have a way to contact the school so that I can inform them if something not wanted occurred.

- Drivers user stories

US 12.0

As a driver, I want to have a bus number from the school so that I can access the application.

US 13.0

As a driver, I want to view my bus location.

3.3   Non-Functional Requirements

- Performance

  Performance should not be an issue because we are using firebase as a server.

- Reliability

  The software will meet all of the functional requirements without any unexpected Behavior.

- Usability

  The software will be easy to use for the parents.

- Portability

  This software will be designed to run on any Android operating system version 5.0 or higher.

3.4   Analysis and design

3.4.1   Use case diagram
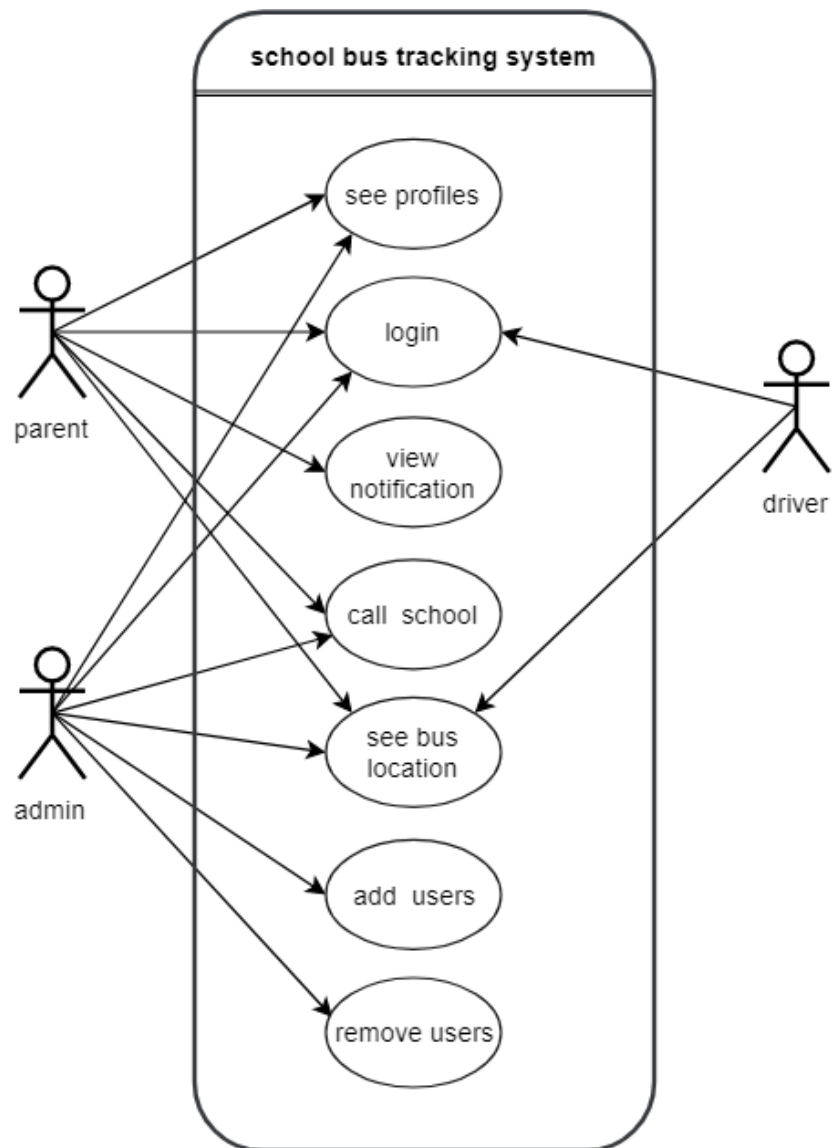
The use case diagram describe the roles of the actors.

Figure (3-1) Use Case Diagram

3.4.2 Class diagram

This diagram show the relation between class and their attribute and method.
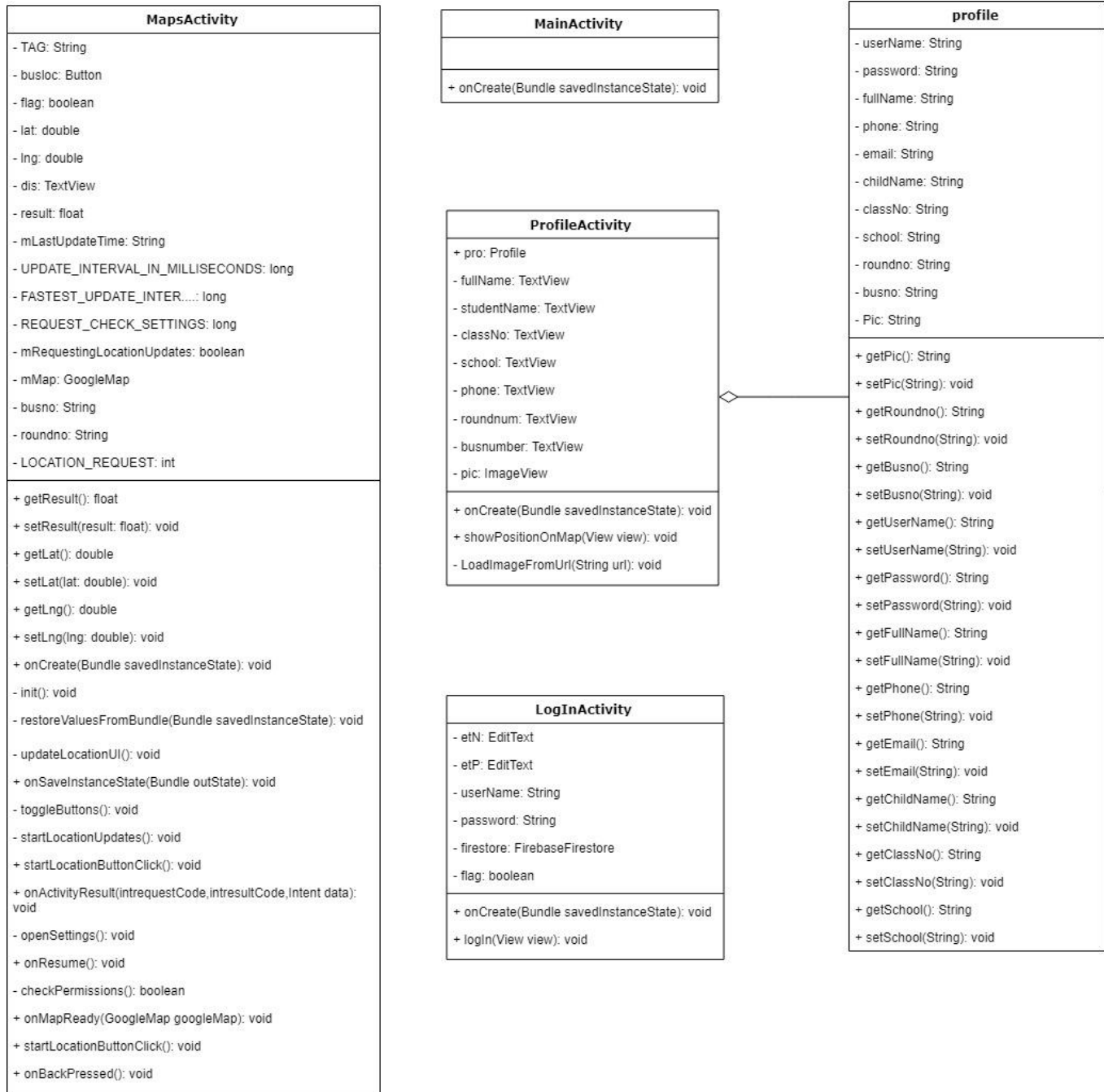
3.4.2.1 Parents application

MapsActivity

- TAG: String
- busloc: Button
- flag: boolean
- lat: double
- lng: double
- dis: TextView
- result: float
- mLastUpdateTime: String
- UPDATE_INTERVAL_IN_MILLISECONDS: long
- FASTEST_UPDATE_INTER....: long
- REQUEST_CHECK_SETTINGS: long
- mRequestingLocationUpdates: boolean
- mMap: GoogleMap
- busno: String
- roundno: String
- LOCATION_REQUEST: int

+ getResult(): float
+ setResult(result: float): void
+ getLat(): double
+ setLat(lat: double): void
+ getLng(): double
+ setLng(lng: double): void
+ onCreate(Bundle savedInstanceState): void
- init(): void
- restoreValuesFromBundle(Bundle savedInstanceState): void
- updateLocationUI(): void
+ onSaveInstanceState(Bundle outState): void
- toggleButtons(): void
- startLocationUpdates(): void
+ startLocationButtonClick(): void
+ onActivityResult(intrequestCode,intresultCode,Intent data): void
- openSettings(): void
+ onResume(): void
- checkPermissions(): boolean
+ onMapReady(GoogleMap googleMap): void
+ startLocationButtonClick(): void
+ onBackPressed(): void

MainActivity

+ onCreate(Bundle savedInstanceState): void

ProfileActivity

+ pro: Profile
- fullName: TextView
- studentName: TextView
- classNo: TextView
- school: TextView
- phone: TextView
- roundnum: TextView
- busnumber: TextView
- pic: ImageView

+ onCreate(Bundle savedInstanceState): void
+ showPositionOnMap(View view): void
- LoadImageFromUrl(String url): void

LogInActivity

- etN: EditText
- etP: EditText
- userName: String
- password: String
- firestore: FirebaseFirestore
- flag: boolean

+ onCreate(Bundle savedInstanceState): void
+ logIn(View view): void

profile

- userName: String
- password: String
- fullName: String
- phone: String
- email: String
- childName: String
- classNo: String
- school: String
- roundno: String
- busno: String
- Pic: String

+ getPic(): String
+ setPic(String): void
+ getRoundno(): String
+ setRoundno(String): void
+ getBusno(): String
+ setBusno(String): void
+ getUserName(): String
+ setUserName(String): void
+ getPassword(): String
+ setPassword(String): void
+ getFullName(): String
+ setFullName(String): void
+ getPhone(): String
+ setPhone(String): void
+ getEmail(): String
+ setEmail(String): void
+ getChildName(): String
+ setChildName(String): void
+ getClassNo(): String
+ setClassNo(String): void
+ getSchool(): String
+ setSchool(String): void

Figure (3-2) parents class diagram

3.4.2.2 Driver application

MainActivity
-btnStartUbdate:Button
-mMap:GoogleMap
-lat:double
-lng:double
-ebusnumber:EditText
-eroundnumber:EditText
-firebaseDatabase:FirebaseDatabase
-mLastUpdateTime:String
-UPDATE_INTERVAL_IN_MILLISECONDS:Final Long
-FASTEST_UPDATE_INTERVAL_IN_MILLISECONDS:Final Long
-REQUEST_CHECK_SETTINGS:Final Int
-mRequestingLocationUpdates:Boolean
+ getlat(): double
+ setLat(lat: double): void
+ getlng(): double
+ setLng(lng: double): void
+ onCreate(Bundle savedInstanceState): void
- init(): void
- restoreValuesFromBundle(Bundle savedInstanceState): void
- updateLocationUI(): void
+ onSaveInstanceState(Bundle outState): void
- toggleButtons(): void
- startLocationUpdates(): void
+ startLocationButtonClick(): void
+ onActivityResult(int requestCode,int resultCode,Intent data): void
- openSettings(): void
+ onResume(): void
- checkPermissions(): boolean
+ onPause(): void
+ onMapReady(GoogleMap googleMap): void

Figure (3-3) Driver class diagram

3.4.3 Flow chart (Parent application)

The figure bellow describes the application processes flow.

Figure (3-4) Flow chart (Parent application)

3.4.4 Flow charts (Driver application)

This charts show how the driver can access to the application and what the information they need
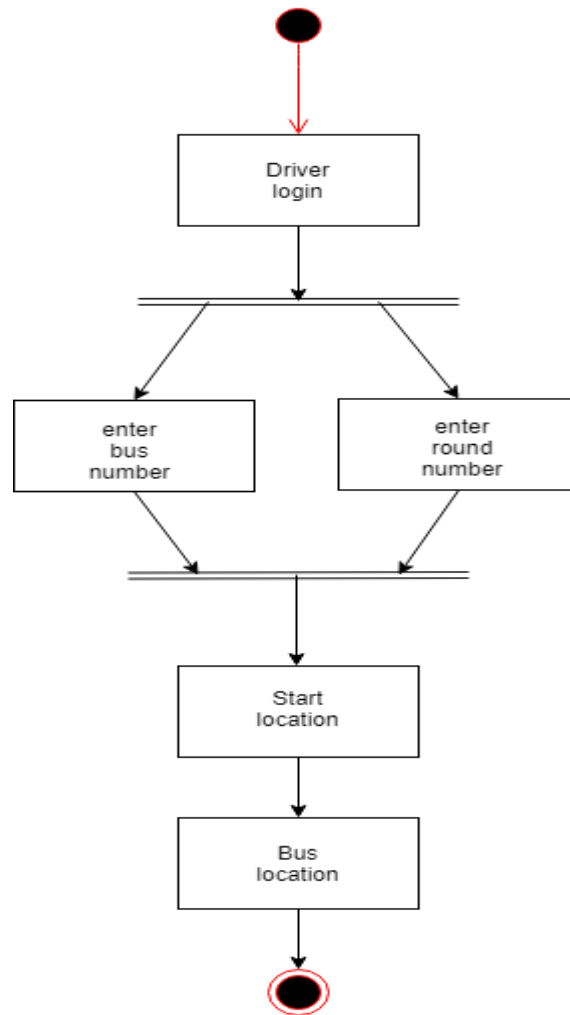
Figure (3-5) Flow chart (Driver application)

Chapter 4
System Implementation and Outcomes

4.1   Introduction

Finally, after a period of development and programming system was built a critical stage of software development process is system implementation.

The implementation stage of software development is the process converting a system specification into an executable system. It always involves processes of soft-ware design and programming.

4.2   System Requirements

4.2.1   The User

- Android device with Internet capabilities and location access.
- Android version of 5.0 and above.
- Computer with internet access

4.2.2   The Server

- Firebase
  - Cloud fire store
  - Real time database

4.3   Installation Guide

You can download the application from this link
https://mega.nz/#!gnRBFChb!v9CAhSWUehCwGKjpxcZsUm28hWWSEuUdUW
WpgBpfqnE (MEGA) and to install it to your device you must have a device
running on android OS. Then, start installing the application as follows:

1. First of all, be sure to check the source installations unknown:
- Select the Unknown Sources check box.
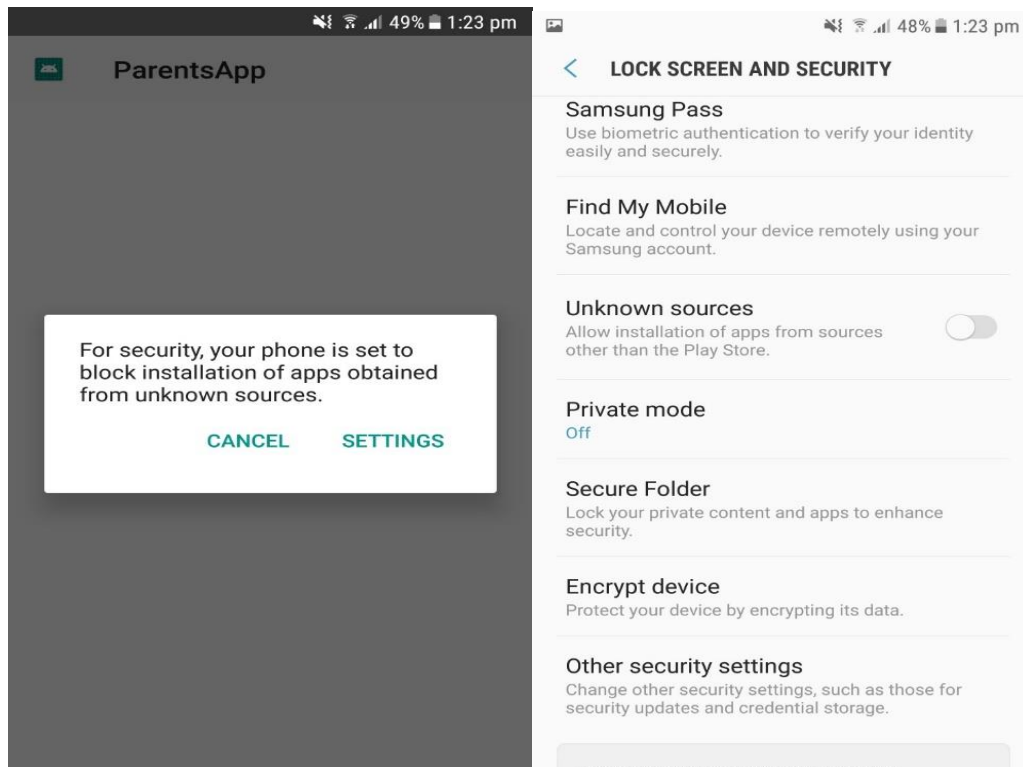
Figure (4-1) Installing the application (1)

This figure describes the location access permission activity.

2- Click on "Install" and wait until the installation process is finished.
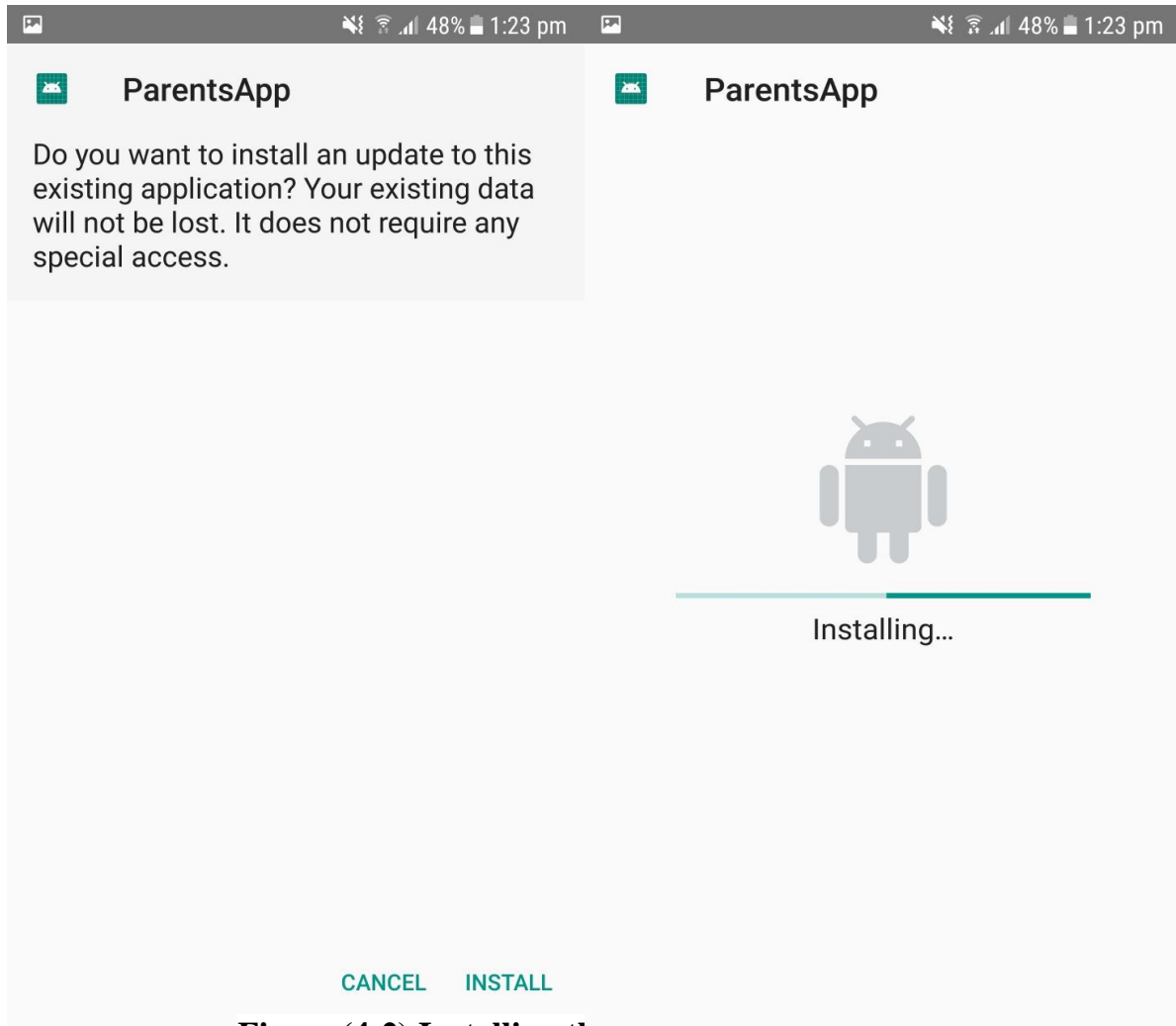
Figure (4-2) Installing the application (2)

This figure describes the application installation process.

3- Click on "Open", to start running the application.
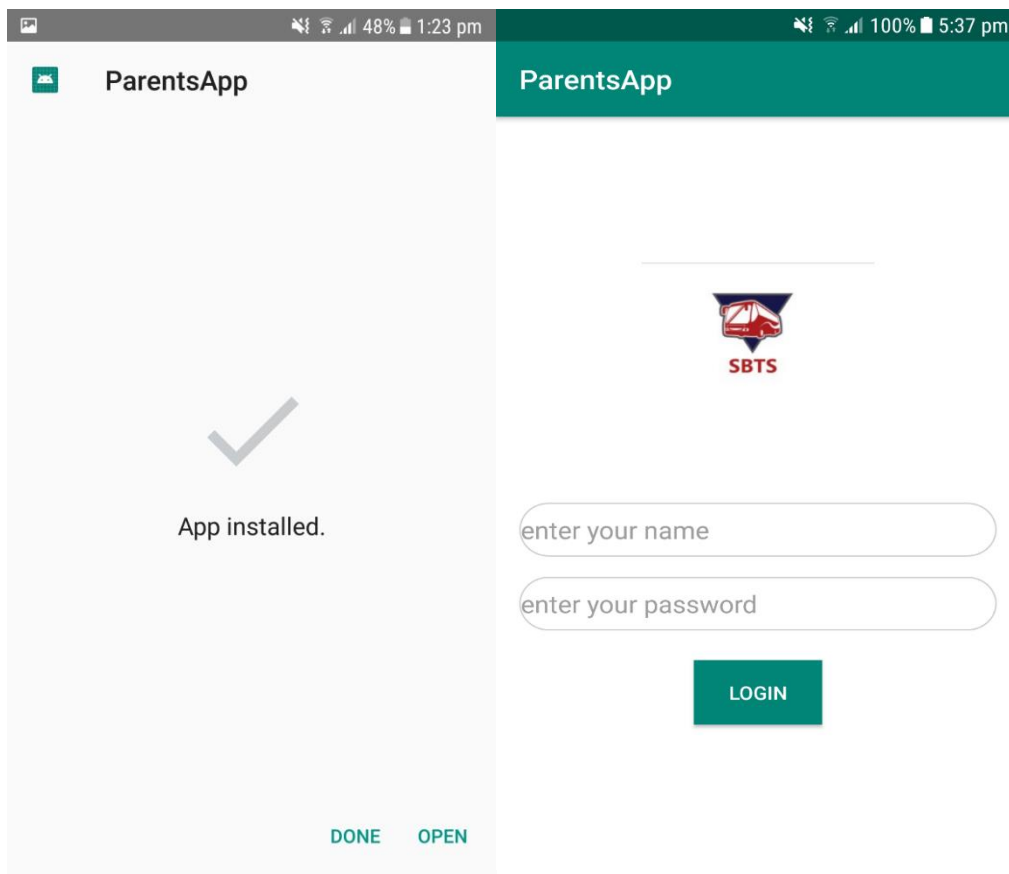
Figure (4-3) Installing the application (3)

This figure shows the login screen after the installation ends.

4- Before you start using the application, make sure you give it all the permissions required.

- the application will ask you to allow it to access the device location to
- know your location on the map as shown in the figure bellow
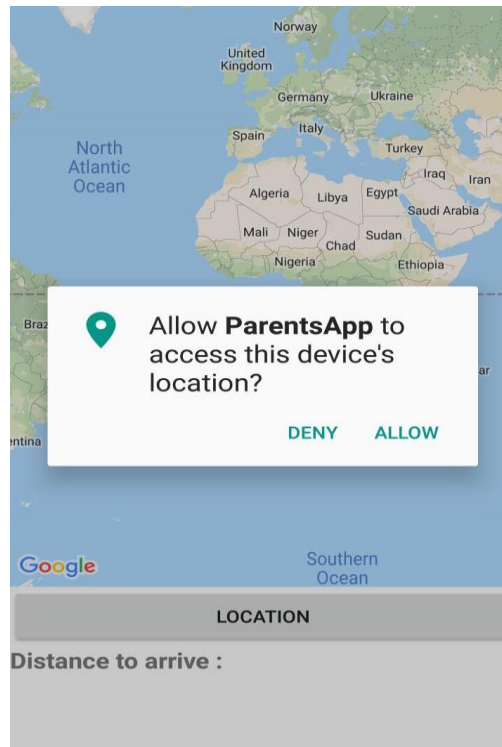
Figure (4-4) location permission

This figure describes the location access permission activity.
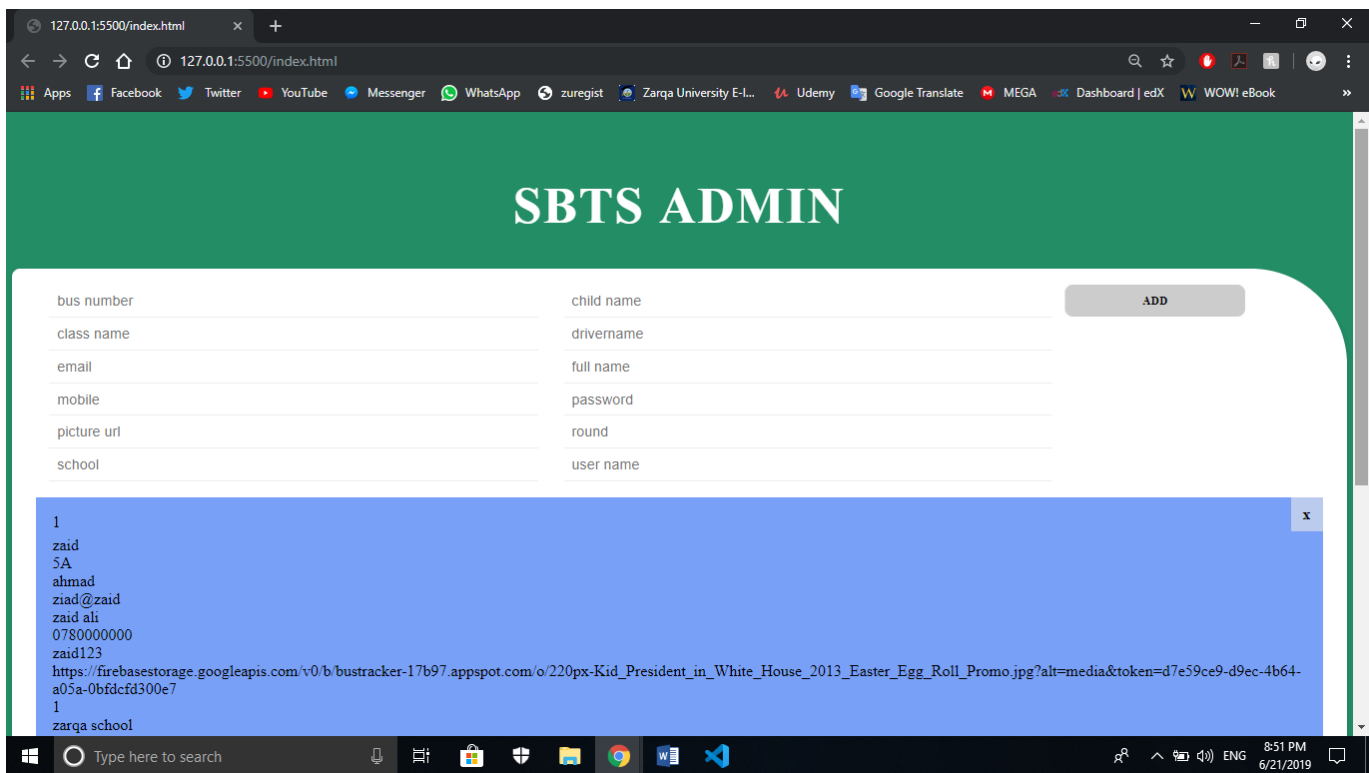
4.4   User Manual

4.4.1   Signing up a new user

To sign up a new user, the admin should enter his information on the SBTS website (Admin website) and click the add button, and this will relay the user information to the firebase cloud fire store and open a new document to the user.

4.4.2   Deleting users

To delete a user, the admin would go to the website and delete the user and this will remove him from firebase.

Figure (4-5) Creating new account (Admin)

This figure shows the admin website.

4.4.3   Login as parents

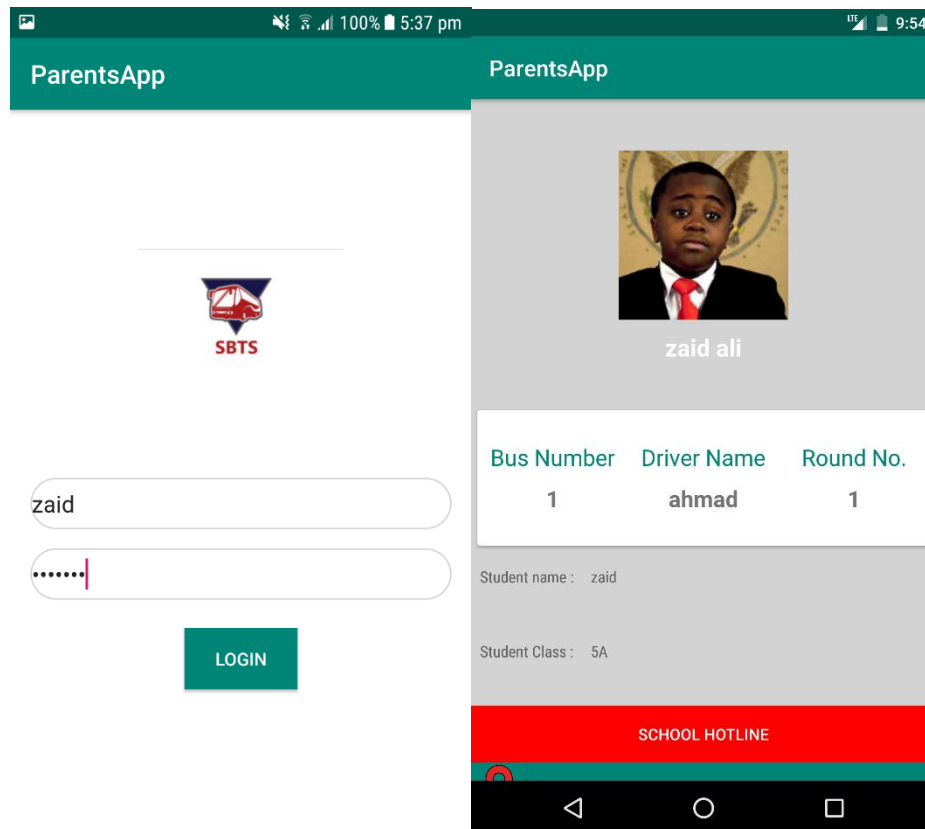- Enter your user name and password that the school had gave you, then click "login".

Figure (4-6) Login screen

This figure shows the login screen and the user profile after login.

4.4.4　Location maps activity

- To go to the bus location, press the position now button.

- The distance between the bus and the parents house will be presented under the map.
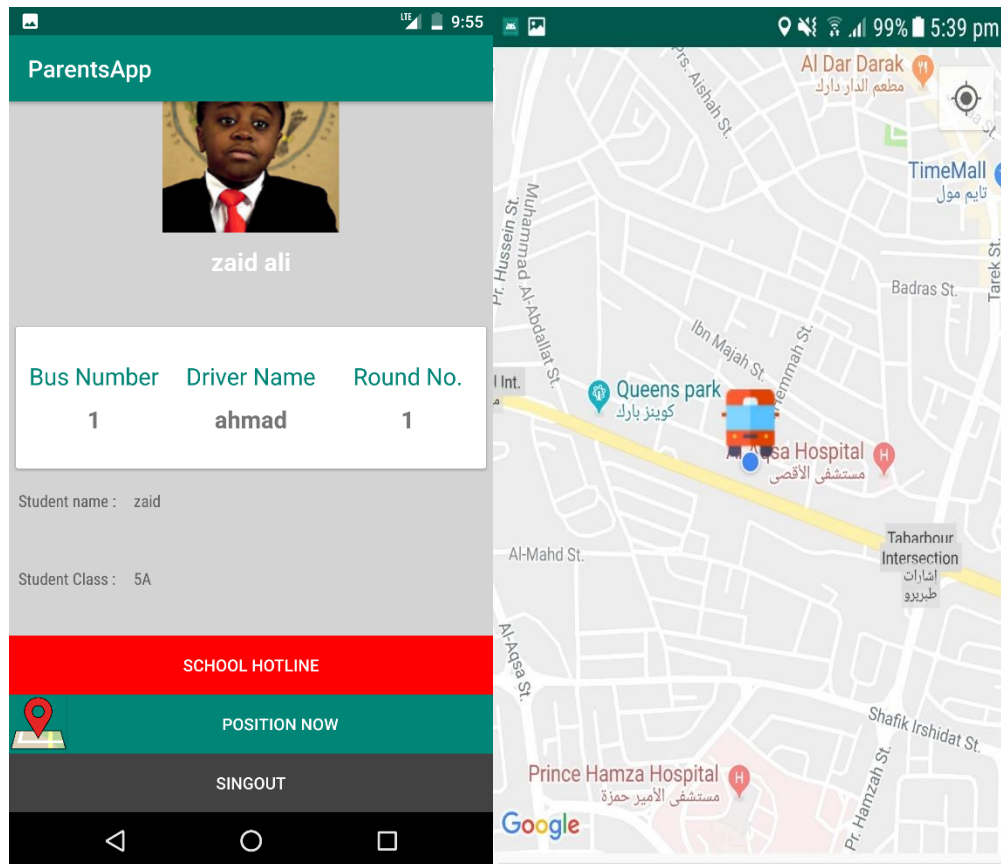

Figure (4-7) profile and map

This figure shows the map activity after the position now button have been pressed.

4.4.5   Emergency school call

To contact the school if emergency happened, press the school hotline button the application will open the phone diel and the school number is auto added.
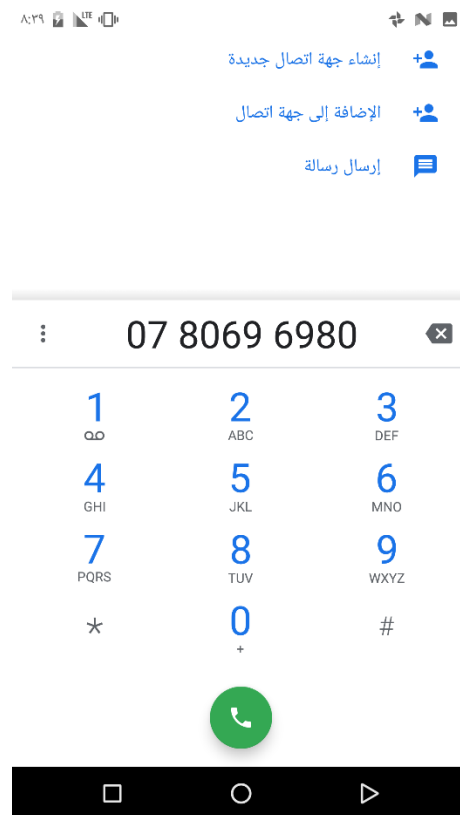

Figure (5-8) call activity

This figure shows the call activity after the school hotline button have been pressed.

4.4.6 Login as driver

- Enter the bus number and round number, then click "Start Location".
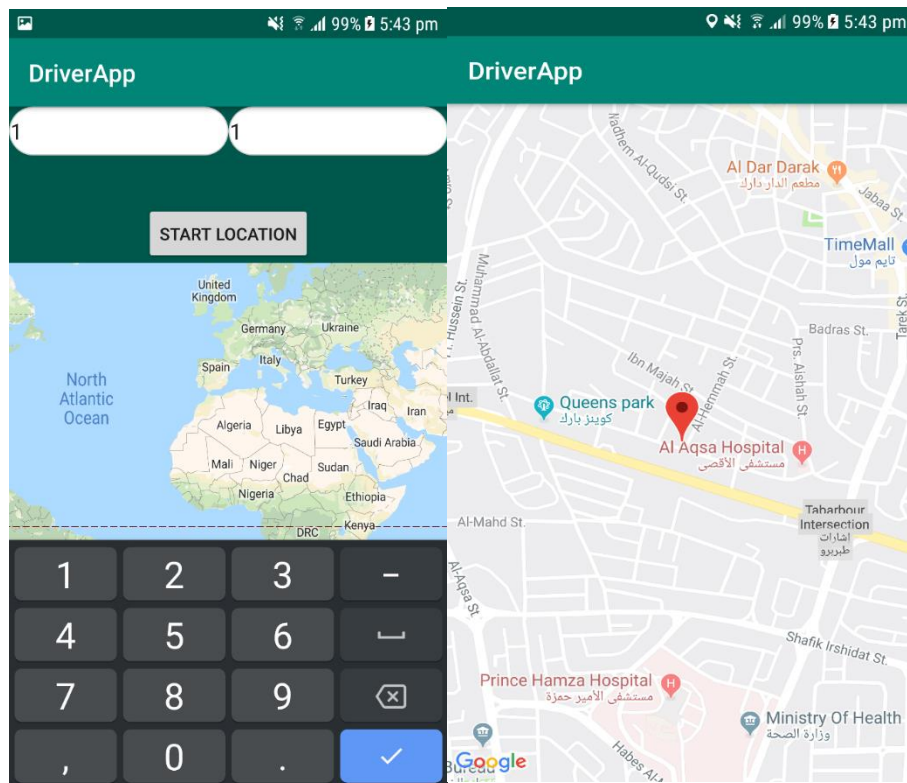
- The location of the bus will appear.

Figure (5-9) Login as a Driver

This figure shows the driver login and map activity.

4.4.7 Updating profiles and logout

- You can update your profile only through the administrator.

- You can logout from the application only from profile page

Chapter 5
System Testing

5.1   Introduction

System testing is one of the most important things the team had done to ensure that the basic functions and requirements of the system are properly translated into the required system.

Acceptance testing certifies that the system satisfies the end user or customer's scope and detailed requirements. It is the users or client's responsibility to assure that all features and functionality are included so that project's goal will be achieved.

5.2   Acceptance Test Forms

In the following pages, the team represented three User Acceptance Test (UAT) forms, represented as charts, for our system.

Three users had tested the system, each user filled up his form once as a parent, once as an Admin and once as a driver

The user will evaluate each user story by a scale from one to five, 1 indicates poor,2 means not bad, 3 means medium, 4 means good and 5 indicates excellent.

Table 5.1, table 5.2 and table 5.3 (shown in the following pages) have been filled by the first, second and third users respectively. Each user has evaluated the first three user-stories as a parent, then evaluate the rest user-stories as a Driver and then evaluate the rest user-stories as an Admin.

Table 5.1:   UAT form evaluated from 1 to 5 by user 1

	Verification	Validation	Ease of use
As a parent's			
Q1 Logging into a parent's Application	**3**	**4**	**4**
Q2 Track bus route by parents	4	**5**	**5**
Q3 Getting a notification when the bus arrives at parents	**4**	**5**	**3**
As a driver			
Q4 access the driver Application	**3**	**5**	**5**
Q5 view my bus location	**2**	**3**	**4**
As an admin			
Q6 View the bus location by Admin	**3**	**3**	**3**
Q7 Creating a parent's account by admin	**4**	**5**	**5**
Q8 Creating a driver account by admin	**4**	**4**	**4**

Table 5.2:   UAT form evaluated from 1 to 5 by user 2

	Verification	**Validation**	**Ease of use**
As a parent's			
Q1 Logging into a parent's Application	**4**	**5**	**3**
Q2 Track bus route by parents	3	**5**	**5**
Q3 Getting a notification when the bus arrives at parents	**3**	**4**	**4**
As a driver			
Q4 access the driver Application	**4**	**5**	**5**
Q5 view my bus location	**4**	**5**	**5**
As an admin			
Q6 View the bus location by Admin	**4**	**4**	**4**
Q7 Creating a parent's account by admin	**2**	**3**	**4**
Q8 Creating a driver account by admin	**4**	**5**	**4**

Table 5.3:   UAT form evaluated from 1 to 5 by user 3

	Verification	Validation	Ease of use
As a parent's			
Q1 Logging into a parent's Application	**4**	**5**	**5**
Q2 Track bus route by parents	3	**3**	**4**
Q3 Getting a notification when the bus arrives at parents	**4**	**4**	**4**
As a driver			
Q4 Access the driver Application	**3**	**3**	**5**
Q5 View my bus location	**4**	**3**	**4**
As an admin			
Q6 View the bus location by Admin	**3**	**3**	**3**
Q7 Creating a parent's account by admin	**2**	**3**	**5**
Q8 Creating a driver account by admin	**2**	**2**	**3**

After representing all user's evaluations, figure (5-1) illustrate all evaluations previous as a bar charts.

Figure (5-1) represents the average of all three evaluations:
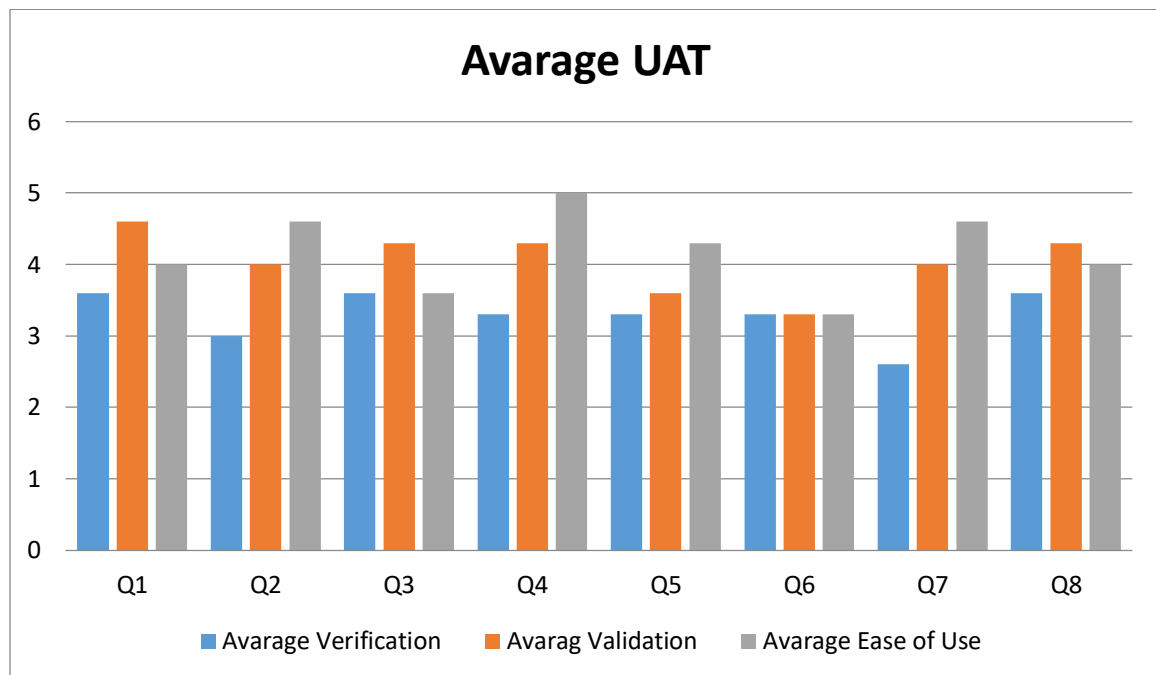

Figure (5-1) Average bar chart for all three users

Chapter 6
Conclusion and Future work

6.1   Conclusion

This project is a system that contains a mobile application works on google maps to help the parents and school in tracking the buses and call the school if something happened and a website for the admin to add users.

6.2   Future Work

As a future work, we are planning to develop the system to make it compatible with deferent platforms other than Android, such as IOS and web based application that will be done in order to make large number of users able to benefit from our system.

Also, we're planning to add several features, such as:

- A smart sensor Piece to monitor bus speed.

- A smart sensor Piece that notifies the school admin if the bus carries students more than the required number.

- adding a camera in the bus to monitor the ride

- A chatting room in the application to chat with the school

الخلاصة

يعتبر طلاب المدرسة من أهم فئات المجتمع، تم تصميم هذا البرنامج لمعالجة المشكلات التي تواجة الأهالي و المدارس في عملية نقل الطلاب و معرفة مكان تواجد الحافلات.

والفكرة هي عمل تطبيق للهاتف يربط أولياء الأمور و المدرسة بالحافلة عبر الخرائط، لمعرفة أماكن تواجد الحافلات و تتبعها في الوقت الحالي بشكل مباشر؛ أيضا يعمل البرنامج على تنبية الاهل بموعد وصول الحافلة الى منزل الطلبة للتقليل من الوقت الضائع في انتظار الحافلة.

السبب الرئيسي لبنائنا هذا التطبيق هو جعل نقل الأطفال اكثر امانا وفعالية من خلال تطبيق التكنولوجيا الحديثة ومن خلال هذا التطبيق نأمل في الوصول إلى اهدافنا.

References

[1] URL: https://www.revinfotech.com/scrum-method

[2] URL: https://www.projectmanager.com/blog/scrum-roles-the-anatomy-of-a-scrum-team

[3] URL: https://www.revinfotech.com/scrum-method

[4] URL: https://www.simplilearn.com/scrum-project-management-article

[5] URL: https://www.w3schools.com/html/html_intro.asp

[6] URL: https://en.wikipedia.org/wiki/Cascading_Style_Sheets

[7] URL: https://en.wikipedia.org/wiki/JavaScript

[8] URL: https://en.wikipedia.org/wiki/Java/(programming_language)

[9] URL: https://en.wikipedia.org/wiki/Android_Studio

[10] URL: https://www.quora.com/What-is-firebase

[11] URL: https://code.visualstudio.com/docs

[12] URL: https://en.wikipedia.org/wiki/Project_planning

[13] URL: https://en.wikipedia.org/wiki/Gantt_chart