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Automated Vehicle Monitoring System based on Zigbee Technology

Ch. S. S. Vasavi[1], S. Ashok Kumar[2], A. Shainy[3], R. Mahesh[4], N. A. Jyothi[5], S. Sai Sandeep[6]

Abstract: ***The system approaches to reduce the traffic congestion in cities by using efficient bus transport system. In this modern generation, the automobiles have been increased vigorously especially in cities during the peak hours, traffic control and pollution control had been the main issues. To prevent these problems, mass transport like buses are preferred for major transport. The proposed system implements the real time bus query system to choose the right bus at the right time. The system adopts Arduino as the main controller, GPS for monitoring bus location and Zigbee technology as the communication medium. It uses an LCD at the user to display the data about the bus. It gives information about bus number, bus location, seat availability and location of the next stop of the bus. The system helps in choosing travel path efficiently and saves time.***
Keywords: GPS, Zigbee Technology, LCD, Arduino UNO board

I. INTRODUCTION

The main intention of this project is to develop a vehicle monitoring system using zigbee under the control of Arduino Uno. Nowadays, due to the heavy traffic, buses are delayed in time and people will be waiting for the bus without even knowing the bus time of arrival. For saving public time, the waiting time can be reduced by providing the details with bus arrival time and its seat availability. Zigbee is used to establish a wireless network among the buses, bus stops and the central bus stand in order to create interconnection. This paper introduces an advanced technology to the existing system, by implementing navigational technologies such as GPS to track the vehicle's location. A transmitter circuit is installed in the vehicle or bus which data needs to be monitored. It consists of GPS, Zigbee which are controlled by arduino. GPS module is used to determine the precise location of the bus and the data of longitude and latitude is given to arduino. By the zigbee protocol these data is transmitted to the receiver end by zigbee antenna. In the bus stops or at the users end, the status of the bus is displayed on the LCD screen. LCD is comprised by the receiver part along with arduino and zigbee module to receive the data from transmitter fixed in the bus. This mechanism forms the intelligent bus query system which makes it more efficient than the conventional methods.

II. EXISTED SYSTEM

In existing systems, the bus query systems use GSM or GPRS as the wireless technologies and GPS for tracking the bus location. Microcontroller is used to control the whole system. These are implemented in the vehicles for transportation safety and traffic control. In proposed system, this system is made more efficiently using present technologies.

III. PROPOSED SYSTEM

In proposed system Zigbee is used as the connectivity medium. By this communication, the GPS data, bus location and bus status is transmitted between the bus and the display boards in bus stops. In this project, we use Arduino Uno as the microcontroller. This system becomes more flexible and efficient by using arduino as microcontroller as it becomes the heart of the system. Arduino is also cost-effective. As we have two circuits like both transmitter and receiver, we use two arduino boards respectively. Thereby, the system becomes simple and the overall performance of the system also increases.

IV. SYSTEM ARCHITECTURE

The system consists of two sections namely, the Bus section which is the transmitter part fixed in the buses to track their location and bus data and then the Display section that displays the status of bus at the receiver end.

A. Bus Section

The bus section that is the part of the transmitter is placed inside the bus buses. It consists of Arduino Uno module, zigbee and GPS module. The GPS is connected to arduino for serial reception. The block diagram of this section is as shown below

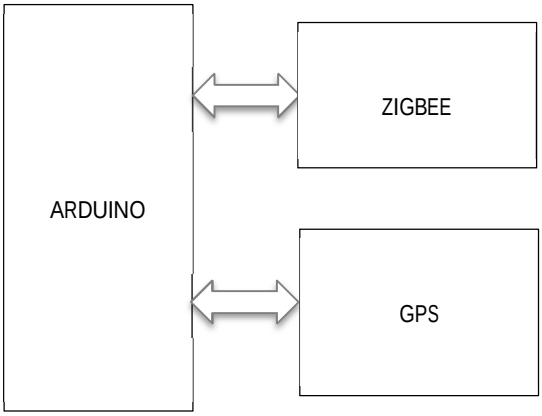

Fig: Block diagram of bus section

The GPS module acquires the current position of the vehicle and the location coordinates like latitude and longitude are given to the arduino. The arduino transmits the GPS data and bus information to the display section through zigbee module. The zigbee module will be the wireless communication medium that follows zigbee protocol.

B. Display Section

The display section is placed on the receiver side that means at the bus stops as the display boards to show the information about the required bus. It consists of Arduino Uno module, Zigbee module and LCD display. The Zigbee and arduino module are connected for serial transmission. The block diagram of this section is as shown below

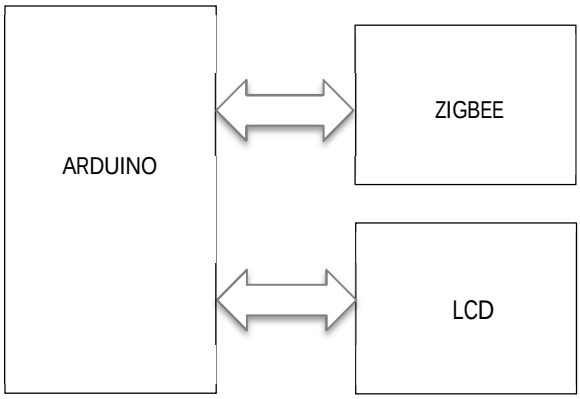

Fig2: Block diagram of Display section

The zigbee module receives the data sent by other zigbee module from the transmitter circuit present in the required bus to be tracked. The obtained data is given to the arduino which displays it on the LCD screen.

V. HARDWARE DESCRIPTION

A. Arduino Uno

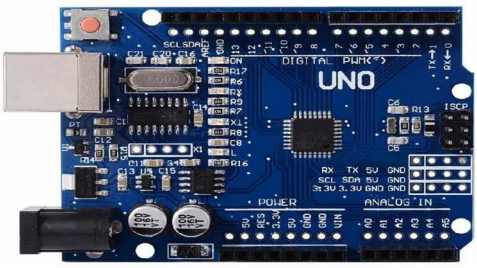

Fig3: Arduino Uno microcontroller

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Arduino is a single-board microcontroller used for building digital devices and physical objects. Arduino consists of both physical programmable circuit board and a piece of software, or IDE software that runs on your computer, used to write and upload the code to the physical board. Arduino boards use a variety of microprocessors and controllers. These consist of analog and digital input/output pins which can be interfaced with a wide range of breadboards or circuits. In this system, we use Arduino Uno as the microcontroller. It is a compact and breadboard friendly version board based on ATmega328 processor with 32KB flash memory. The ATmega328 provides serial communication which is available on digital pins 0 (RX) and 1 (TX). Also a SoftwareSerial library present in IDE software allows for serial communication on any of the digital pins. It consists of 6 analog pins and 14 digital pins in which 6 pins are for PWM output, a USB connection, a power jack, a 16MHz ceramic resonator, an ICSP header and a reset button. The Arduino Uno can be powered via the USB connection or by external power supply. It contains everything needed to microcontroller; it is just needed to get connected to a computer through a USB cable or power it with a battery or adapter to start.

B. GPS Module

Fig4: GPS module

The GPS or Global Positioning System receiver is capable of receiving information from GPS satellites and to calculate the device's geographical position. The location from the satellite is given in the corresponding latitude and longitude coordinates. A GPS receiver calculates its signals by precisely timing the signals sent by GPS satellites high above the earth. The receiver uses the messages it receives to determine the transit time of each message and computes the distance of each satellite. These locations along with the satellite's locations are used with the possible aid of trilateration, depending on which algorithm is used to compute the position of the receiver. This position is then displayed with a moving map display or latitude and longitude; elevation information may be included.

The GPS receiver displays various types of information like time, direction and speed apart from location. GPS receivers requires at least four or more satellites to obtain the location. GPS is dual-use technology, means it has both military and civilian applications. GPS is widely used tool for commerce, scientific uses, tracking and surveillance. This GPS gives the location of the bus or vehicle we are tracking continuously at every point of time.

C. LCD Display Module

LCD or Liquid Crystal Display is a flat plane display that uses the light modulating properties of crystal to display. It displays the alphanumeric digits and characters. In our system, we use dot matrix LCD modules to display the GPS location and the required information about the buses. It shows the fault conditions and the parameters.

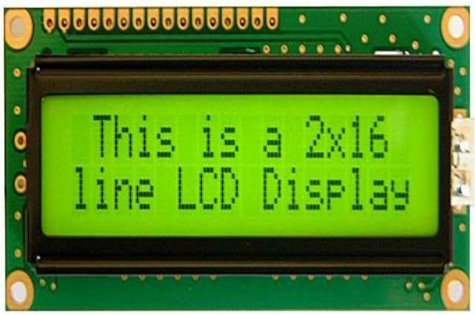

Fig5: LCD 2*16 display

16 characters 2 line display is used to display the data. Liquid crystals does not emit light directly. The main reason for using LCD display is due to the low prices and efficient display. It has a controller to interface data's and LCD panel. The arduino gets the received information from zigbee module and is given to the LCD module. The LCD module displays the information in the display boards setup in the bus stops.

D. Zigbee Technology

Fig6: Zigbee module

Zigbee is the wireless communication protocol like Wifi and Bluetooth. Zigbee is one of the open global standard that addresses the low cost and low power applications. The wireless communication range of Zigbee may be up to 1 mile. This system uses CC2530 zigbee module to make the complete network. The frequency range of this xbee module is about 2.4 GHz. These modules allow a very reliable and simple communication between microcontrollers, computer, systems, and anything with a serial port. In this, point to point and multi-point networks are supported. Zigbee is used at radio frequency RF applications that require a low data rate, long battery life, and secure networking. The list of applications using zigbee wireless technology are home automation, medical applications, mobile services, telecommunication services, industrial control and embedded sensing applications. Zigbee is mesh network architecture. Every single xbee can be interconnected with 65000 other xbee's. It consists of the collecting node, routing node and coordinating node. Mesh network or Zigbee network uses collecting nodes to establish communication between zigbee's by sending and receiving the data.

VI. RESULTS

The bus section is connected as the transmitter part in the bus to track its location and bus information like bus number and seat availability.

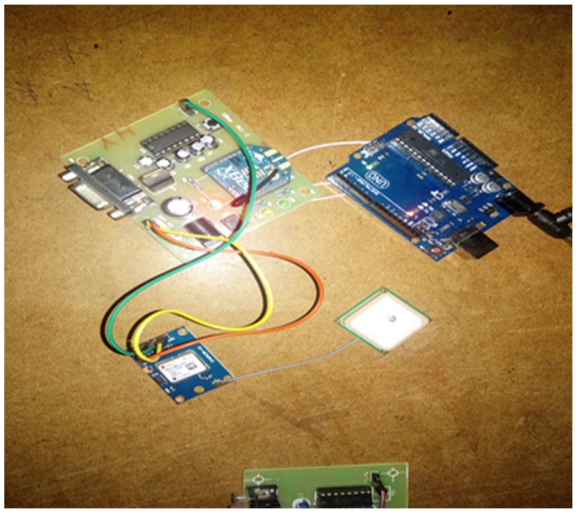

Fig7: Bus section output

The Display section is connected in the bus stops or at the users end to display the latitude and longitude of the bus position. The below circuit consists of LCD showing the bus location.

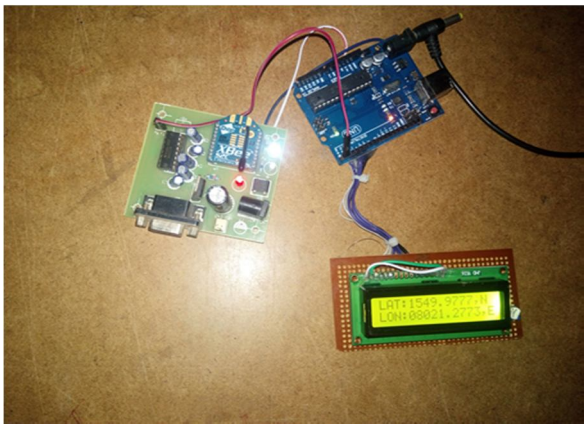

Fig8: Display section output

VII. CONCLUSION

In this project, Arduino is connected to zigbee and gps modules through serial communication. These three modules together form the transmitter part which is setup in the bus. Arduino connected in serial reception with zigbee along with LCD module forms the receiver part to display the bus status.

The complete system forms the real time bus query system that helps in choosing better travel path and to avoid traffic problems.

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