REAL TIME BUS MONITORING AND PASSENGER INFORMATION SYSTEM

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Abstract:
The Real Time Bus Monitoring and Passenger Information bus tracking device is a standalone system designed to display the real-time location(s) of the buses in Mumbai city. This system will enable the tracking device to obtain GPS data of the bus locations, which it will then transfer it to centralized control unit and depict it by activating LEDs in the approximate geographic positions of the buses on the route map. Specific softwares will be used to interface the data received to the map.

I. *MOTIVATION*

A passenger in Mumbai often faces the decision of whether it would be quicker to wait for the next bus or to walk or to hire a cab/rickshaw to reach his/her destination. Many passengers are often late to work, students are late for classes because they decide to wait for the bus instead of just simply using a alternate transportation. The design team surveyed 30 students about their opinions on the current bus transportation service, and the following conclusions were extrapolated from the results:

1. 75% of the population asserted that they had been late to their destination because they decided to wait for a bus instead of walking.
2. 96% of the population affirmed that knowing the position of the buses on campus would be beneficial in deciding whether to walk or wait for the bus.
3. 96% of the population also affirmed that knowing the location of the buses is more indicative of wait time than an approximate arrival time.
4. The overall approval rate of the current transportation notification service was 38%.

If passengers had an easy way to see which bus is near to their location and approximate time it would take to reach the stop, in real-time, they could make a more accurate, informed decision of whether or not to wait at a stop. The Real Time Bus Monitoring and Passenger Information system will provide pedestrians with this convenience. Not only would the Real Time Bus Monitoring and Passenger Information system be a new product for Best Transportation, it would also be an improvement to the transportation service already provided, addressing the dissatisfaction with current wait times of the buses.

II. *PROJECT DESCRIPTION AND GOALS*

The goal of the Real Time Bus Monitoring and Passenger Information bus tracking device is to provide a product that pedestrians of Mumbai city can use to help them decide whether to wait for the bus or walk or use alternate transport. The display will be on a LCD screens which can be placed at bus sites around Mumbai city. This would be a product to sell to the BEST transportation department for use by city pedestrians.

A. Product Features

1. LCDs will be placed along a map of BEST bus routes
2. LCDs will light up and display all the bus numbers along with their routes to indicate the buses which are near to the bus stop along with the estimated time it may take for the buses to reach the stop

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3. The whole system will be powered with a backup battery
4. The device will be enclosed in a standalone weather-proof case with Plexiglas cover
5. The system will use RF devices to transmit as well as receive data.

B. Goals

1. Completely self-contained with easy installation, no external wires required
2. Low power, less than 500 mA current draw
3. Target cost of prototype parts, less than Rs. 12000
4. Target labor cost to produce prototype, Rs. 1000

III. *INTRODUCTION:*

The Real Time Bus Monitoring and Passenger Information system is a standalone system that displays the real-time location(s) of the buses in Mumbai. This system, designed to be deployed at various bus stops around city, is comprised of a power source, a battery, a microprocessor, LEDs, and RF Transceiver. The RF Transceiver will be used to poll a signal from the systems installed on the buses that contains GPS data of each bus's location. The data will then be processed by a microprocessor connected to the RF transceiver and used to display on the LEDs (control unit) that will represent each bus's location and on the LCD screens on the bus stops. This system will assist pedestrians in making the decision of whether to wait for the bus or walk.

A. Objective :

The Real Time bus monitoring and passenger information system will be equipped with three basic modules.

1. Basic transmitter modules mounted on the buses which will continuously transmit the data obtained from the GPS module like its position (latitude and longitude) along with the basic information like route name and number. These transmitter modules will act as active circuits they will transmit the data continuously as soon as GPS module refreshes it at the end of the a second

2. The receiver module which will be fitted on the bus stops will receive the data from the transmitter. These will be passive circuits, meaning that since these circuits are stationary on the bus stops these will get active or receive data only when the transmitter enter their range of reception.

3. The third module will be a centralized control system. Here the GPS readings from all the buses in the Mumbai city will be collected and then plotted on the map, so that the controller will have the idea of where each bus is in the city.

B. Background:

Most real time arrival systems, currently in use, are completely web based applications. For example, NextBus[1] a popular bus tracking service in UNITED STATES provides the passenger with a website where he/ she can login to find out the location of the buses and textual time estimates projecting the next bus arrival at a particular stop. These displays are often misleading since there is no clear indication of where the bus is actually located and whether there are potential delays. Moreover, the technologies used require GPRS or web connected device with the passenger, which only few of the passengers have. The project will help the passenger to find out all the information without any expense required

IV. *DESIGN APPROACH*

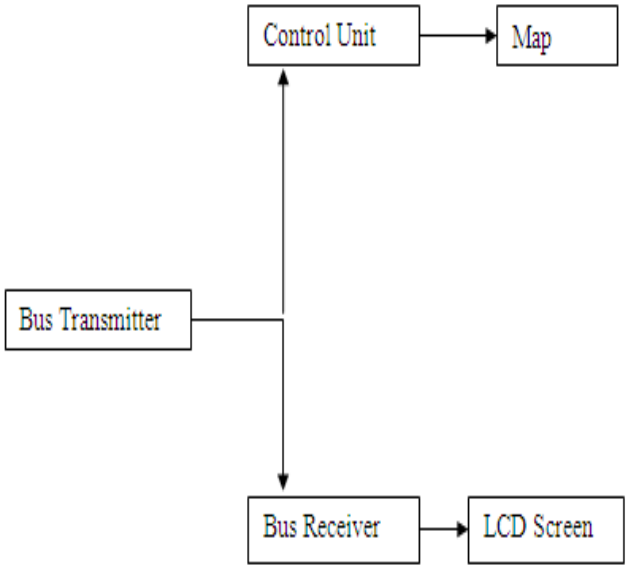

FIG. Functional block diagram of Real Time Bus Monitoring And Passenger Info. System

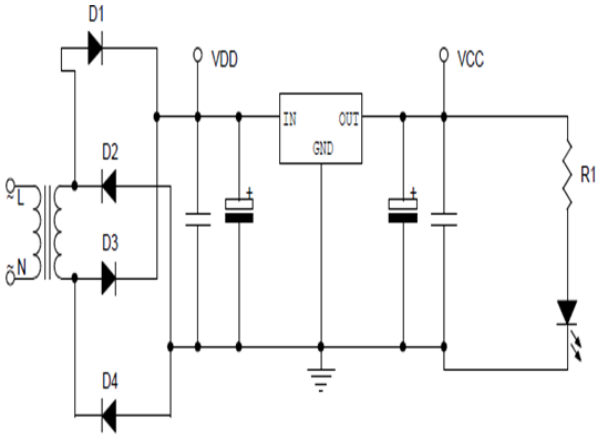

FIG. Circuit diagram of power supply

A. *Power supply module :*

The power supply for the Real Time Bus Monitoring and Passenger Information bus tracking device is designed to be completely sustainable. The panel is capable of supplying enough current to power the device load. The core components of the Real Time Bus Monitoring and Passenger Information bus tracking device require 5V of power to operate; therefore, the system design implements a switching regulator to step down the supply voltage from 240V to the 12V. This 12V output that we obtain is then connected to LM7805 [2] IC which gives a stable 5V output voltage required for the circuit.

B. *Transmitter Module :*

The initial phase of the tracking process involves requesting and receiving the GPS[4] data through the module from the satellites. The GPS embedded module will serve as the communication link between the Real Time Bus Monitoring and Passenger Information system and the satellites. Consequently, the data received from the GPS module will be passed on to the PIC microcontroller 18F4520[5] using a UART serial link where it will then be processed, the latitude and the longitude coordinates of the location will then be separated from the bulk of data obtained by the GPS module using software. These readings obtained will then be transmitted to the control unit through the RF transmitter. Also the controller will regularly transmit the bus information through the RF transmitter module which will then be received and further processed at the receiver module. All the data to be sent for transmission will be sent through the SPI protocols[3].

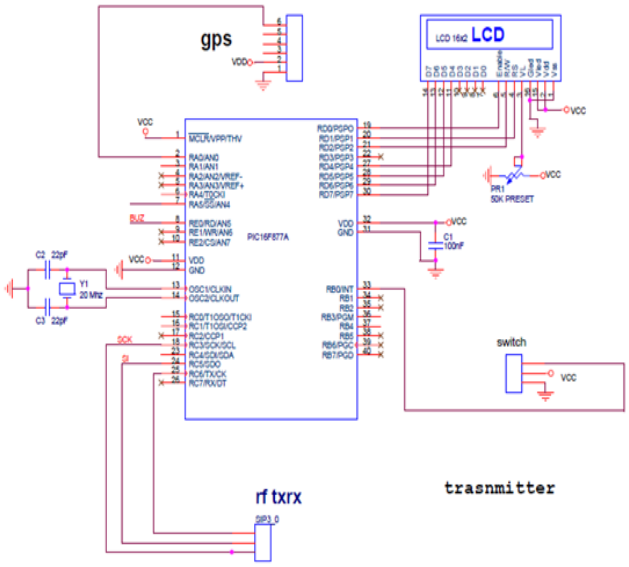

FIG. Circuit diagram of transmitter

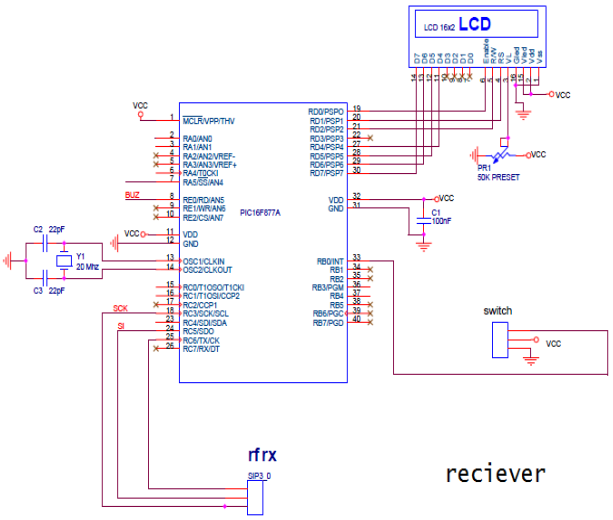

FIG. Circuit diagram of Reciever

C. *Receiver Module*

The receiver unit of the Real Time Bus Monitoring and Passenger Information system will tentatively consist of a PIC microcontroller board equipped with a PIC 18F4520 [11] microcontroller to receive the data through the RF receiver. The transfer of the data from the TF receiver to the controller is done through the SPI protocols. The controller will then implement custom programmable logic to interpret the data. The design team will utilize the programming language, based on C/C++, to create the algorithms and instructions for processing the data. After data processing, the processing platform will send the data to

the LCD displays.

D. Control Module :

Upon receiving the coordinates from the transmitters atop the buses the control module will process the data and illuminate the LEDs corresponding to the coordinates obtained. In order to minimize power consumption, the LED drivers will only instruct LEDs to blink; this will reduce power consumption by 50%. For display purposes, the bus routes will be illustrated on a map decal imposed on Plexiglas®. LEDs, whose locations, will be positioned to represent bus stops and intermittent locations in-between bus stops.

E. Software Module :

Upon receiving the coordinates from the transmitters atop the buses the control module will process the data and illuminate the LEDs corresponding to the coordinates obtained. In order to minimize power consumption, the LED drivers will only instruct LEDs to blink; this will reduce power consumption by 50%. For display purposes, the bus routes will be illustrated on a map decal imposed on Plexiglas®. LEDs, whose locations, will be positioned to represent bus stops and intermittent locations in-between bus stops. We are going to use PICBASIC compiler to program the pic controller. DBMS will be used to store the record of the bus stops , the bus routes and the bus numbers.We are also going to implement VISUAL BASIC (VB) which acts as the graphical user interface (GUI) to interface the map to the pic controller.

I. *TECHNICAL SPECIFICATIONS*

The WaitLess bus tracking device will employ many different components, all working together to attain GPS information, process the data, and display the location via tri-colored LEDs. To make the Real Time Bus Monitoring and Passenger Information bus tracking device completely self-contained, all of its power will need to be delivered via direct electric current or backup battery.

Table outlines the components needed to make the WaitLess system.

Component	**Manufacture**	**Qtity**	**Component Category**
PIC 18F4520	Microchip	8	Micro-controller
GPS Module	Nsk electronics	1	GPS modules
Custom PCB	PCB	1	Sign/Main board
RF transceiver module	Nsk electronics	4	Wireless communication

1. The backup battery will be able to supply 1A at 12V for 7.2 hours [7].
2. Total power drawn from the system must be less than 5.5W to prevent the backup battery from unnecessarily discharging.
3. A switching voltage regulator from Texas Instruments will be used due to its high efficiency of approximately 96% [8].

The bus tracking system must be able to operate in an outdoor environment. Consequently, the system's enclosure will be waterproof and UV resistant.

1. The system will be able to operate in temperatures ranging from 10-100 ºF.
2. A polycarbonate based enclosure will be used to ensure that the enclosure is waterproof, UV resistant, and strong enough to maintain the weights.
3. Weather resistant grommets will be used around all exterior holes to prevent water from leaking inside the case.

II. *SUMMARY*

Currently two transmitter and two receiver modules have been done. The control module and the software module will be implemented in semester 8. Since those two parts are not needed until the end of the project, this is acceptable. Assuming the completion of control module in December all the programming of the controller boards will begin in January. Once functionality is observed and characterized, of the basic hardware modules, the design team will begin programming the software module in mid February.The Real Time Bus Monitoring and Passenger Information bus tracking device is a standalone system designed to display the real-time location(s) of the buses in Mumbai city. The system will consist of a

1. Backup battery, RF wireless

communication module, PIC microcontroller, GPS module at transmitter installed on the buses.

2. Backup battery, RF wireless communication module, PIC microcontroller, LCD screens at receiver boards installed on the bus stops
3. LED embedded map of the BEST bus transportation routes at the centralized controller.
4. It will also have passenger information system software installed at the bus stops and which will give the user the relevant information regarding all the bus numbers going for his source to destination along with the route details and the cost.

Assembly of these components will enable the tracking device to obtain GPS data of the bus locations, which it will then transfer it to centralized control unit and depict it by activating LEDs in the approximate geographic positions of the buses on the route map. It will also transmit its bus numbers and route names continuously as soon as the bus comes with in the range of the receiver at the stop all the information will be transmitted will be displayed on the LCD screen installed on the bus stop. In addition, the device will be portable and sustainable; it will not require an external power source, which will eliminate long-term energy costs.

The Real Time Bus Monitoring and Passenger Information bus tracking device will serve as a viable notification system that will effectively assist pedestrians in making the decision of whether to wait for the bus or walk. A system prototype can be designed and assembled for approximately Rs.12,000, when accounting for labor and component costs. If, subsequently, 5000 of these systems were produced to be installed at each of the buses[1] and bus stops in the Mumbai city; each device could be individually sold for Rs 7000, resulting with a 15% profit margin.

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[2](18/10/11)http://www.sparkfun.com/datasheets/Components/LM7805.pdf

[3]17/10/11)http://en.wikipedia.org/wiki/Serial_Peripheral_Interface_Bus

[4](20/10/11)http://en.wikipedia.org/wiki/Global_Positioning System

[5](20/10/11)http://www.microchip.com/wwwproducts/Devices.aspx?dDocName=en010297

Project inspiration from:

(19/10/11)http://www.ece.gatech.edu/academic/courses/ece4007/09spring/ece4007104/dk2/ (Georgiatech-‘ waitless bus tracking system’)

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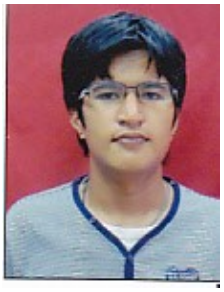

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