RFID Based In-Vehicle Road Sign Notification System

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Abstract— The following project documents the development of an RFID based system that alerts vehicle drivers about approaching road oddities at an optimum distance before encountering them. Radio-frequency identification (RFID) is a technology that uses communication via electromagnetic waves to exchange data between a terminal and an object such as a product, animal, or person for the purpose of identification and tracking. Some tags can be read from several meters away and beyond the line of sight of the reader. The objective is to design a wireless system that delivers road signs (and other road-related information) to the commuter inside his/her vehicle visually and aurally, at an appropriate distance before encountering the corresponding road aberrations. The final aim is to bring about a change in the current road safety paradigm by providing a more efficient and ergonomic electronic alternative to static road signs. In addition to reducing dependency on road signs, the device will also aid in averting accidents and traffic jams, and in better implementing traffic law and order.
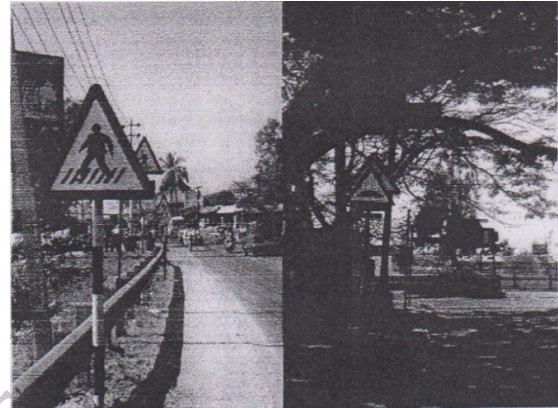
I. INTRODUCTION

The hassles of vehicular commuting in crowded metropolitans in developing countries are many - having to wait hours together in traffic jams, taking tortuous detours due to on road construction, trying to spot speed breakers, navigating blind turns, one-ways and so on. Forked roads, railway crossings, sudden reverse bends and steep ascents and descents are just few of the road oddities that one may encounter on the average drive.

At times, such road oddities are accompanied by road-signs. However, most vehicle drivers miss road signs more often than not. It is understandably difficult to keep an eye out for road signs when one should be focused on driving. The inconvenience is augmented by inadequately placement and poor noticeability of the signs.

The problems pervade much deeper than our daily hassles. Over 1, 30,000 fatalities due to road accidents are reported annually in India alone. (National Crime Records Bureau). With rapid increase in road transport throughout the world, there emerges a need for novel concepts and intelligent systems that enhance driving safety and convenience. The preliminary concept hasbeen described in details an RFID based in vehicle Alert System for Road Oddities.

Fig. 1. : Improper position of road sign

II. SYSTEM MODEL

The objective was to replace the road signs with RFID tags, and use in-vehicle RFID Reader-enabled modules to sense them, and provide tangible information to the driver.

In this prototype model we used a passive RFID reader which is wirelessly connected to the display console inside the vehicle. Along with this system we also provided speed control functions that can control the hydraulics in case of crossing speed limit TAGs. Along with a visual alert on the LCD, a vocal alert can be was incorporated to provide the vehicle driver with an aural notification as well.
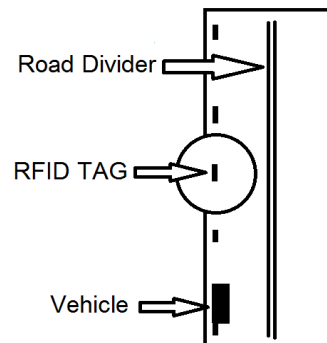

Fig. 2. RFID System Model

III. RELATED WORK

Radiofrequency identification (RFID) is a technology that use for the purpose of identification and tracking using radio waves. Most RFID tags contain at least two parts. One is an integrated circuit for storing and processing information, modulating and demodulating a radio frequency (RF) signal, and other specialized functions. The second is an antenna for receiving and transmitting the signal.

No direct Line of Sight required for identification & tracking. Enables very specific detection of vehicles. Simultaneous multiple detection of vehicles are possible using RFID. No performance degradation during harsh weather. Tags emit radio signals that can be captured by devices like routers or coordinators.

There are two types of RFID devices:
- Active RFID device contains a battery and can transmit signals autonomously.
- Passive RFID devices have no battery and require an external source to provoke signal transmission.

A. RFID Tag consideration

Each Tag is assigned a unique ID while fabrication - a value that can extend upto 24 characters. We can the values on the test Tag. The objective was to assign each of these unique ids to a particular road aberration. It makes more sense in terms of portability that Tags-IDs are assigned to road oddities in software, rather than writing them into the tag memory during its manufacture. This way tags can be used for multiple road oddities at different times; they can be removed and placed elsewhere should the road topography change. The operating temperatures of the given RFID tags range from sub-zero to 80 degree Celsius, which encompasses road temperatures globally.

B. Vocal Alert

Along with a visual alert on the LCD, a vocal alert can be was incorporated to provide the vehicle driver with an aural notification as well.

C. Power Supply Required

The objective of this notification system implementation brings in the need for a robust power supply which should deliver good power. The required power is delivered by a car adapter - a 12V point provided in all cars today.

D. Beacon Rate Estimation

For our application we designed a mathematical model to estimate the beacon rate. The tag is unidirectional with a specified range. The signal gets detected once the vehicle is in the range as per the specified distance. The signal dies after that range.
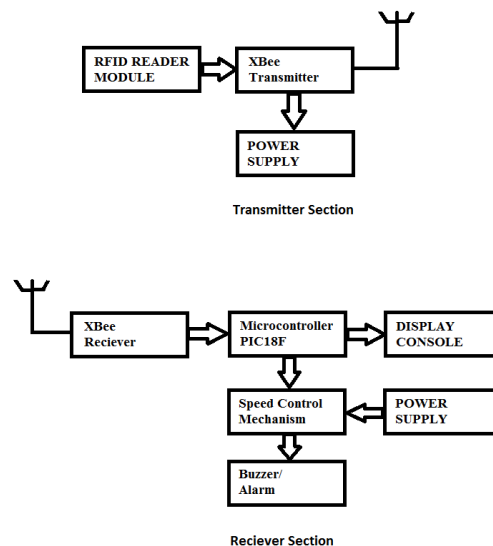
IV. SYSTEM BLOCK DIAGRAM

Fig. 3. Block Diagram of the system

The function of different blocks is:

A. Transmitter Section

1) RFID READER MODULE: It reads the tags and sends the data encoded in the tag to the xbee transmitter.

2) Xbee Transmitter: It transmits the encoded RF signal in the range of 10 - 20 cm.

3) Power Supply: This unit will supply the various voltage requirement of each unit. This will be consists of transformer, rectifier, filter and regulator. The rectifier used here will be Bridge Rectifier.

B. Receiver Section:

1) Xbee Receiver: It receives the signal transmitted and decodes it and passes it to the microcontroller.

2) Microcontroller: We have use PIC18F. The microcontroller receives the data from the decoder and check the signal is of what sign. After decoding that it will decide whether its speed based sign or not. If it is speed based sign, it will send signal to display, voice IC and motor drive and it will only send the signal to display and voice IC. This unit is the heart of the complete system. It is actually responsible for all the process being executed. It will monitor & control all the peripheral devices or components connected in the system. In short we can say that the complete intelligence of the project resides in the software code embedded in the microcontroller.

3) Speed Control Mechanism: This block is used to limit the speed of the vehicle using relays. It will work only after the driver ignores the warning of speed limit given by the system.

4) Display Control: We are going to use 16x2 character LCD. This will be connected to microcontroller. The job of LCD will be to display all the system generated messages coming from the controller. LCD will provide interactive user interface. This unit requires +5VDC for its proper operation.

5) Alarm: It is used to give warning to the driver about the speed limit.
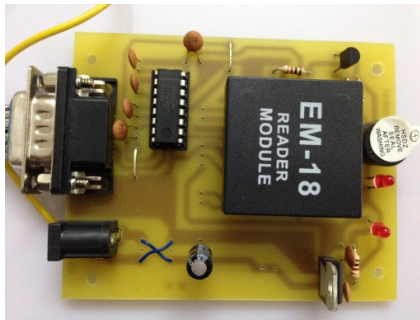
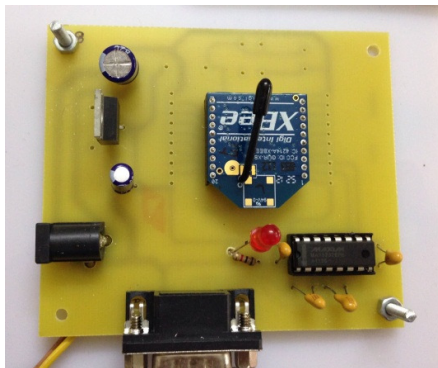## V. HARDWARE IMAGES

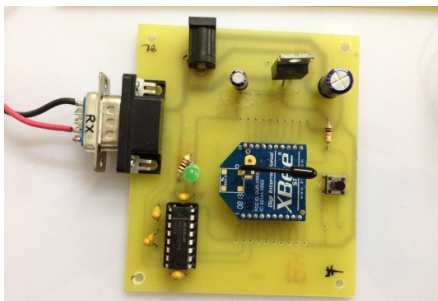Fig. 4. ID Reader

Fig. 5. ID Xbee Transmitter
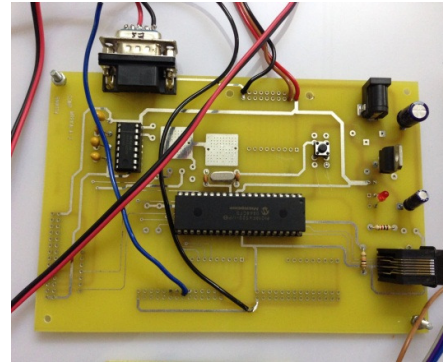

Fig. 6. Mainboard Xbee

Fig. 7. Mainboard

VI. DIFFERENCE FROM EXISTING SYSTEM

At present, there is a system in the vehicle to tell incoming emergency vehicles and senior citizens in help in the area in USA.

So far, only prototypes of the system showing just signs are available.

In this system, it will display signs and as well as limit the speed of the vehicle in the critical area. Thus making the road much safer and easier to commute.

VII. RESULT

The physical road signs are replaced the tags whose message can be seen on the display console fitted inside the vehicle. Visual basic is used to develop message on the display console.

VIII. ADVANTAGES

1) Makes the navigation easy for the driver on an unknown place.

2) Safer driving can reduces the accident rates in India.

3) All the sign can be replaced by the respective tag in their place reducing the cost.

4) Simultaneous multiple detection of vehicles are possible using RFID.

IX. LIMITATIONS

1) Putting tag all over the place may take a lot of time and force.

2) Regular maintenance is required for a smooth running of system.

3) Every vehicle will have to install the receiver device.

X. APPLICATIONS

1) Used in easy navigation of the road.

2) Used in controlling the speed of reckless driving.

XI. FUTURE DEVELOPMENT

1) The signal from microcontroller to display and voice system can be made wireless by using ZigBee modules.

2) Also, the need of extra LCD can be eliminated by making the display in the bottom of existing music and navigation system already installed in vehicle using Visual Studio Software.

3) The overall console can also be replaced by Tablet PC.

XII. CONCLUSION

By the realization of the above proposed system one can learn many aspects of a digital electronic circuit. This will give the complete knowledge of designing microcontroller based system and developing embedded software.

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