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Bus Navigation System with Effective Data Transmission Using GPS and Wireless Transmitter

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ABSTRACT

Global positioning system (GPS) is being actively employed in a variety of vehicular monitoring systems such as automated car navigation and emergency assistance. Nowadays easily observed many passengers footed at the Bus stops waiting for the bus. This paper considers performance issues in Public transport monitoring system that utilize GPS and embedded system. For the purpose of monitoring the movement of the bus, to report the location of the bus in the bus stop and to record whether the bus stops in its respective bus stop using Global Positioning system in collaboration with Transceivers modules, and detect any passenger stands in footboard is described here. In addition to some basic functions such as real-time monitoring, some special functions are combined to make the system compatible with the daily operations of any public transport scheme. The proposed method will surely provide smooth and linear transmission of location information to the bus stations which led people to take decision either to wait for Bus or not.

KEYWORDS: GPS, Embedded system, Public transport monitoring system.

I. INTRODUCTION:

Significant increase in vehicles inside city areas results in adding more troubles to that section of citizens using public transportation network as their primary source of travelling. This specific section of society is a victim of this rapid growing traffic volume and causing a huge waste of time due to not having proper information of required bus current position .The problem results in not only wasting of time but also mentally Un-happy and tensed citizens. Nowadays, passengers want to get the clear information of their desired buses at station, like the position and estimated time of arrival of bus etc. Some bus drivers do not stop the bus in the bus stop, this irritates the people who are waiting for the bus. Necessary action can be taken by recording whether the bus stops in the respective stops. To ensure the safety of the passengers if they stand in bus step it can be detected.

The global positioning system (GPS) [6] is a satellitebased navigation system made up of a network of 24 satellites which broadcasts precise timing signals by radio to GPS receivers, allowing users to determine their locations on Earth. With the popularity of general purposed GPS receivers becoming consumer electronics, GPS has been

emerging as a convenient tool for positioning and navigation. In the past, many papers & projects utilized the traditional display of several parameters using GPS data for the real time monitoring [2], [3], [7] but there is no progress observed for the efficient transmission of coordinates using single board embedded systems and to manage the accuracy [5], [8] by the modem technology cooperation. Like Kai Qin et al.'s proposed system [2] is about the entire system using the existing GPRS network to transmit information collected from the GPS module to the IP-fixed control centre in the internet. He gave some good answers related to Long distance wireless transmission in his article but in highly dense urban areas, the proposed system seems not capable enough to provide the facilities. Thus the past works [1-4], [9] clearly describe that in the vast areas of Inertial Navigation System; the key issues are the consistent monitoring System with reliable error compensation using maximum faultless techniques and real time solutions for frame work designing. This paper focus on developing a new bus monitoring system based on GPS and intelligent system for its location transmission. The package of designed network system consists of the advanced control technique comprising of bus unit, mounted on the Bus and the bus stop unit, mounted on every bus stop, and the bus station unit, mounted on the bus station.

This required core software used for programming the setup and creating a replica of the real network. Now the base and Bus station hardware is responsible for receiving the GPS data transmissions and making them available for the Computer and graphical display at every Bus station. The software part includes the monitor part and IDE part. A Graphical User Interface (GUI) and software management package are also developed to monitor and maintain the system. MPLAB has been selected as the IDE and C32 as the compiler for the advanced controller unit so both the hardware and software solutions are integrated in the proposed system to make it most reliable and user friendly.

This paper organizes, second section introduce overall system architecture of bus monitoring system. Third section contains the proposed system frame work with implementations techniques. Finally the forth section talks about the experimental results and fifth one gives the conclusion.

II. THE DESIGNED FRAMEWORK:

A.Overall system description:

According to the presented invention, the GPS based bus monitoring system is a first embodiment of the Buses navigation system in which accuracy measures and planed embedded system designing are also given importance. Structure of the presented Bus monitoring system is differentiated into three major units, containing Bus unit, Bus stop unit, Bus station unit. Firstly the GPS module is

provided with signal received from satellite by GPS antenna [5], typically considered as the Input to the Bus unit. Secondly after tracking the position coordinates, the

advanced wireless protocol is utilized to transmit the acquired signal if the coordinates matching by bus control unit is success, to the Bus stop unit and so on. This is considered as the output to the Display as the Real time position monitoring. In Fig.l there is shown an overall GPS navigation system that incorporates the aspects of proposed
invention for buses monitoring system. The bus selector in the bus unit and decoder section in bus stop unit is used for detecting whether the bus stops in its stop.

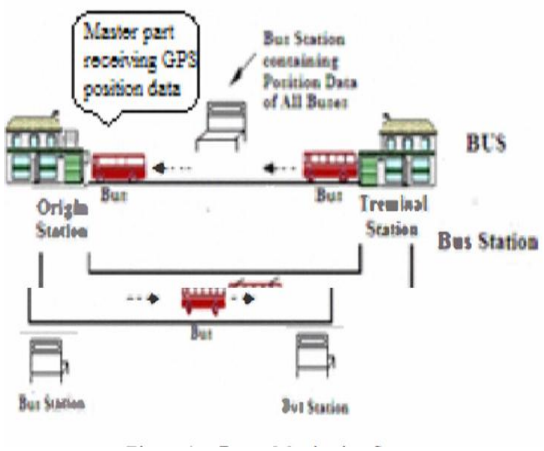
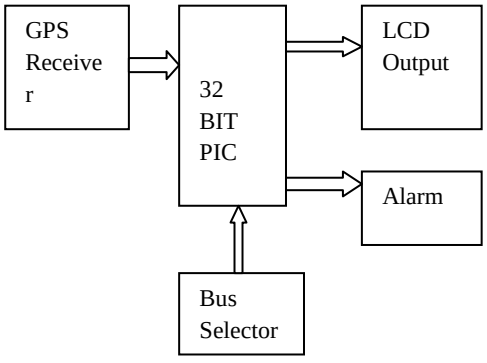


Figure 1. Buses Monitoring System

B.Overall Systemflow: Since this paper proposes and implements a low cost object tracking system using GPS and Succession of RF Transceivers. The system allows a user to view many live monitoring features based on present and the past positions recorded of a target object. So in order to initialize the system and continue it in the most convenient way, the Bus operator has to be input some current data like Bus uniqueID, time of depart and another sign like either UP or Down direction of bus (Input information by Bus) and surely provide the output to all the Bus stations appear in the particular bus route, for example GPS map display of the current location of Bus through wireless. The Intelligent system is designed to make several decision based on the scenario. Figure 2 shows the overall designing process flow of the proposed Buses monitoring system.

III. REAL TIME IMPLEMENTATION:



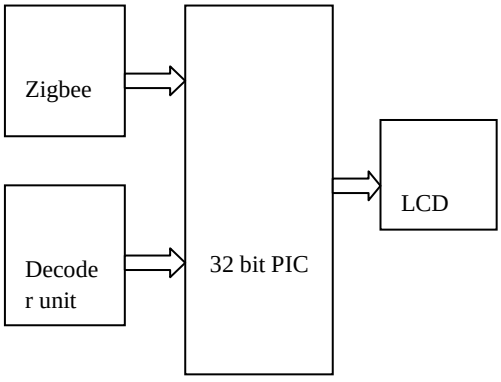


Figure 3 Implementable frame work

transmitter for detecting whether the bus stops in the stops.

B. Bus stop unit :

The bus stop unit are designed such that it displays the position of the bus and it has RF receiver and decoder which is used to find whether the bus has stopped in the stop. When the bus is ready to move after sometime the bus unit is configured as just transmitter first and the nearest bus station will be configured as the receiver.

In the practical monitoring system using GPS, we can set certain time intervals to update Latitude, Longitude and Time data according to need in order to get the space
positioning data. The GPS module used follows the NMEAO 183 protocols. In most of the navigational systems, the positioning data we are concerned about such as latitude and longitude, speed, time can gain from the "$GPRMC" frame which GPS receiver sends to the MCV. So our bus positioning data can easily be selected by using this frame. Output baud rate is 4800. MCV communicate data with GPS module by serial port. This is the standard asynchronous communication mode. Set the same baud rate of MCV with GPS output baud rate, then GPS module will sent positioning data to MCV by serial port. It is programmed to allow MCV to receive and store data, and then bus location will be calculated. The main theme of paper lies in the proficient configuration of Transceivers modules based on the design scenario. These modules were also got place in the serial port. For the purpose the MCV is selected wisely and will be described in the connection designing. Complexity is ensured to reduce by dividing the whole presented system in into three basic units: Bus unit, Bus stop unit and Bus station unit as shown in Fig.3.

A. BUS UNIT:

This designed will provide the right answer for multifaceted problems found in the existing Buses Monitoring System. Since the whole proposed system is typically divided into three basic units, out of one is bus unit. This art is embedded on the every bus. The system comprises of 32bIt PIC produced by Microchip. MCU is responsible for receiving information, means it will receive the positioning information send by GPS module to MCU deal with the input of keyboard information, like Bus unique ID, either UP or Down and time of departure. MCU will compare the bus position information received from GPS module with the station position information recorded in advance. In case matching, the advanced Zigbee will be triggered as just transmitter first corresponding actions (such as the display of position, time of departs and the special sign to recogmze either the Bus is coming from which side) by the system. In a word, MCU is responsible for the control and management of the system. At the same time it will connect the Bus stop units wirelessly in order to transfer GPS data. The bus unit has bus selector part which is used for encoding the bus ID and transmits through RF

From the bus station the GPS location information is literally transmitted to nearest bus stop units. Now when the Bus is on the move, the bus stop unit 1 will be configured as transceiver and will send the Bus Position data to bus stop unit 2 (2nd next Bus Stop) and up to so on. This chain for transmitting, receiving and Displaying Bus Position information will be last till the final Bus station for every bus found in the particular route. Detection of stopping of bus in the stop can be done by using RF receiver which

receives bus ID from bus unit. The time for which the data is received is recorded and the relevant data is transmitted to base station where it is recorded in system.

C.CONNECTION DESIGNING:

In this part, there are three key modules: MCU: PIC32MX320, GPS module SANAV FV-M8 and the advanced wireless: IEEE 802.15.4-2003 standard for Low-Rate Wireless Personal Area Networks (LR-WPANs).The MCU of the embedded gateway is 32 bits MCU produced by MICROCHIP, designed to provide a cost effective and high performance microcontroller solution for general applications. To reduce total system cost with maximum efficiency, it also provides the following: speed
80MHz, 1.56 DMIPSIMHz, 32-bit MIPS M4K Core, 2- channel UART with handshake, System manager (chip
select logic, FP/ EDO/SDRAM controller), 110 ports, RTC, IIC-BUS interface and so on. For GPS module, SANA V is
adopted, and its characteristic is: 32 parallel channels Sensitivity -158dbm, 5Hz Update Rate, support DGPS technology, NMEA 0183 protocol and 9600bps. ZigBee is a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2003 standard for Low-Rate Wireless Personal Area Networks (LR-WPANs), such as wireless light switches with lamps, electrical meters with in-home-displays, consumer electronics equipment via short-range . The technology defined by the ZigBee specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth. ZigBee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking. Position information can get from the GPS module. The next is to connect the remaining RxDITxD with the wireless. This all for the Bus unit while regarding Bus station unit, the only difference is that MCU will be utilized to control the mechanism of wireless reception and transmission so no need of GPS is required at Bus stop unit. That why the designed solution is more reliable and cost effective and can easily be adopted by any public transportation organization. Regarding display, the graphical LCD is selected. The main concept is designed via core programming to provide maximum benefits to the passengers. The facilities contain the current position of total buses coming to the particular stop, even if any of bus found in between two bus stops, would be shown by the arrow in between the targeted stops
with poles apart IDs.

IV. EXPERIMENTAL RESULTS:

This Paper explores and identifies a unique design phase contains a system to mount the GPS based embedded system on every Bus. The stand alone GPS containing system receives the raw signal and transmits at the Bus Station by Zigbee transceivers. These specially designed long range modules are efficiently configured to make sure a practical communication loop only found in the particular bus Route. To achieve best real time monitoring with finest and optimum results, several data sets of coordinates are collected from a selected bus route . Each of the inputs and outputs are associated with a location within a predefined region of max 20Km diameter, since the area is likely be covered by the prescribed transceivers modules. On the basis of generalized circuit diagram, a mature prototype design is constructed and tested using collected coordinates and after utilizing pre configured transceiver modules, the transmission is checked. The NMEA message format analyzed here is the real coordinates of one of the station as; $GPRMC, 16 1229.487, A, 0343.0366, N, 10307.1202, E, 0.13, 309.62, 120598, * 10. From the message, our major concerns are;
Effective bits: the data following the second comma is A, indicating that this GPS message is effective; Latitude: the data following the third comma is 0343.0366, and the following N, expressing that the North Latitude is 03 degrees and 10.03 1 1 minutes; Longitude: the data following the fifth comma is 10307.1202, and the following E, expressing that the East Longitude is 10 1 degrees and 4 1.555 1 minutes. After receiving the $GPRMC through Receiver to the MCU the coordinates data with exact and stored data are allowed to match by MCV. In case matching, the transceivers were activated to send the data to the next bus stop unit 1 and so on. This looping of transceiver modules gave a better results especially in the dense urban areas. The activation of Transceiver modules is also the function of ID of the Bus in order to achieve the best transmission of location with exact Bus ID. The status whether the bus stopped in the bus stop is recorded in bus station. Implementation and maintenance of management information system are as important as system design and development. Now this system would be able to expect the time as well position to display on the LCD at Bus stations coming on the route of particular Bus by in the convenient way for the persons come to bus.

V. CONCLUSION AND FUTURE ENHANCEMENT:

Concisely, the design adopted a new kind of method, that is to say, MCU combined with GPS module and Transceiver modules to achieve GPS based automatic station-report function with buses movement monitoring system. All modules were configured correctly to obtain the most efficient monitoring frame work. It can carry on the effective management to the public transportation vehicles in the most convenient way to the suffered passengers. It has many expandable functions, with considerable prospects for putting it on the market. After testing and modifications for about half a year, the system tends to be much stable and played an important role in dispatching buses and commanding public transit operations. With few workload of processing, this technique is quite feasible.

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