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# BUS RAPID TRANSIT SYSTEM

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***Abstract:*** The bus systems in India are not as efficient as the railways. In order to bring out the same efficiency in bus systems, the BRTS (Bus Rapid Transit System) is designed. The BRTS involves use of two technologies, the RFID (Radio Frequency Identification) and GPRS (General Packet Radio Service). The whereabouts of each bus passing through a particular bus station is given to all the other bus stations present in the route. The time of departure and arrival is stated. Visual Basic is used as the front end and SQL is used as the back end in the project.

***Keywords:*** *BRTS, GUI, GPRS, RFID, SQL, VB.Net, Webpage*

## 1. Introduction

BRTS [1] has been recorded in the literature with the variations made with the buses used for transport. There have been buses with radio and television, an automatic ticket collector and air conditioned buses. None of the above stated changes have made the Bus transport system efficient for the users.

The main disadvantage of using public transportation [2] is irregularity in scheduling. In some regions, the mass transit is limited and hence is available only after specific durations. Travelers with disabilities need to make a pre-trip investigation. Furthermore, some of the transit systems do not work on public holidays or weekends.

All these reasons have led to the design of BRTS [1][3]. This system will basically increase the speed of the transport system in India. The passengers will be well aware of the bus timing which would make it convenient for their travel. The system would become very efficient after the use of the system. It would make the system faster and simpler.

## 2. Proposed System

BRT system uses two technologies, RFID and GPRS. Radio Frequency Identification (RFID) tags have emerged as a key technology for real-time asset tracking [4]. It is an automated identification technology that allows for reading of data without contact making it attractive in vehicles. RFID readers can read tags even when they are hidden.

In this system, there is a RFID tag located on the bus and a RFID reader is present at a particular height at the bus station. As soon as the bus arrives at the first station the RFID reader will read the unique address from the RFID tag. The RFID reader is connected to the processor via RS232. The data is then sent to the processor. The processor is programmed using Visual Basic. The time of arrival of the bus and the name of the bus is stored in the database. The processor already contains a look-up table that contains the unique address of each bus against its registration number. This enables us to know which bus has arrived at the station. The information is then loaded into the server. The server updates the information in the database and forwards it to the other stations using GPRS. Every station has a web page that is interconnected and will be refreshed automatically so that every latest entry of the bus can be entered.

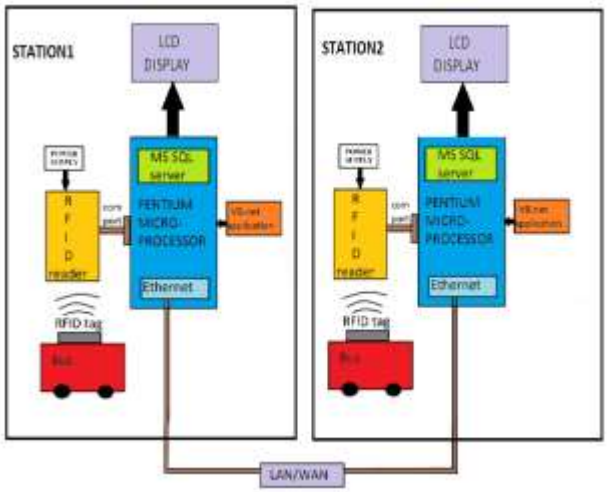


*Fig1: Block Diagram*

As the bus arrives at a particular station, the other stations will be informed about the time that will be required to reach their stations. This enables the passengers to know where the bus is currently present, and in how much time the bus is expected at the desired stop [5]. All this information will be displayed on a LCD display present at the stations.

*RFID (Radio Frequency Identification):*

RFID devices can be classified mainly as Active and Passive devices.

Active tags require a power source—they are either connected to a powered infrastructure or use energy stored in an integrated battery. In case of active tags, a tag's lifetime is limited by the stored energy, balanced against the number of read operations the device must undergo. However, batteries make the cost, size, and lifetime of active tags impractical for the retail trade. The lifetime, size and cost depend on the battery which makes it impractical for retail use.

Passive RFID tags do not require batteries or maintenance. The tags have an indefinite operational life and are small enough to fit into a practical adhesive label. A passive tag consists of three parts: an antenna, a semi conductor chip attached to the antenna, and some form of encapsulation. The tag reader provides power and communicates with the tag. The tag antenna captures energy and transfers the tag's ID which is co-ordinated by the tag chip. The encapsulation protects the antenna and chip from being damaged by environmental reagents. Encapsulation also provides the tag integrity. The encapsulation is a small glass or a laminar plastic substrate with adhesive on one side to enable easy attachment.

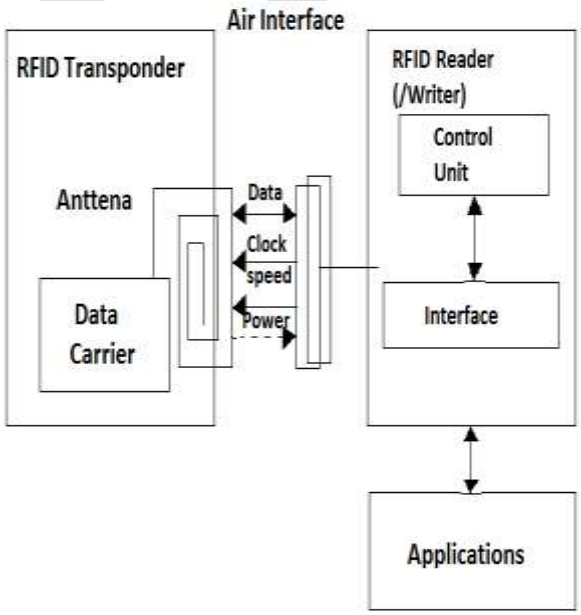


*Fig2: RFID working principle*

RFID technology consists of a tag, reader and middleware.

*RFID Reader:*

RFID uses radio frequency electromagnetic waves to transfer the data from a tag that may be attached to any object for the purpose of identification. The RFID Reader is as shown in Fig 3. and reads any tag that is within its range.

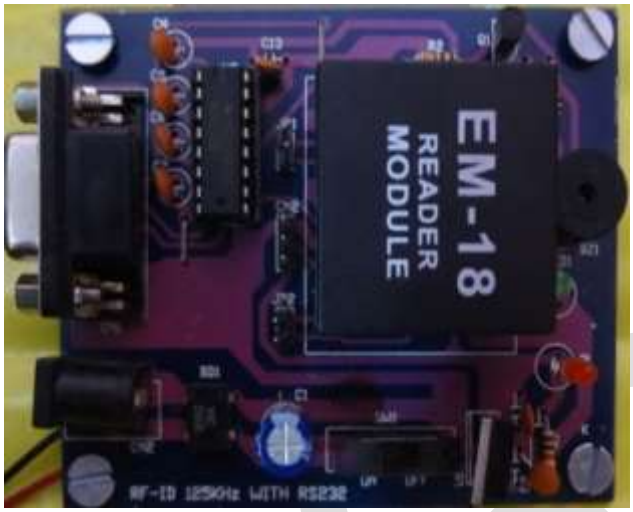


*Fig3: RFID Reader*

The data is transmitted over serial line which can be read easily. The reader has an LED for power indication and also a buzzer that indicates presence of a card. The reader shown in Fig3 can detect cards in the range of 8-10cm.

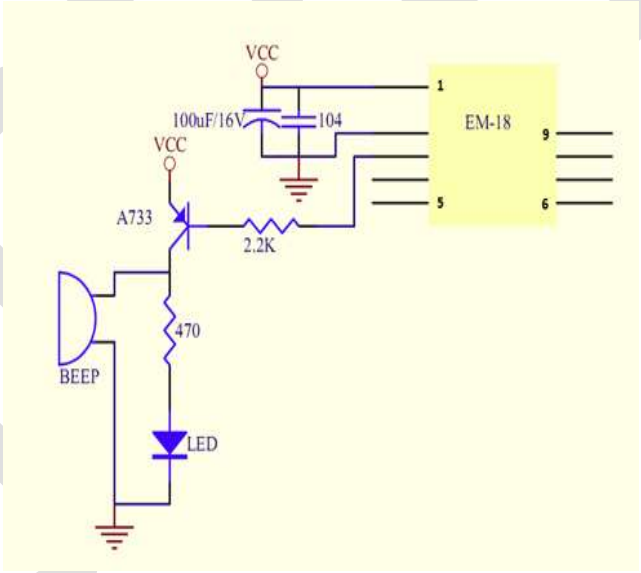


*Fig4: EM-18 Application Circuit*

*Table1: EM-18 PINOUT*

| | | |
|---|---|---|
| 1 | VCC | 5V |
| 2 | GND | GND |
| 3 | BEEP | BEEP AND LED |
| 4 | ANT | NO USE |
| 5 | ANT | NO USE |
| 6 | SEL | HIGH IS RS232, LOW IS WEIGAND |
| 7 | RS232 | RS232 |

| | | |
|---|---|---|
| 8 | D1 | WEIGAND DATA 1 |
| 9 | D0 | WEIGAND DATA 0 |

*RFID Tag:*

The tag contains electronically stored information which can be read from up to several meters away. A barcode needs to be in line of sight of the reader. This is not the case with RFID tags and may be embedded in the tracked object. Two-way radio transmitter-receivers called interrogators or readers send a signal to the tag and read its response.

*Fig4: RFID reader*

The tag's information is stored electronically in a non-volatile memory. The RFID tag includes a small RF transmitter and receiver. An RFID reader transmits an encoded radio signal to interrogate the tag. The tag receives the message and responds with its identification information. This may be only a unique tag serial number, or may be product-related information such as a stock number, lot or batch number, production date, or other specific information.

RFID tags contain at least two parts:

1. An integrated circuit for storing and processing information, modulating and demodulating a radio frequency (RF) signal, collecting DC power from the incident reader signal, and other specialized functions
2. An antenna for receiving and transmitting the signal.

Signaling between the reader and the tag is done in several different incompatible ways, depending on the frequency band used by the tag. An Electronic Product Code (EPC) is one common type of data stored in a tag. When written into the tag by an RFID printer, the tag contains a 96-bit string of data. The first eight bits are a header which identifies the version of the protocol. The next 28 bits identify the organization that manages the data for this tag; the organization number is assigned by the EPC Global consortium. The next 24 bits are an object class, identifying the kind of product, the last 36 bits are a unique serial number for a particular tag.

*GPRS (General Packet Radio Service):*

GPRS is a wireless mode of communication that has a wide range of applications. It provides uninterrupted data transfer at the rate of 56-114kbps to all the users. It is integrated into GSM.

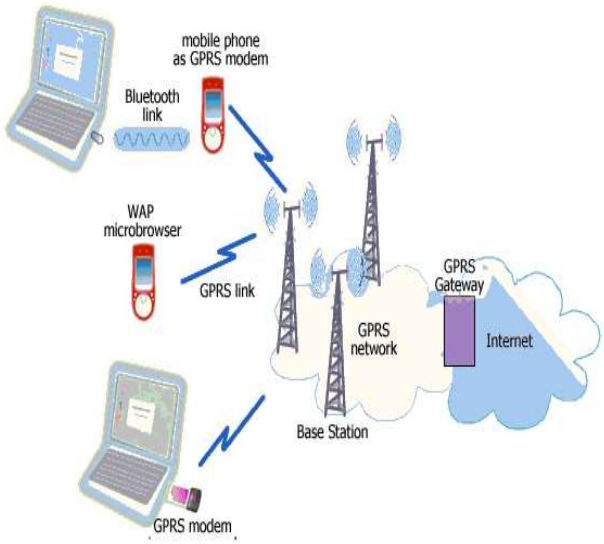


*Fig5: GPRS Structure*

Currently being maintained by the 3GPP (3rd Generation Partnership Project), It provides a certain quality of service.

*SOFTWARE FUNCTIONING:*

1. Data is monitored using COM port

When the bus arrives at a station, the reader reads the unique identification number and sends the data serially to the central control unit. The Software functioning is shown in fig 6.

2. Bus ID is identified by the database

There is a database created at the central unit that contains the ID of a tag attached to a bus against its registration number. The database is created in SQL (Sequential Query Language). As the data from a station is received, it is looked up in the existing database.

3. Bus is identified using look up table

After the reception of the ID, it is compared with the data present in the look up table, from where the route of the bus is identified.

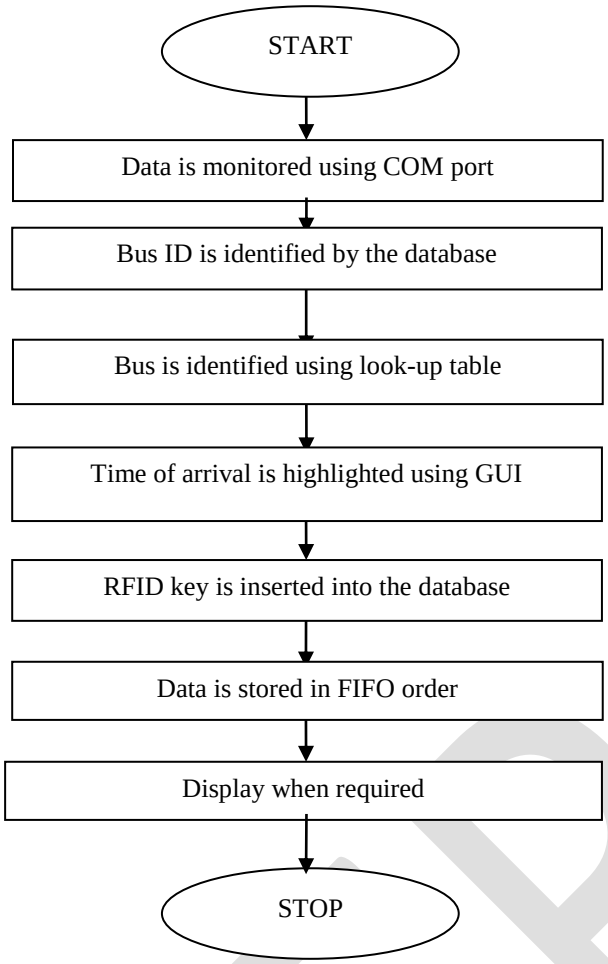


*Fig6: Software Functioning*

4. Time of arrival is highlighted using GUI

Every station including the central unit has a login page created using Visual Studio. This acts as the frontend of the system. The time of arrival of the bus is stored and is sent to all others stations in the route via GPRS. All the information is transferred to and read from a private webpage that is created especially for the system. It is integrated using the IIS (Internet Information Service). This ensures speed and less congestion in the network path.

5. RFID key is inserted into the database

The RFID key i.e. the identification number is inserted in the database which indicates the bus name and number.

6. Data is stored in FIFO order

The data that is received is stored in as first in first out order. The data is stored in another temporary database that has limited number of entries. As the database gets full, the oldest data in the database is deleted.

7. Display when required

Every station has a LCD display connected to the processor. As the database is updated, the information is displayed in the LCD and the travelers can get the whereabouts of a required bus and other additional information.

**3. Result**

Using this technique every module were tested the following results were obtained. Fig7 shows the Login page created in Visual Studio using VB.Net. This login page is present at control unit. Fig8 shows the webpage after the authority logs into his system and connection is established with the system. Fig9 is the temporary database created for the entries of the bus. Fig 10 shows the webpage for the local host, which would be present for every station other than the central control unit. Fig11 shows the connection of the local host with the system. Fig12 shows the webpage linked with the local host. Fig13 shows the data that is received and can be displayed on the LCD. Fig 14 represents IIS debugging.

*Fig7 : Login page*


*Fig8: Connection established*

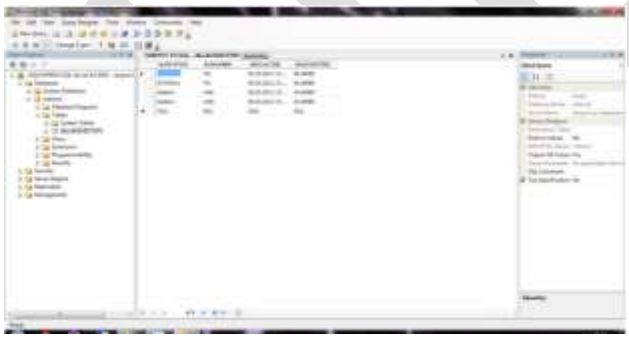

*Fig9: Entries recorded into SQL Server*

*Fig10: Webpage created*

*Fig11: Local host created*

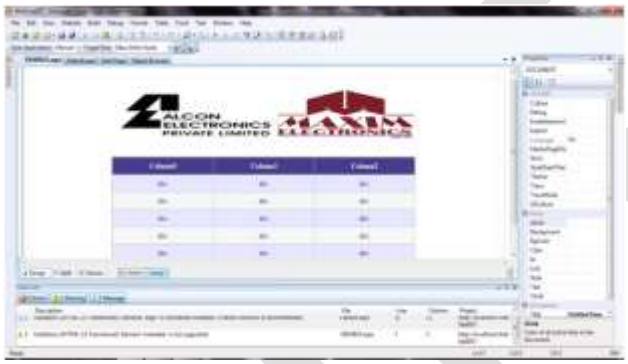

*Fig12: Webpage created*

*Fig13: Webpage on each station*

*Fig14: IIS debugging*

## 4. Conclusion

The BRTS has been implemented using RFID and GPRS. The system increased passenger convenience and thus made it more reliable. The use of passive RFID makes the system cost efficient. The webpage created is used exclusively by the authorities and hence reduces congestion in the network. This increases the speed and makes it more efficient than the existing system.

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