ZIGBEE and GSM based Passenger Bus Alert System

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ABSTRACT
This system presents an automatic Bus announcement for easy transportation using Zigbee and GSM modems. This system uses an Zigbee module, which is used to detect the arrival of the bus at the bus station. The arrival of the bus is announced at the approaching bus station.

The same information is then transmitted from the present bus station to the next bus station using the GSM modem. Thus, we are announcing the arrival at the present or approaching bus station and the arrival at the next bus station earlier to its actual arrival as well.

Keywords
Microcontroller, AT89V51, Speaker, Speaker driver, IC APR33A3, Bus station, Bus unit, Zigbee S1, GSM, SIM900, AT commands

INTRODUCTION
The population of our country has been increasing rapidly which directly or indirectly increases the vehicle density. Due to untimely nature of public transport system the private vehicle density is on upsurge. The aim of the project is to ease the way of transportation, especially the public transport system such as the Buses.

In this fast moving world, new technologies have been evolved for every second for our human life style improvement. There have been enormous advancement in automobile technologies already and there are many more to come. Because of these technologies, now we are enjoying the necessary comfort and safety. But, it’s just one side of a coin. If we look at the other side a very grave case of environmental pollution creeps up. Due to technology dependency and ease of transportation it is difficult to curb the use of private vehicles. But looking at a bigger picture and considering the damages caused to the environment there is a need of using more and more of public
transport system. And a way to make the public transport system more user friendly, and more timely, there seems to be a need for a technology which considers the basic need of a user.

Presently, a passenger waits at the bus station for his choice of bus, and more often than not a lot of time is wasted in this process with the passenger hardly having any hint of arrival time. The timetable does exist and bus drivers are ordered to strictly follow those times. But, this timetable does not take into account the peak hour’s traffic, bus breakdown and many such delays. To rely just on such a timetable is not acceptable.

While thinking other way round, if passengers waiting at the bus station for a longer period of time gets some kind of an alert or an hint from the previous bus station then a passenger stands in a better state to make a decision, of whether to wait for his choice of bus or to take another means of transport. Also, when a bus is approaching a bus station, passengers by using line of sight can see a bus approaching but can’t decide whether it’s their choice of bus, mainly due to the size of present naming boards. In such a case if a passenger has a hint of the approaching bus then he will be in an alert mode to catch it, especially if a passenger is a blind person or a senior citizen.

1. BLOCK DIAGRAM AND DESCRIPTION

In this project we are designing a system which can be used for announcement of bus arrival a few minutes earlier before the actual arrival of bus. Communication between two bus station is done using GSM technology. A bus code is transmitted from one bus station to another bus station using GSM, this code is used for announcing the details of the bus. Zigbee protocol is used for communication between bus and the nearest bus station.

The Zigbee module is interfaced with the microcontroller which is used to send the bus information to bus station and to get the information from the bus to bus station. The Bus Station Module is fixed at every bus station which consists of zigbee node which is interfaced with the Microcontroller.

Announcement of arrived bus is done using speakers at the station at which the bus is present and also at the next bus station. APR33A3 is used for interfacing speaker with the controller.
1.1 Bus station module:

This module contains one microcontroller & Zigbee used for synchronization with bus, the bus is unendingly broadcasting its code through zigbee. This code is received by the Zigbee present at the bus station system. After the code is received further announcements at the present station send next station are made using suitable devices.
A loudspeaker is used to make an announcement at this station. After the announcement is being made the bus code is transmitted to the next bus station through GSM where the arrival of bus is announced.

After the announcement made at the present station the code of the bus is transmitted to next station using GSM module.

1.2 Microcontroller for station unit- AT89V51

The Flash program memory supports both parallel & serial programming whereas for 80C51 only parallel programming is supported. So, we opted for 89V51

In-System Programming (ISP). It is compatible with the industry-standard 80c51 instruction set and pin out.

89V51 has 64 kB of on-chip Flash program memory

1.3 Zigbee modem:

Zigbee is one of the newest technologies enabling wireless personal area networks (wpan).

- Lower cost and lower power consumption.
- Ultra-low power consumption is a key system design aspect of the zigbee technology.
- Wireless network solution that is simple to develop and deploy.
- Low data rate applications, robust security and high data reliability.
- For our project we used S1 generation zigbee having a range of 100m, which is sufficient for establishing connection between bus and bus station.

SERIES 1:

- Serial Data rate : 1200-250000 bps
- (6) 10 bit ADC inputs, (8) Digital I/O pins
- Indoor/Urban range : 100 ft (30m)
- Outdoor/RF line of sight range : 300ft (90m)
- Transmit Power output : 1mW (0dBm)//60mW (+18 dBm)

1.4 Speaker driver IC:

The APR33A3 device offers true single-chip voice recording, non-volatile storage, and playback capability for 40 to 60 seconds. The device supports both random and sequential access of multiple messages. Sample rates are user-selectable. The device is ideal for use in portable voice recorders, toys, and many other consumer and industrial applications.
APR33A3:

Most popularly used record & playback IC’s are APR96xx & APR33Ax series. The main reason to opt for APR33A3 is the duration of recording and easily switching 2/4/8 message modes.

1.5 GSM Modem:

GSM (GLOBAL SYSTEM FOR MOBILE COMMUNICATION) is the most widely used mobile technology using a simple Subscriber Identity Module (SIM) it has taken the world of mobile communication to new heights. It is based on a simple architecture. Even with the introduction of new technologies like CDMA, GSM has stood its strength due to its efficiency and simplicity. A GSM modem is a wireless modem that works with a GSM wireless network.

GSM is one of the most vital components in our set up since all the communication between the next Bus station units takes place through this modem.

2. NEED OF AT COMMANDS:

Computers use AT commands to control modems. Both GSM modems and dial-up modems support a common set of standard AT commands. So we can use a GSM modem just like a dial-up modem. AT is the abbreviation of Attention. Every command line starts with “AT” or “at”. That’s why modem commands are called AT commands.

2.1 Types of AT commands

There are two types of AT commands.

1) Basic commands: These are the AT commands that do not start with “+”

2) Extended AT commands: These are the AT commands that start with “+”. All GSM AT commands are extended commands

2.2 AT commands to send and receive message:

2.2.1 For sending SMS in text Mode:

- AT+CMGF=1 press enter
- AT+CMGS="mobile number” press enter
- Once The AT commands is given’ >’ prompt will be displayed on the screen.
- Type the message to send via SMS. After this, press “ctrl+Z” to send the SMS.
- If the SMS sending is successful, “ok” will be displayed along with the message number.

2.2.2 For reading SMS in the text mode:
• AT+CMGF=1 Press enter
• AT+CMGR= no.
• Number (no.) is the message index number stored in the sim card. For new SMS, URC will be received on the screen as +CMTI: SM ‘no’. Use this number in the AT+CMGR number to read the message.

3. APPLICATION AND FUTURE MODIFICATIONS

3.1 Advantages of the designed system:

• Ease of transportation.
• Saves time of passengers.
• Most helpful for disabled persons

3.2 Applications:

• Can be implemented in any public transport system
  Like City buses and even in Railways

3.3 Future Modifications:

• Establishing GSM connection between all buses and bus stations so that the desired position of any bus can be announced at the bus station.
• Establishing MUX(2:1) at each Bus Station to make it as an transreceiver station.

4. REFERENCES:

• Websites:


• Books: