UNIVERSITY BUSES ROUTING AND TRACKING SYSTEM

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ABSTRACT

This paper proposes development of an android app to improve the transportation services for bus rental companies that lift Taibah University students. It intends to reduce the waiting time for bus students, thereby to stimulate sharing of updated information between the bus drivers and students. The application can run only on android devices. It would inform the students about the exact time of arrival and departure of buses on route. This proposed app would specifically be used by students and drivers of Taibah University. Any change in the scheduled movement of the buses would be updated in the software. Regular alerts would be sent in case of delays or cancelation of buses. Bus locations and routes are shown on dynamic maps using Google maps. The application is designed and tested where the users assured that the application gives the real time service and it is very helpful for them.

KEYWORDS

Bus Routing, Bus Tracking, Google Maps, GIS

1. INTRODUCTION

Android is becoming very popular because the source code is completely free; also, Android is highly suitable for expansion as the developer see fit, so building a mobile application for Android devices is very common these days due to the mentioned reasons [1].

A geographic information system (GIS) is a machine framework intended to catch, store, control, investigate, oversee, and show different kinds of spatial or land information. The acronym GIS is in some cases utilized for geographical information science [2]. GIS platform is used to constitute a map of route net, beside the user's interface based on VB. Net to use Desktop, assisting individuals who use buses' that moves inside the city to be familiar with buses' routes and their actual sites, in addition to data about out-of-work buses[2].

GIS can relate disconnected data by utilizing area as the key record variable. Areas may be recorded as x, y, and z directions. All Earth-based spatial–temporal area and degree references ought to, preferably, be relatable to each other and at last to a "true" physical area or degree. This feature of GIS has started to open new streets of exploratory. It gives a pursuing time technique of buses, assisting the management of traffic sufficiently and solving emergency situations. It is available a as web application for passengers to be familiar with routes' conditions and buses' routes[2].

Location Based Services (LBS) denotes applications integrating geographic location to provide a certain service. Examples of such applications include emergency services, car navigation systems or tourist tour planning information delivery[4]. Location services are mainly used in

three areas: military and government industries, emergency services and the commercial sector[4]. Analysts and researchers classified the LBS services as the following [4]:

- Person oriented: Position the location of the user or use the position of the user to enhance a service for example, friend finder application. The located person can control the device.
- Device oriented: Used to locate objects for example a group of people or a car. The located person or object cannot control the service.

Also the location based services could be divided into [4]:

- Push services: The user receives information according to his/her location without requesting the information, for example receiving a welcoming message when entering a new town.
- Pull services: In the contrast, the user pull information from the network, for example finding the nearest ATM machine.

This paper presents an application for intelligent mobile devices, mainly GPS. Several methods are proposed to reduce the wastage of time of students waiting for a bus to arrive; we proposed GPS based Bus Tracking and Monitoring system in which the tracking is done by implementing maps with GPS facility. The Android Application is designed for students where they can access/view the daily timetable of bus, bus route, location of bus, and bus arrival and delay timing information. Our main focus is to provide the student with such a system which will for sure reduce the waiting time and will provide the student with all necessary details regarding the arrival time of the bus, its exact location and expected waiting time.

In the next section, a review of the relevant work is presented. The main characteristics of the application are presented in section 3. The results are in section 4. The conclusion and the future work is in section 5.

2. REVIEW OF RELEVANT WORK

In table 1, a comparison between related works and our proposed mobile application is presented. We compared all works against most popular features as GIS, GPS, Maps and whether or not the applications calculate the arrival time.

The proposed mobile application is used for solving many problems starting from the students waiting for the bus. The mobile application will be useful to know next stops and students can monitor the location of the bus on the map. The application is very helpful to find that either student missed the bus or it is late due to traffic. The chance of missing the bus by students will be reduced. This application will save the time and iterations of bus wait will definitely lessen by this app. GIS and GPS technologies introduced this application Taibah University is going to use this application for their students and providing them best transport services. This system stores all operations done in a day and helps the student and management of transport services. University using this app for better management and quick transport services for students.

3. SYSTEM MAIN CHARACTERISTICS

The system architecture is presented in figure 1, where the main characteristics of the presented application are:

Table 1. Comparison between related work and our work

	[1]	[2]	[3]	[4]	[5]	Our work
GPS	√	√	√	√	√	√
GIS	√	x	x	x	√	√
Maps	√	√	x	x	√	√
Arrival time	√	√	√	√	√	√
SMS& GSM	x	x	√	√	√	√
Mobile Application	√	√	x	√	√	√
Dynamic Maps	x	√	x	x	x	√

3.1 DYNAMIC MAP

By dynamic map, we mean that the map will be updated automatically for students and drivers which will facilitate to find out the students' exact positions and also determine each bus stop.

3.2 GEO DATABASE

Geodatabase has many features specific to databases and the most important of the total dispensed from the other database programs and set up tables inside, tables can be presented on the map and also the student's name .

3.3 DIJKSTRA'S ALGORITHM

It is a solution to the single-source shortest path problem in graph theory. However, it is about as computationally expensive to calculate the shortest path from vertex u to every vertex using Dijkstra's as it is to calculate the shortest path to some particular vertex v. Therefore, anytime we want to know the optimal path to some other vertex from a determined origin, we will use Dijkstra's algorithm feature that is in google maps platform.

3.4 NOTIFICATION SYSTEM

In the application, a notification system is applied which is more convenient between the server and driver and passengers. As the application is a mobile application then sending notifications is a very practical way.

The system architecture which describes the structure and overall design of a system is presented in figure 1. A class diagram of the system is presented in figure 2. The admin has a login username and password to log to the web portal to carry out his tasks. The admin can control all the tasks from his screen. The driver can set the availability of the bus weather the bus is available or not, if the bus is not available a notification will be sent to the concerned students. The timetable of each student will be entered, a notification will be sent and route will be updated accordingly if there are any changes in the presented schedule.
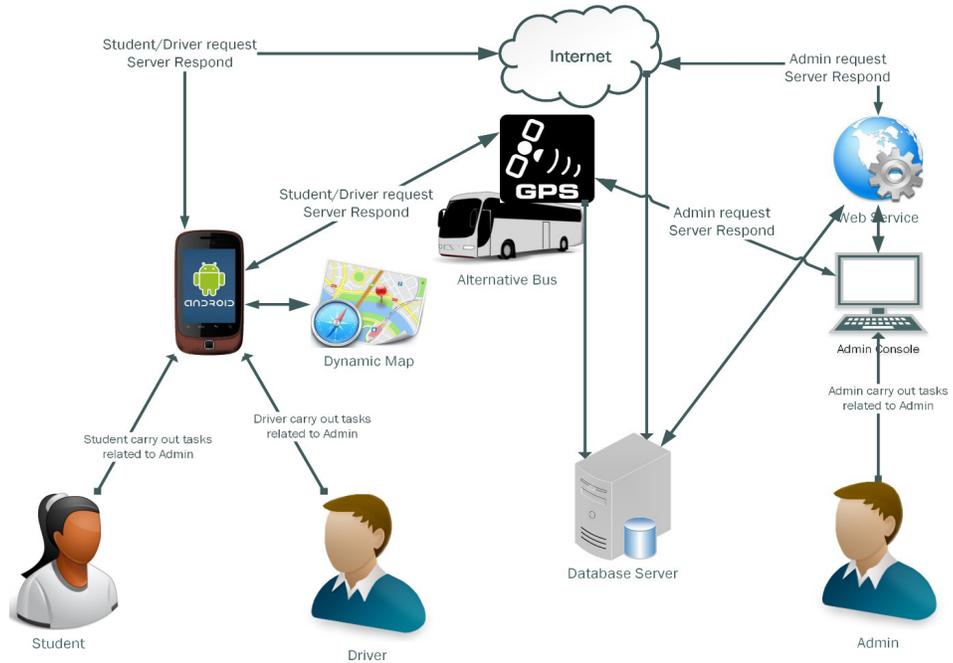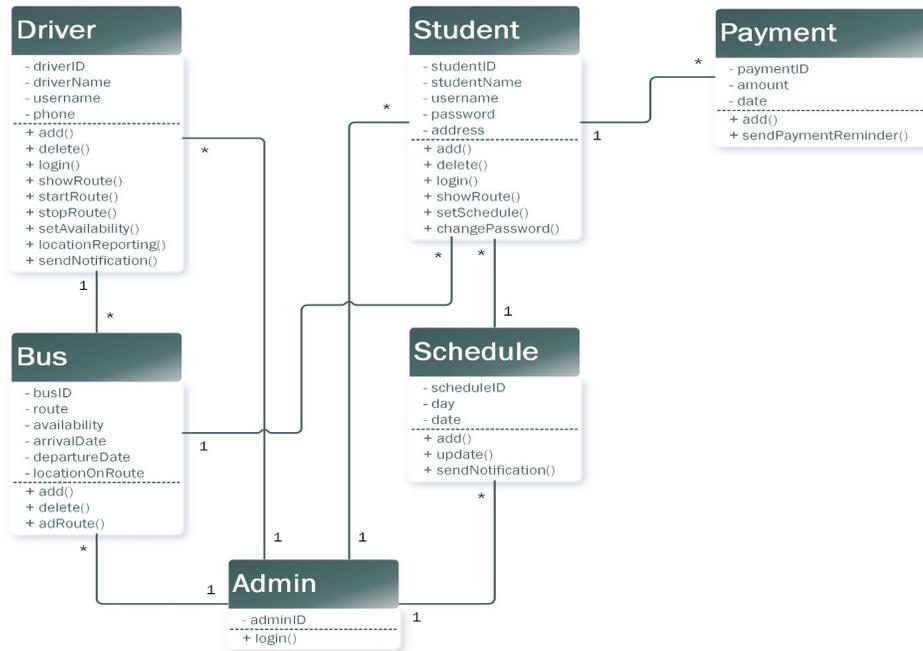
Figure.1 System Architecture
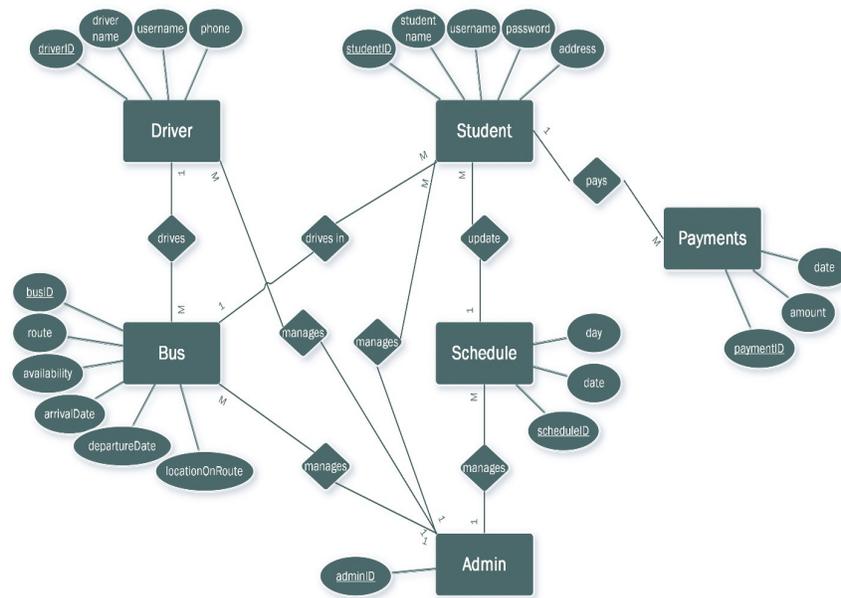

Figure 2 System Class diagram

Figure 3 Database Design

In figure 3, there are 6 relations in the database: Student, Driver, Schedule, Admin ,Payments and Bus. The admin manages all the tables in the ERD. The student is related to Bus and Schedule tables where any student can update the schedule and for every bus there are many students.

Figure 4 shows the admin sequence diagram since login until he logs out where admin can manage students or drivers and can set the schedules and can manage buses, also the sequential diagrams for both the driver and the students are implemented.

4. RESULTS

The application has 3 main users Admin, Student and Driver we will present main screen shots for each user as described below.

4.1 ADMIN

In Figure 5, The admin logs into the system with user name and password, the admin mages routes, students and drivers he can add students and delete them, add drivers, delete them, also the first thing the admin does is add routes that are stored in the database, also the users data is stored into the database in the users table, while adding students the admin assigns routes to student.

Admin can add routes to the system by clicking manage routes where routes screen will appear and add information about route by stating its name and bus number, adding the departure and arrival times; departure is the time the student going route to the university and arrival is the retuning route from the University.

Finally through the route tab the admin states the start and end point of the route by taping on the map to select location A then tapping to select location B. Admin also can delete a student name. Student's information can be viewed by clicking a long click on the student name where a menu appears to view credentials. Admin also can add and delete drivers' names.
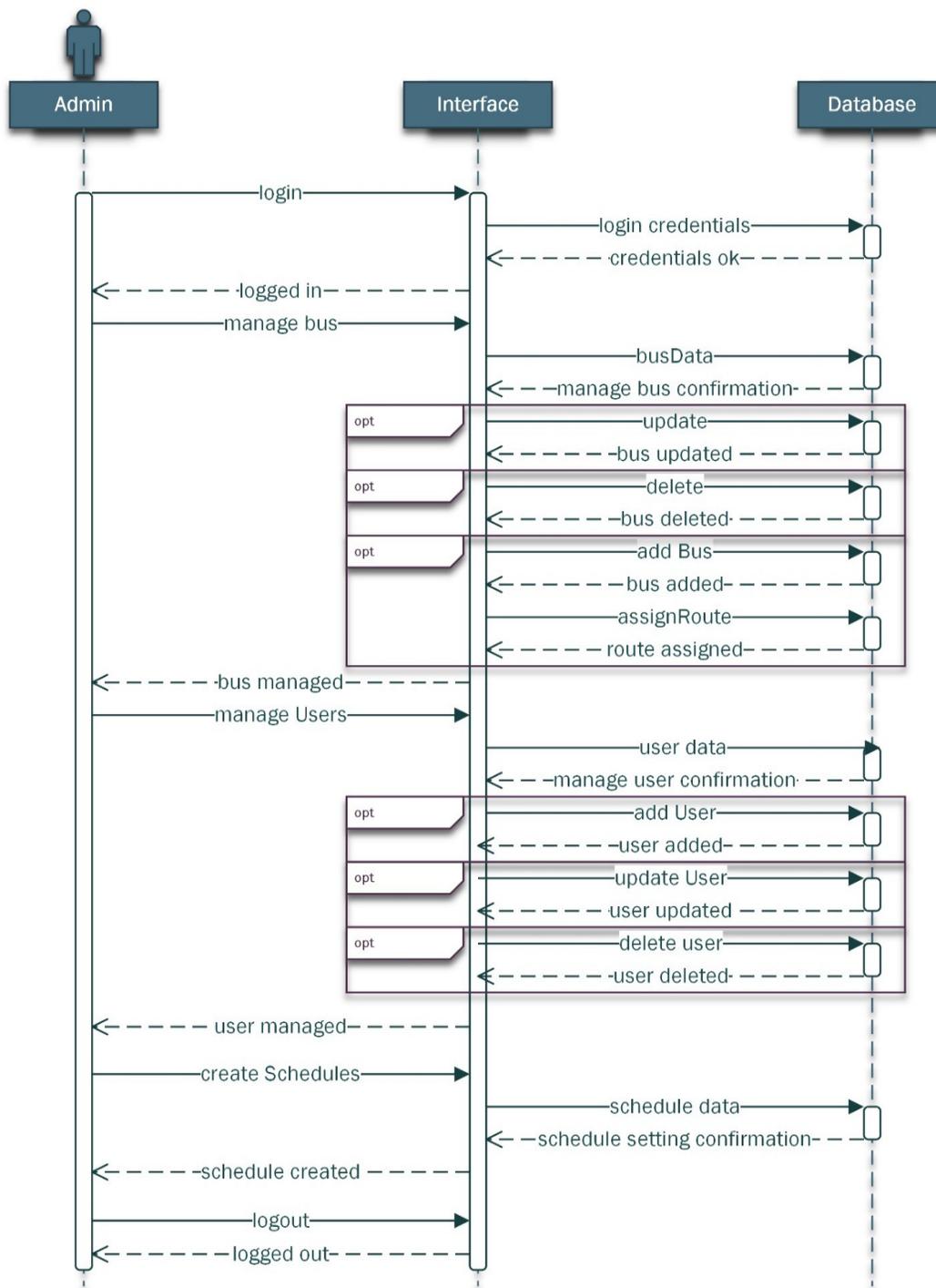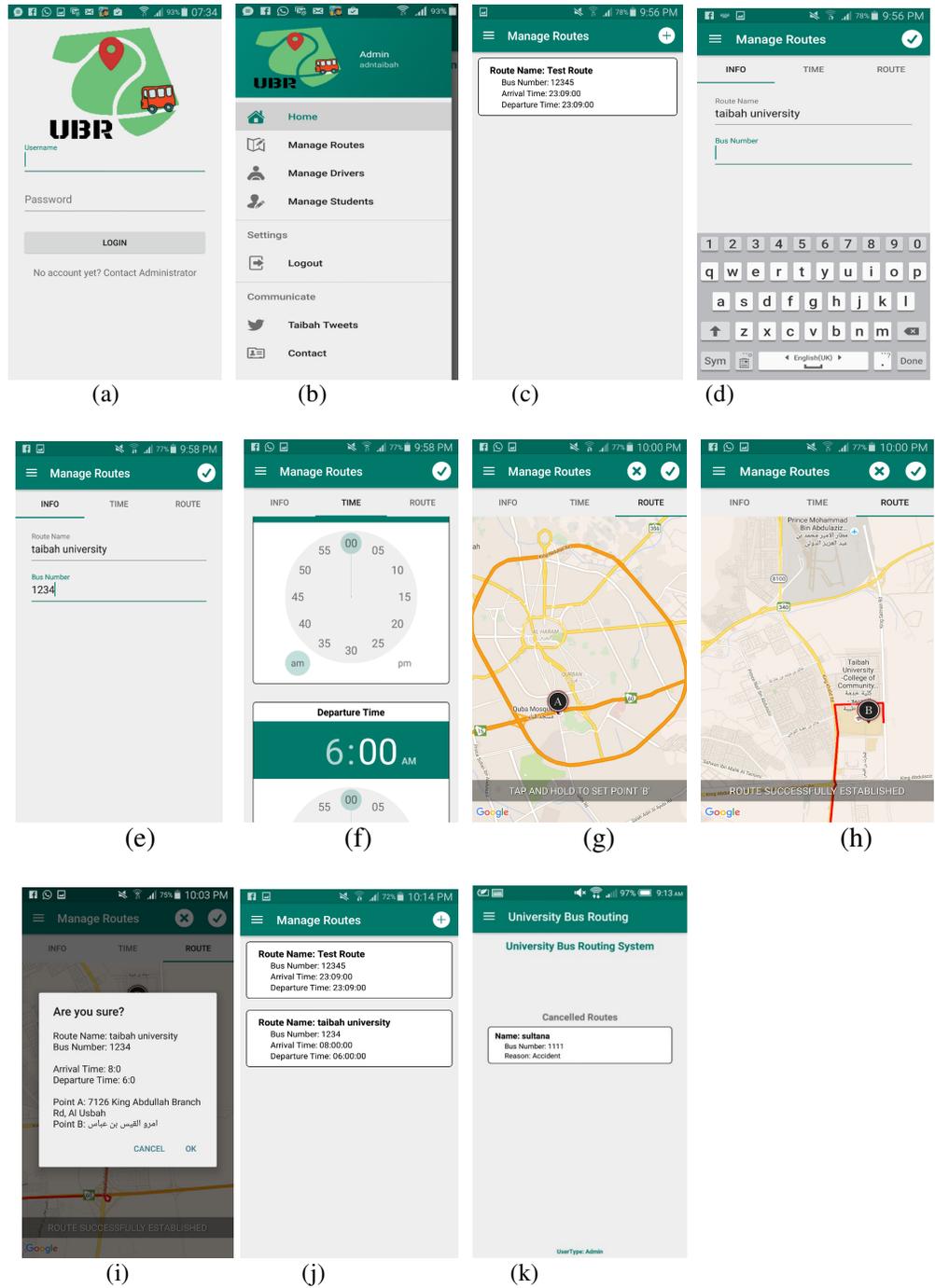
Figure 4 Admin sequence diagram

Figure 5 Admin screen shots' example

4.2 STUDENTS

As shown in figure 6, the student can login to the system with username and password provided by the administrator, students can view the route in real time and can locate the drivers location on the map when the driver clicks start route, the student will be able to locate the driver on the route and the speed will be displayed too.
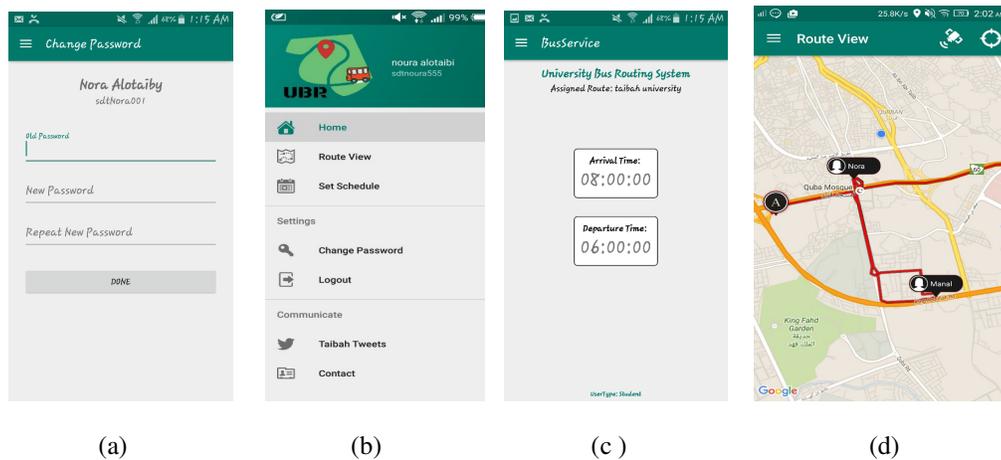
Figure 6 Students screen shots' example

4.3 DRIVERS

The driver logs into the system by providing the username and password, driver can start the route by clicking start route on his home page, as soon as the driver clicks start route button the route starts and real time tracking starts on the driver and student mobiles, the driver can view the route where the students' locations are shown. The driver can choose to report a situation if an accident occurs or the bus is out of service and this will appear on the admin's home page immediately to take the ultimate solution to solve the problem as shown in figure 7.
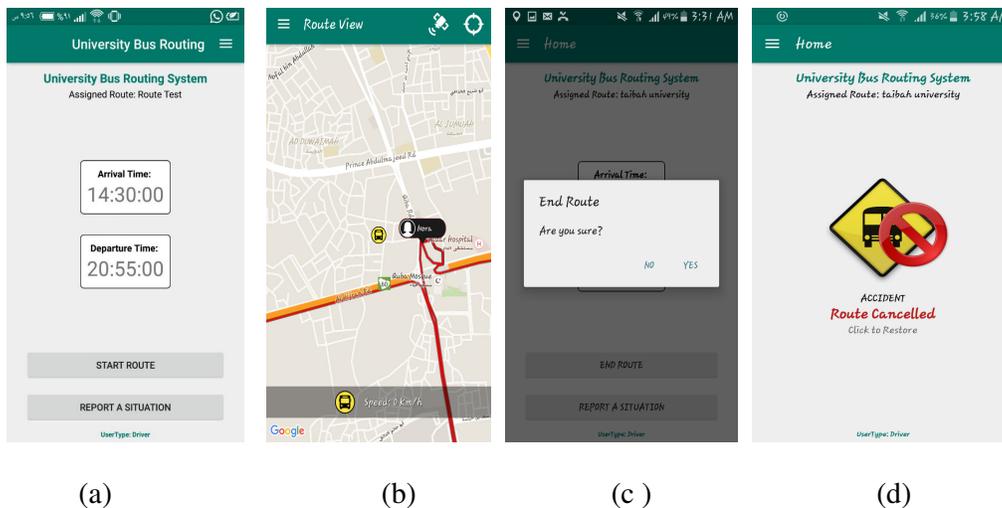

Figure 7 Students screen shots' example

This application was tested among students, drivers and admin in Taibah University, Almadinah ,Saudi Arabia. They assured that the application is a very useful and will help them. They assured that the user interfaces was easy and the navigation through the application was not hard. Also the application gives real time service as it was developed to be, efficiency of the application was very good.

6. CONCLUSION AND FUTURE WORK

This proposed project intends to resolve the problem with long waiting times students of the Taibah University are facing for buses. It's primarily important to upgrade the existing manual Bus Tracking and Monitoring system to improve transportation services.

For the proposed application, GPS based system is used to suffice the intended purpose. In this proposal, extensive study has been done to elaborate on the bus management and a mobile application based on the same. It also studies previous research works conducted in this field to gauge the potential challenges in future. So, users would need a mandatory GPS, reliable internet connection, and GPS enabled android phone to utilize the app.

 The design entails three sections: Geo tracking, scheduling & fair query and security module. The central server would play pivotal role in storing all the information which connects the driver and the students. Considering the potential of GPS enabled systems, this app surely holds the potential to improve the existing bus transportation system for students.

We are considering adding more features and improvements such as a notification messages, calculating the remaining time, and a notification when all are on-board.

There is a possibility to modify our system by adding a 3D map at least for the famous places in the rout for example at Taibah university when the rout is Taibah university location , for example, it can appear in 3D. Figure 8 shows the university entrance in 3D and figure 9 shows the 3D mapping of both the bus and the university.

Figure 8 3D Mapping of university entrance

Figure 9 3D Mapping of bus and university entrance

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