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EFFICIENT PUBLIC TRANSPORT USING GPS AND ZIGBEE

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ABSTRACT

Whenever a Bus Stops in middle the road, Driver first tries to check the problem related to the bus. If the problem is beyond solving then he calls the representative at the depot for a Mechanic. This usually takes a lot of time and due to which the bus is stuck in the middle of the road and due to this the traffic intensity behind the bus increases and no notification in sent to the traffic police to handle the traffic. This leads to chaos and other disturbances on the road. So this paper proposes a system based on Global Positioning System (GPS) and Zigbee for efficient public transport. The status of the bus will also be known to the passenger waiting at the bus depot. This system takes into account the respective advantages and disadvantages of GPS, Zigbee and Atmega 16 and designs a feasible solution successfully.

Keywords: Atmega 16, Bus, GPS, Status, Zigbee.

I. INTRODUCTION

With the development of computers, wireless communication, people's life standard is constantly enhancing. Thanks to the rapid development of information technology and growth of the internet through high speed networks, network environments have even been changed from office oriented environments based on business industries and public institutions to the interconnection of digital electronics in the home networks. Buses are offered by the Government as an unrestricted service, worth of which will directly establish the expediency of public travel. It is a significant decisive factor for quality of service standards that if the bus stops in the middle of the road, proper measures are necessary to be taken as quickly as possible to reduce the chaos caused due to the traffic by knowing the position of the bus given to the nearby bus depot.

II. PROPOSED SYSTEM STRUCTURE ANALYSIS

2.1 Zigbee

Zigbee is a specification for a suite of networking, security and application software layers using small, low-power, low-cost, low data rate communication technology based on IEEE 802.15.4 standard for personal area networks. The Global Positioning System (GPS) is a space based radio navigation system that provides geolocation and time information to a GPS receiver anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The GPS system provides critical positioning capabilities to military, civil, and commercial users around the world. In this paper a system based on GPS and Zigbee technology to improve the efficiency of management and realize intelligent service system is proposed.

The emergence of wireless interface devices created a strong demand for low-data-rate short-range wireless networking. This led to the development of Zigbee standard, which is a set of new communication protocols for wireless transmission [1]. The Zigbee standard is developed by the Zigbee Alliance [2], which has hundreds of

member companies, from semiconductor industry and software developers to original equipment manufacturers and installers. The Zigbee Alliance was formed in 2002 as a nonprofit organization open to everyone who wants to join [3].

The Zigbee standard has adopted IEEE 802.15.4 as its Physical Layer (PHY) and Medium Access Control (MAC) protocols [4]. Hence, a Zigbee device is compliant with the IEEE 802.15.4 standard as well. The PHY layer supports three frequency bands: a 2.45 GHz band with 16 channels, a 915 MHz band with 10 channels, and 868 MHz band with 1 channel. Main network topologies used in ZigBee wireless networking are star and peer-to-peer networks. These topologies can be used in different environments and situations. In the star topology, every device in the network can communicate only with the personal area network (PAN) coordinator. A Full Function Device (FFD) takes up a role as PAN coordinator, the other nodes can be "Reduced Function Device" (RFDs) or FFDs. In the peer-to-peer topology, each device can communicate directly with any other device if the devices are close enough together to establish a successful communication link. Any FFD in this topology can play the role of the PAN coordinator.

The technical features of Zigbee include:

2.1.1 Security

Provides data integrity check and authentication, and uses AES-128 security algorithm. Each application has the flexibility to determine its safety properties.

2.1.2 Reliability

It uses collision avoidance mechanism, and at the same time it reserves a dedicated time slot to require a fixed bandwidth of the communication service, avoid the competition and conflicts when data is sent. MAC layer uses a full confirmation of data transfer mechanisms, and each packet of data sent must wait to receive confirmation.

2.1.3 Low Cost

The initial cost of module estimates about US$6, and soon will fall between US$1.5 and US$2.5, and ZigBee Protocol is free of royalties.

2.1.4 Power Saving

As the duty cycle is very short, transmitting and receiving information has lower power consumption, and using the hibernation mode, ZigBee technology ensures that two N size batteries can support from 6 months to 2years. Of course, different applications have power different power consumptions.

2.1.5 High Network Capacity

A ZigBee network can accommodate a maximum of 65536 devices.

2.2 GPS

Global Positioning System is a network of orbiting satellites that send precise details of their position in space back to earth. The signals are obtained by GPS receivers, such as navigation devices and are used to calculate the exact position, speed and time at the vehicle's location [6]. For communication to take place between Atmega 16 and GPS, we need only three basic signals namely, RXD (receive), TXD (transmit), GND (common ground) which are connected to RxD serial port, TxD serial port of microcontroller respectively. It consists of two supplies, 3.3V and5V, out of which we will be using 5V. Operating frequency of GPS is 1575.42 MHz and one packet is sent at 10.23 MHz.

2.3 System Structure

2.3.1 Bus Unit

Whenever a bus stops in the middle of the road, driver first checks the problem which usually takes some amount of time. If the problem is beyond solving then he calls a representative at the depot then the necessary measures are taken which takes a lot of time and there is a chance that the traffic intensity due to that bus may increase. This chaos can be avoided using following system.

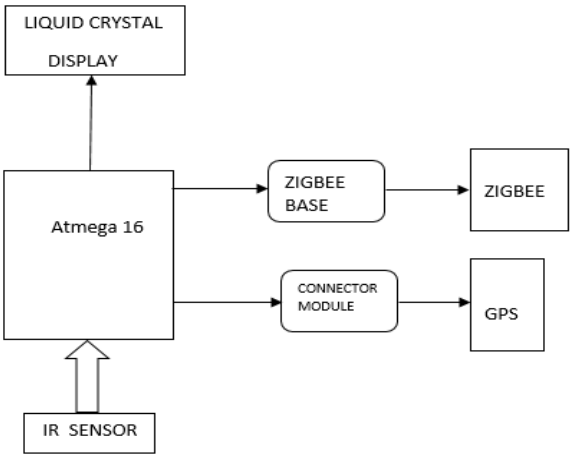

Fig. 1 Bus Unit

IR Sensors are used to detect the intensity of the traffic around the bus. Once the object the detected, signal will be sent to the microcontroller and if the sensors are ON for a certain amount of time and if the traffic is not moving then location of the bus will be notified to the nearby bus depot via GPS and this communication between bus and depot will take place via Zigbee.

2.3.2 Bus Stop Unit

If the passenger arrives the bus stop early or late but he/she doesn't know whether the bus came or left and he/she wants to know the status of the bus, it can be done with the help of the following system.

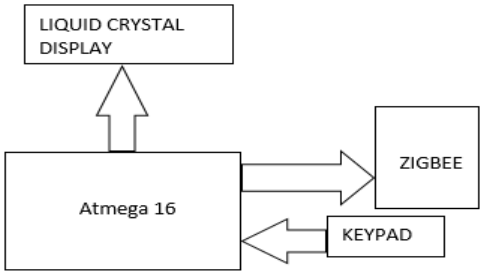

Fig. 2 Bus Stop Unit

When a passenger arrives at the bus stop, with the help of the keypad provided, he can enter the bus number in which he wants to travel. The request will be sent to the depot and the status of the required bus will be displayed on the LCD which will be present at the bus stop.

2.4 Software Design

This design is done to obtain the location of the bus with the help of the GPS via Zigbee. If the location is available connection with the GPS satellite will established and latitude, longitude will also be obtained.

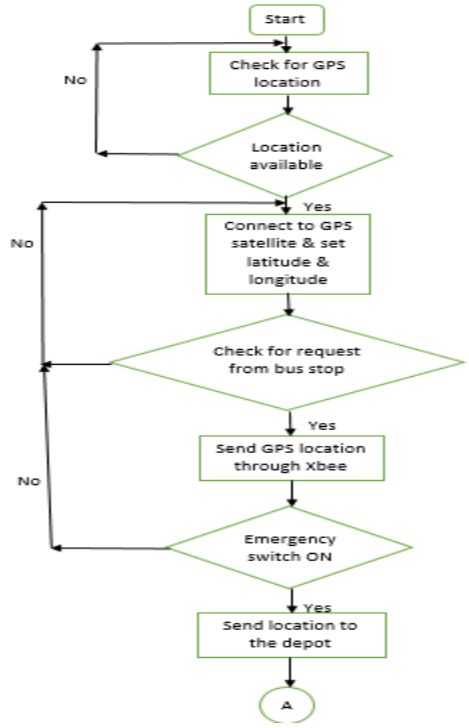

Fig. 3 Flow chart of bus unit 1

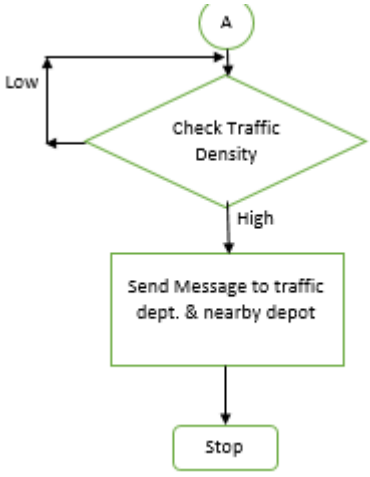

Fig. 4 Flow Chart of bus unit 2

III. CONCLUSION

The application of GPS and Zigbee technology to bus monitoring system can solve many problems. In this way, public transport management quality and operational efficiency will improve. GPS, Zigbee and Atmega 16 in the system implementation will prove a vital tool in monitoring road transportation system. The passenger is also able to get the information about the respective bus.

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