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Real Time Bus Tracking and Scheduling System Using Wireless Sensor and Mobile Technology

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Abstract: The public bus transportation system has the direct impact on economic development of the country. Scheduling, tracking and monitoring the schedule of the public bus transportation is one of the major issues for any public transportation sector. Presently, there are many vehicle tracking systems are available using Global Positioning Systems (GPS) technology. But there is no implementation at all buses in centralized scheduler. To keep track of buses in manual system is error-prone in the existing time keeping process by Time Keepers, and also this manual log is not being centralized to share with relevant authority and passengers. This project aims at designing a wireless sensor network that would identify and automatically provide the visual information for a real time movement of the public transport busses. The scheduler will dispatch data on arrival and departure with the bus ID and time-stamp from bus stops and passenger shelters along the bus route and it will report to the centralized scheduler. All these bus-stops and passenger shelters will be based on microcontrollers which is to be designed using the Arduino and RFID receiver. Bus will be equipped with front and rear tags. Detected RFID information will be sent through the Arduino and GSM / GPRS shields which are to be placed at the bus-stops into central scheduler, it will process the sensed raw data and will upload the derived coordinates on Google Maps, using Google Fusion tables. Administration and Passenger can check the real time movements over the web interfaces.

Keywords: Public Transportation, RFID, Microcontroller, Arduino, GSM/GPRS

1 Introduction

A happiest, smooth, well maintained and continuously monitored public transportation network is a must for the economic development and the well-being of people in any country. Unfortunately, it is a nightmare in most of the developing countries like Sri Lanka, it does not have such well-planned public transportation networks. The cause for this pathetic situation is firstly the lack of funds mainly for building public transportation networks, even though having manual system is the very oldest and cannot be synchronized in real time and it is not compatible in dynamic reporting system scenarios.

It refers to the system that provides information to passengers about the arrival times and current locations of their buses. With the advent of Radio Frequency Identification and Open source microcontroller technology, real time bus tracking for better transport management has become possible. These technologies can be applied to public transport systems, especially buses, which could be possible to make the monitoring and guidance for the

proper time-scheduling for the public bus transportation network. Also, this could guarantee the reporting and prediction mechanism about the traffic jam and any other kinds of breakdowns on the sites [1].

2 Existing System

The Sri Lankan government focuses only on highway construction the transportation sector but monitoring under the proper mechanism is also crucial to sustain. Bus movements are monitored and recorded by the time-keepers available at the main bus-stands in main cities. These time-keepers keep records about arrival and departure buses from the Stand. But many villages do not have the bus stops and only they have passenger halts/shelters. The rest of the huge road was not monitored using proper mechanism. The manual system could have the chances to get the improper recording because of human errors, also this paper based system is worthless in many occasions. These records are not helpful anymore to passengers as well.

Fig. 1. Bus stops & time keeper

3 Literature Survey

Vehicle Tracking Information System and its various applications have been extensively researched over the years. Different techniques have been implemented to achieve the

ultimate goal of travelling comfort. Most of the research in this field revolves around the use of GPS to track vehicles [2]. Systems using General Packet Radio Service (GPRS) have also been implemented successfully [3]. The Intelligent ambient system was proposed in [5], used to monitor vehicle and freight using GPS technology including GSM/GPRS transmission network. Another literature [6] proposed a design to a public transportation scheduler using individual vehicle based on ZigBee technology, here the scheduler gets information about traffic movement and lets driver and passengers know the congestion along the road. Sherif [7] used wireless sensor network to detect vehicle accident on the road in real time, which used RFID to detect.

3.1 RFID

RFID functions with electromagnetic waves. It is used to identify and track objects automatically. It has a tag and reader. The tags hold electronically stored data. Active and Passive types of tags are available. Active tags use their local power sources. But passive tags are usable in closer distances only, which consumes the power from the reader [8].

3.2 Arduino

The Arduino Mega is simple Open Source microcontroller board. It is operated using a 5.5 V power supply. It is so easy comparatively; this board is very simple and anybody can use. [9] and [10]. Arduino IDE uses a simple programing language with continuous support on the driver and latest libraries. Arduino has some Digital and Analog Input and output ports that provide the processing power to any requires nature.

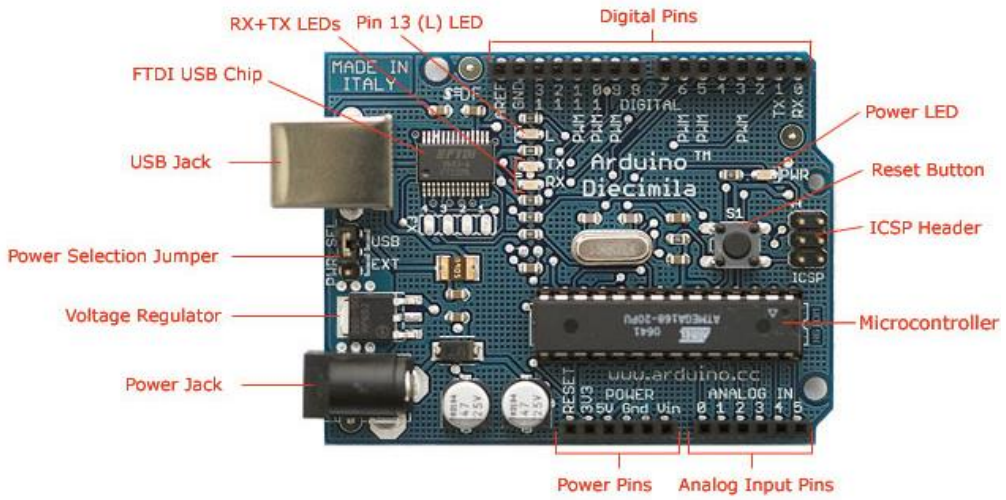

Fig. 2. Arduino

3.2 GSM / GPRS Shield

Arduino GSM / GPRS Shield (Figure 2), delivers many GSM/GPRS band performance for Data, Voice, SMS, and Fax. That will use the Sim and it could GPRS data communication by the AT command. It could be simply fixed on top of Arduino board [9].

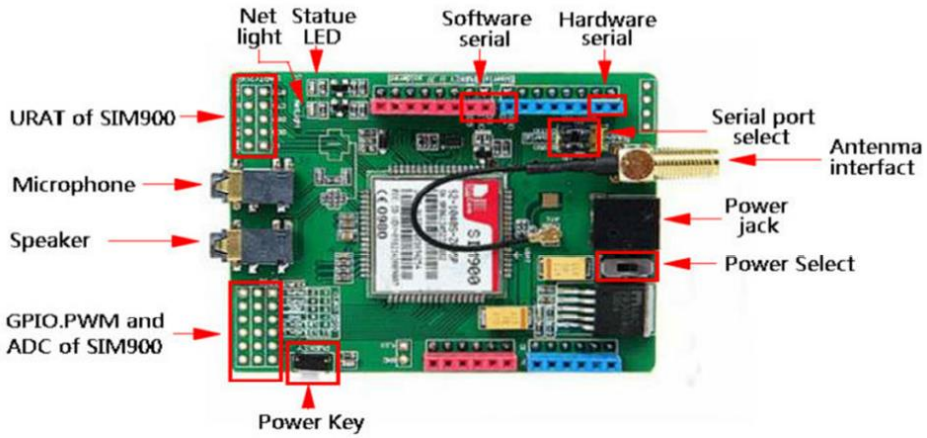

Fig. 3. Arduino GSM / GPRS Shield

4 Proposed System

The proposed bus scheduler basically has the two major part. One is web based interface system, second is sensing unit. Here along the road, there are number of bus halts hut which will consist RFID reader and have serial connection with Arduino. Arduino will provide the identification processing power to RFID reader.

The reader will sense the tag's data from font unit and departure of the bus from on the platform, which will be transferred with the timestamp and ID over the GPRS by the GSM/GPRS shield to Central bus scheduler. Over the Internet, anyone can access the bus movement details for their personal usage.

Bus units will have the two parallel active RFID sub units, one in the front and second in the back side. When a bus arrives into any platform the RFID reader will recognize the vehicle and it will produce with the timestamp to system coordinator. Also while the bus leaves from the platform the rear will be identified by the reader located in the bus stop. These data will be transferred to the central scheduler over the same Internet. The record keeping can be reviewed by the authority and also other kinds of users coming under the user pool, Fig. 4 illustrate the proposed system.

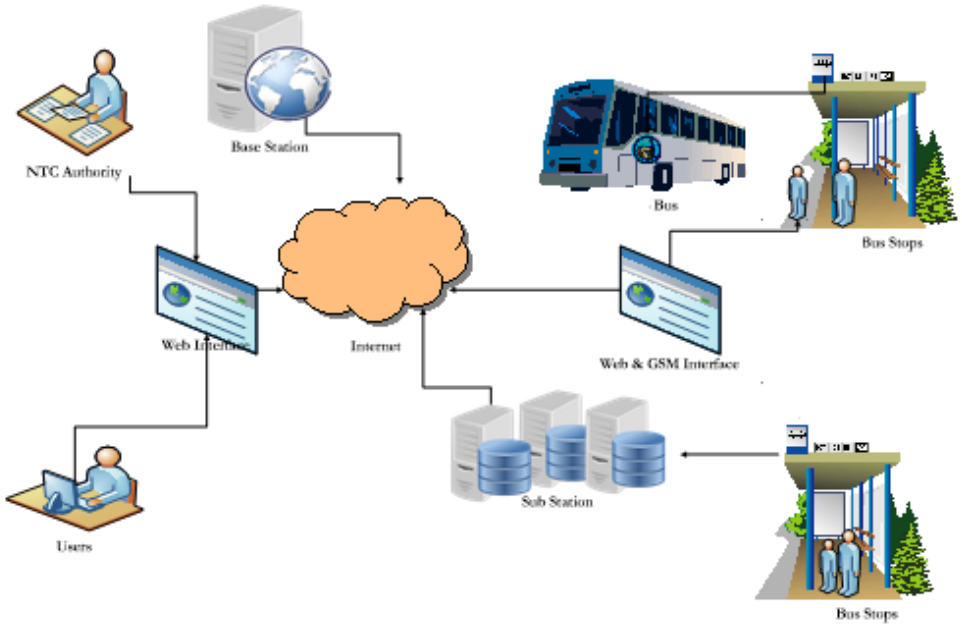

Fig. 4. Real time bus scheduling system model

5 Experiment & Results

The detection rate measured based on the efficiency of the RFID reader. Though it looked to a successful detection rate there are few negative occurrences due to the capacity of RFID reader. Experimentation was carried out with a bus embedded with the two RFID sensing platform fixed with the 95 % success rate on detection.

The system provides the data for future forecasting, congestion identification, travel route planning and modelling. The system can operate in most places throughout the island since in Sri Lanka the GSM / GPRS coverage is available throughout the country from various mobile operators.

6 Conclusion

The proposed model is giving high precision of identification. Automating the timekeeper identification task by the economically feasible way. This will enable to keep a digital record to do the future for enabling low cost embedded system.

The raw data may be processed before going to transferring with the locally available dataset. Processed information transferred into google fusion as the cloud tool to show the visibility as a moving objects in real time to see anyone over the internet on google map.

7 Future Work

This study has devised an initial application to keep track of public transport buses. Future works can be expanded to include features and editions that support the smartphone applications using Android and iOS. And also, it can enrich another feature to send messages to authorized officers in case there would be any interruptions in the movements of busses or any interferences in their operations according to schedules. Further, online bus reservation services with payment gateway can also be integrated in those smartphone applications.

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