

# GPS and GSM modem Integration for Enhancing Public Transportation Management Services

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Received: 01 December 17

Accepted: 01 January 18

## ABSTRACT

This paper proposes and implements a solution for enhancing public transportation management services based on GPS and GSM. The microcontroller based in bus module consisting mainly of GPS receiver, GSM modem and, IR Sensor. GPS modem starts transmitting the current location of the bus and IR sensor counting the number of passengers on the bus then send this data to the GSM modem through the microcontroller. The microcontroller used as an interface between GPS receiver and GSM modem, after that the data is sent to a smartphone through short message service, the location of the bus can be viewed on Google Maps. Which it is designed an Android application for smartphones, the users of transportation service can locate their destination on Google Maps, then the application determines the location of the bus closest to them and the number of passengers. The results have shown that this developed system is useful for facilitating people using public transportation services.

**Keywords—; Transportation; IR Sensor; Android; Google MA.**

## I. INTRODUCTION

Every day we are witnessing the breakthrough of new technologies in all forms of passenger transport. The meaning of technology, future development, and application are based primarily on the finding of methods how to make life easier. Today's development of information and communication technologies is directed to a wide population of users equipped with sophisticated terminal devices [1]. The starting point has been guided by the idea that the implementation of new technologies should fulfill the users' requirements: what they want, where they want it and in the best possible way in which they want it [2].

With the increasing number of people in opportunistic cities, the already existing problem of poor transportation services has grown to an alarming extent. Due to non-availability of prior information about the buses arrival schedule, people have to wait longer on bus stops especially in the morning when

they have to reach the offices in time. The buses are overloaded for most of the times which often results in some kind of fault occurrence in buses and people get late further [3]. Owing to poor infrastructure of roads in the country, the annual growth rate of vehicles has created problems in controlling the traffic flow resulting in traffic congestion on roads. Also with the increased number of vehicles, to improve the public modes of transportation the idea of introducing a technology-based transportation management system that will help the passengers in getting informed about the exact schedule of buses [4].

The real-time location of the vehicle can be tracked by using the GPS (Global Positioning System) and GSM (Global System for Mobile communication) technology. GPS is a satellite-based navigation system which can provide an accurate location, time, speed and direction data [5]. This data allows us to determine the precise location on the earth by measuring the distance from the satellite [6]. GSM is the digital mobile network which is used to transmit the mobile voice and data service through the narrow band with Time Division Multiple Access (TDMA) Technique. It can use for the transfer of data between the modules [7].

As the interface between GPS receiver and GSM modem and also extracted the number of passengers by IR sensor [8]. After Arduino gets location information and the number of passengers is sending this information via the GSM modem through GSM mobile network to the display part. This project was completed in GPS and GSM modem Integration for Enhancing Public Transport Management Services [9].

## II. METHODOLOGY

This research is meant to propose a solution for improving the services provided by the transport management by using GPS and GSM modem integration, where you can determine the current location of transportation and also can recognize the number of passengers in the bus. Achievement of this study can be done by building the hardware circuit for the project and using Arduino IDE (integrated development environment) software program to build a

code Through the use of open source programming language called Arduino c and to deal with Arduino board, and using Android Development Tools (ADT) is a plugin for the Eclipse IDE that is designed to provide an integrated environment in which to build Android applications.

This paper is the content of GPS module, IR sensor, GSM shield, Arduino Uno, and Smartphone. GPS module is receiver module continuously gets information about the location of buses through the Arduino UNO microcontroller which is extracted the latitude and longitude values from this information, and IR sensors use to calculate the number of passengers in the bus through the Arduino Uno microcontroller, two pairs of IR sensors are used to display the current status of the passengers in the bus (One pair for incrementing and other pair for decrementing), This automated passenger counting system will help them to know the exact crowd on the bus and to decide whether to wait for that bus or choose another way of transportation, the standard and comfortable passenger system for public buses can then be attained. Then GSM shield will send information collected from GPS module about the bus location along with a number of passengers to a specific mobile number.

Arduino Uno used as an interface between GPS receiver and GSM modem and also extracted the number of passengers by IR sensor. Then send this information via GSM modem through GSM mobile network to the smartphone with an Android application to show and display the location of buses and the number of passengers, the overall system is shown in Figure 1.

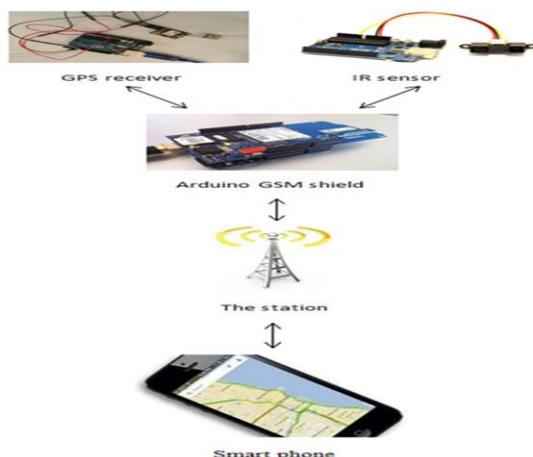


Figure1. Public Transportation Management Services

The program loaded into the Arduino controller and overall hardware design working as should be, as shown Fig.2, the design will work by a sequence of orders commands as shown in the flowchart Fig. 3.

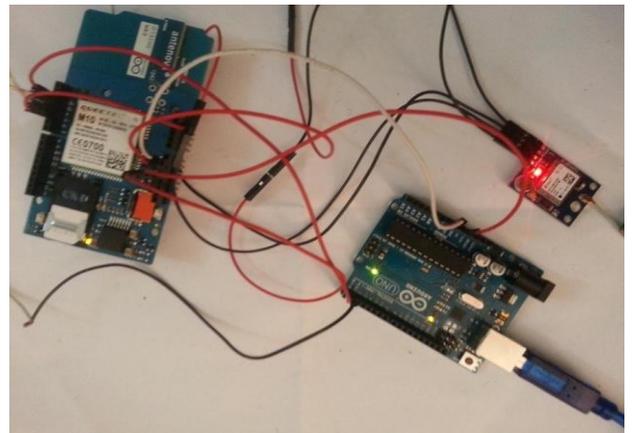


Figure 3. System hardware

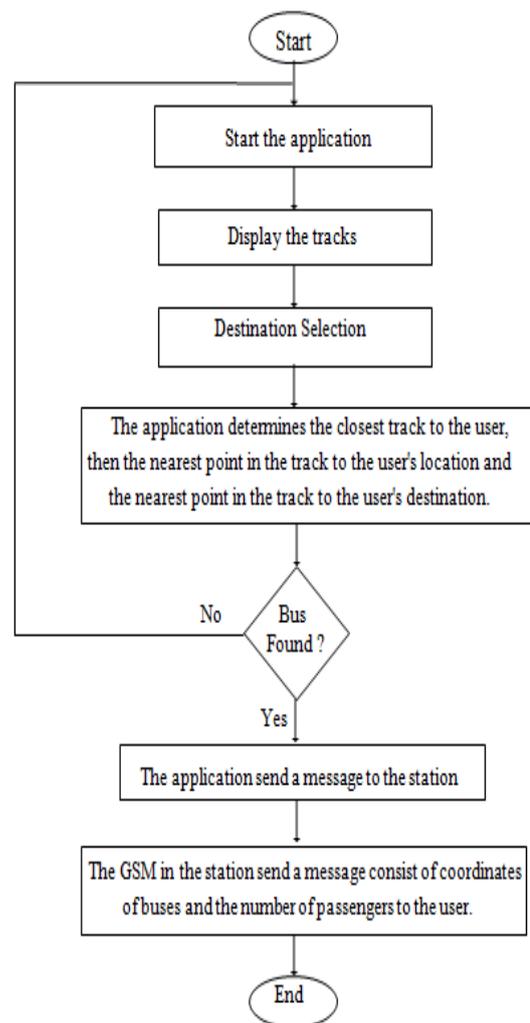


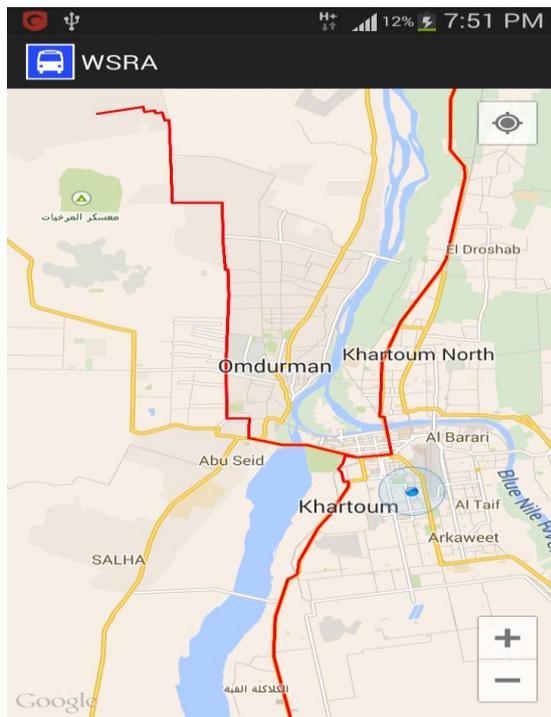
Figure 4. Flowchart of the processes design.

### III. RESULT & DISCUSSION

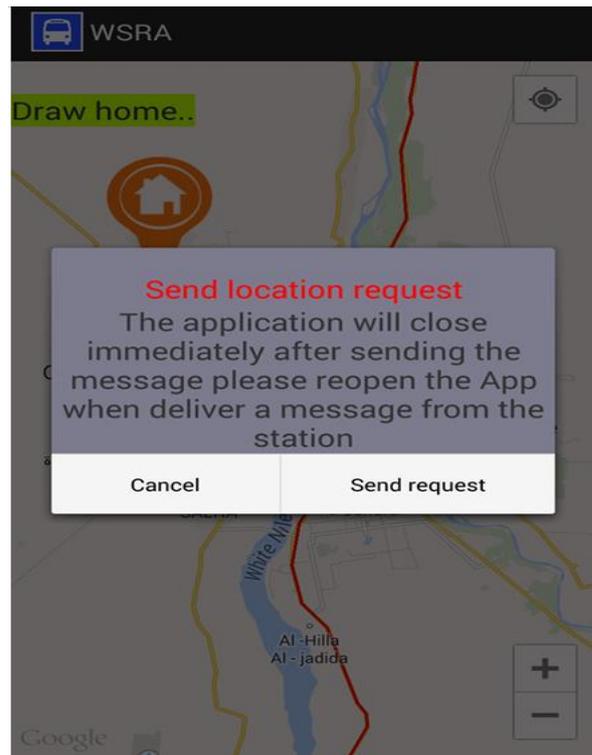
The signal is sent to the smart phone for displaying on the Google Map When the application starts it displays all the tracks of the Buses lines as shown figure 4 (a), then the users will select their destination as shown figure 4 (b), after that application determines

the shortest distance, the nearest point on the track to the user's location, and the shortest track to use it to reach the destination in less time than the other tracks and display the location of the bus and the number of passengers, as shown figure 4 (d).

(b)



(a)



(c)

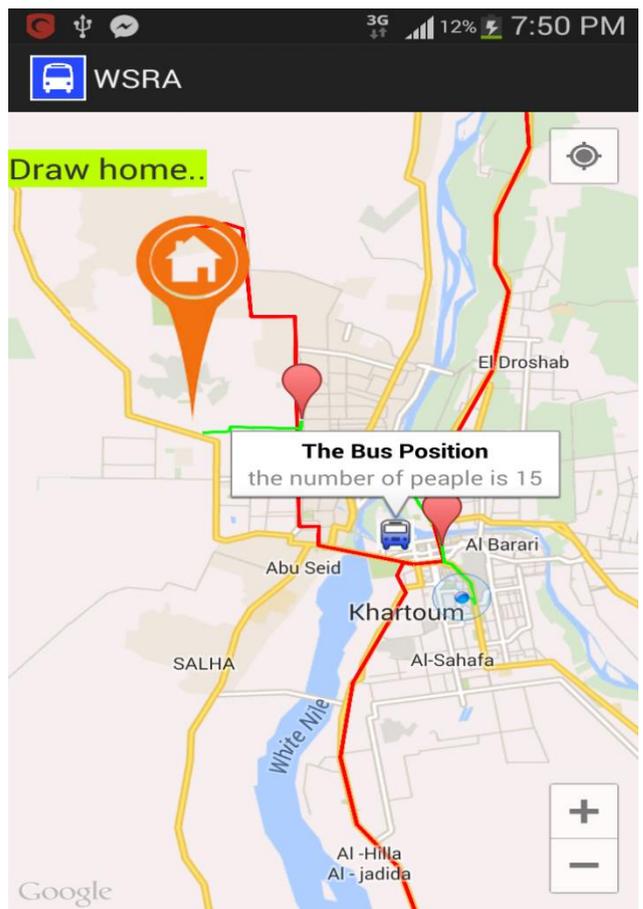
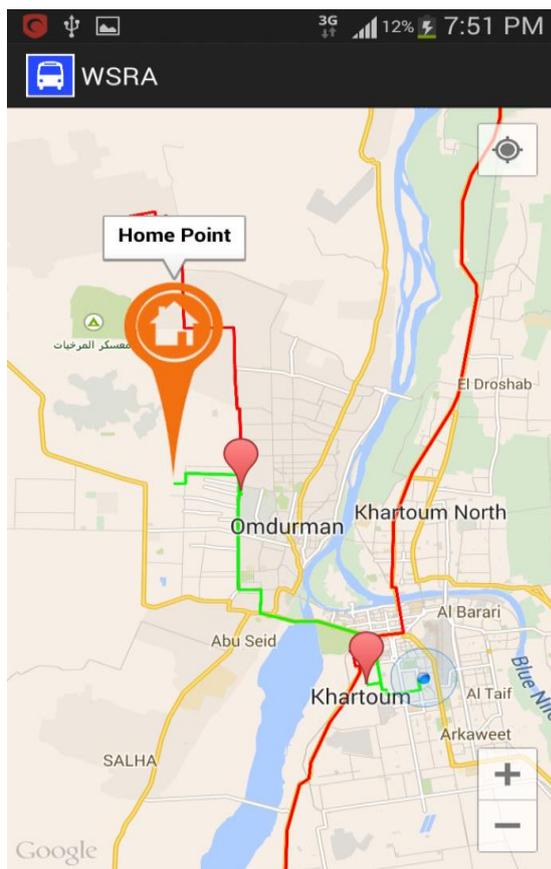


Figure 4. The display part.

#### IV. CONCLUSIONS

In this paper, a transportation management system was developed based on an integration of GPS and GSM data. The systems consist of various modules which are wirelessly linked with GSM modems. Cost effective SMS service of GSM network is used for the transfer of data between the modules. A new service, to facilitate the people who use public transport for travelling, is introduced into the city. The service provides the user with current location information of desired buses based on which the user can adjust his schedule accordingly. The service, therefore, reduces the waiting time at the bus stop. This system provides a user-friendly environment to the people of a city to overcome the difficulty in finding bus route as well as saving a lot of time.

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*Vol. 2 (1), 10 Feb 2018, pp. 18-17*

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