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Microcontroller Based Device for Road Oddity Notification

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Abstract:
This paper presents the design and implementation of a microcontroller based road oddity notification device that augments road safety for vehicle drivers. The device installed inside the driver's cabin will deliver electronic notifications of approaching road oddities visually to the driver on an LCD screen by making use of Radio Frequency Receiver and Transmitter module controlled by a PIC microcontroller. The receiver segment (placed inside the vehicle) when it is in the vicinity of the transmitter will receive the data from the transmitter module (placed near the oddity). This information can be retrieved and used to detect, identify, and display information. The system is capable of providing real-time road-based information to the vehicle driver: providing directions, cautions on speed limits, school zones and can eventually replace cluttered and unreliable road signs creating a new standard in on-road safety for vehicles.

1. Introduction

One of the main aspects in designing a car is visibility. Visibility is the measure of distance at which an object or light can be clearly discerned. There are 2 aspects to improving visibility of a driver: 1. Design the vehicle such that the visibility range is maximum to avoid obstacles or 2. Addition of sign boards along the path to warn the driver about the obstacles ahead.

Due to some unavoidable circumstances, such as, absence, rusting, blocking of signboards, also absence or damaged street lights, the visibility of the driver is hampered. This causes an error in the judgment of the driver, which is an important aspect of road safety. This has led to fatal consequences, causing road safety a major concern these days.

After conducting extensive literature survey [1] on the existing road safety issues, the severity of the situation was understood.78.5% of accidents are due to driver's negligence [2]. A unique, simple and frugal solution was ideated. The solution had to reduce the number of casualties caused due to the fault of the driver. Hence, prior communication of the road condition of the driver was considered as a viable option. This would be technically challenging as well as of great benefit to the society. This led to the idea of alerting the driver of the impending oddity through an LCD display.

2. Design Development

2.1. Microchip PIC16F886

PIC is a family of modified Harvard architecture microcontrollers made by Microchip Technology. The name PIC initially referred to "Peripheral Interface Controller". The architectural decisions of PIC16F886 are directed at the maximization of speed-to-cost ratio. It uses Harvard architecture—in which instructions and data come from separate sources—simplifies timing and microcircuit design greatly, and this benefits clock speed, price, and power consumption[3].

2.2. TX Module [4]

Radio transmitter is an electronic device which, with the aid of an antenna, produces radio waves. The transmitter itself generates a radio frequency alternating current, which is applied to the antenna. The purpose of most transmitters is radio communication of

information over a distance. The information is provided to the transmitter in the form of an electronic signal through a controller or processor. The transmitter combines the information signal to be carried by the radio frequency signal which generates the radio waves, which is often called the carrier. This process is called modulation.

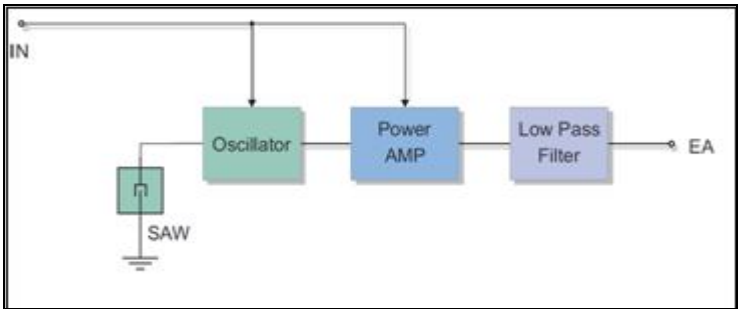

Figure 1: TX module block diagram

2.3. RX Module [5]

The RX module is basically a receiver, which receives data transmitted at 433.92 MHz. A radio receiver is an electronic device that receives radio waves and converts the information carried by them to a usable form. It needs to be used with an antenna. The antenna intercepts radio waves (electromagnetic waves) and converts them to tiny alternating currents which are applied to the receiver, and the receiver extracts the desired information. The receiver uses electronic filters to separate the wanted radio frequency signal from all other signals, an electronic amplifier to increase the power of the signal for further processing, and finally recovers the desired information through demodulation.

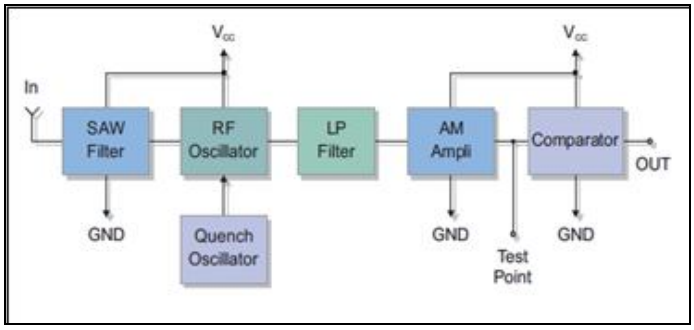

Figure 2: RX module block diagram

3. Implementation

The devices present along the road will be transmitting the message with help of a transmitter which is interfaced with the microcontroller. A receiver fitted in the vehicle will pick up the signal once it is in the vicinity of the transmitter. This signal is retrieved and used to detect, identify, and display information.

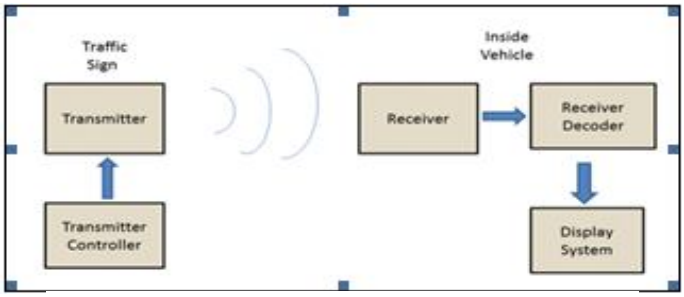

Figure 3: Functional block diagram of the basic design

3.1. Microcontroller Programming

The two PIC16F886 microcontrollers were programmed to transmit and receive data respectively [6] [7]. The microcontroller code was written in C language and converted to HEX file using software called MPLAB X IDE v 1.30 by Microchip Technology and Hi-Tech C compiler. The code was burned onto the microcontroller using PIC programmer using a burning tool called PICkit 2 v2.61 by

Microchip technology. The microcontroller was programmed to transmit and receive data at baud rate of 2400 following Manchester Scheme of serial data transmission.
The RX and TX modules were connected to the microcontrollers and the outputs across the RX and TX pin were observed on an oscilloscope.

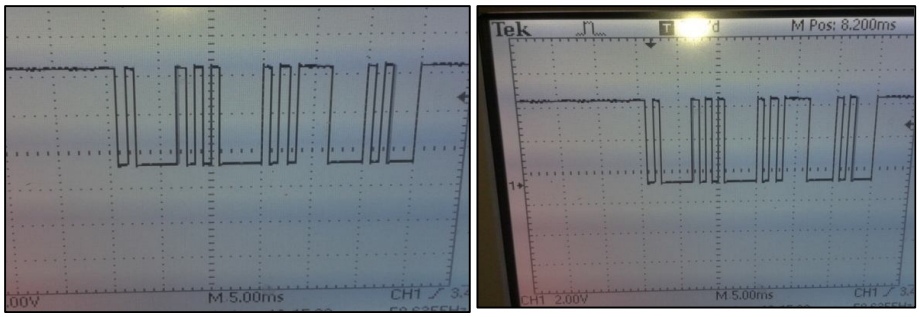

Figure 4: TX and RX output on oscilloscope

4. Result

The device was successfully tested for various messages displayed on the LCD by placing the transmitter at different locations and by moving the receiver in and out of the transmitter's vicinity. The transmitter was placed on the path on a hump. As the car approached the hump, the message was displayed when the car was approx. 75m away from the oddity as seen in figure 5.

Figure 5: Device operating inside a car

6. Conclusion

This system has many advantages over conventional road signs. A comparison between digital road signs and conventional road signs is drawn as in Table 1.

Conventional Road Signs	Digital Road Signs
They are expensive to install due to higher manufacturing costs	Relatively cheaper to produce and install due to electronic components
Each street sign generally costs between Rs. 5,000 and Rs. 25,000 to replace	No necessity to replace often, and if required can be done without incurring much cost.
Visibility factors can affect driving and may lead to accidents.	Visibility factor not an issue as the display system would be inside the vehicle.
Signs are required for every oddity the vehicle is facing.	A single display system along with transmitters is enough to alert for all possible types of oddity

Table 1

7. References

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