Wireless Low Tire Pressure Alerting System

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Abstract

Tire Pressure Monitoring Systems (TPMS) are a new standard for improved vehicle safety. These systems are an important and growing safety feature in newer vehicles. The proposed system utilizes advanced integration techniques to provide a TPMS solution that provides real- time tire pressure monitoring and alerts the driver to improperly inflated tires. The controlling device of the whole systems is a Microcontroller. Potentiometer, LCD, Pressure sensor, RF Encoder is interfaced to Micro controller. User sets some predefined pressure by using Potentiometer. The Microcontroller continuously monitors the pressure inside the tire. Also, it displays the pressure on LCD. If the pressure level is increased or decreased beyond the predefined value, controller gives the instructions to RF Encoder. RF Encoder send the information to RF Decoder, then it gives the audible alert using buzzer. Microcontroller is loaded with an intelligent program written in embedded 'C' language to perform the task.

Keyword - *Tire Pressure Monitoring System, RF communication, Microcontroller, Pressure sensor.*

I. INTRODUCTION

The industry oriented project aims at developing a TPMS (Tire Pressure Monitoring System), which displays the tire pressure onto a LCD. The proposed system provides the facility of dynamically changing the tire pressure limit setting. Also, the system alerts the driver by horning alarm if the tire pressure is high or low wirelessly using RF Technology.

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II. SYSTEM ARCHITECTURE

The block diagram of the project and design aspect of independent modules are considered such as Power supply, Sensor, Microcontroller, Crystal oscillator, RF encoder, RF decoder, LCD, LED indicators, Buzzer.

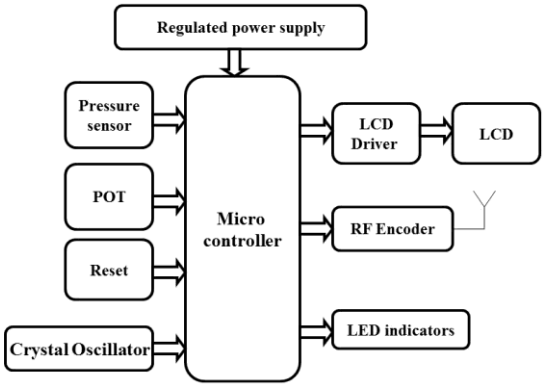

Figure 1: Block diagram of transmitter section

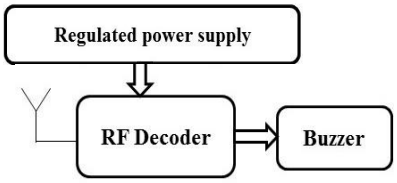

Figure 2: Block diagram of receiver section

A. Microcontroller

The microcontroller used in this project is PIC16F876A. The PIC families of microcontrollers are developed by Microchip Technology Inc. Currently they are some of the most popular microcontrollers, selling over 120 million devices each year. There are basically four families of PIC microcontrollers:

B. Sensor

In the presented system we are using The MPX10 series silicon piezo resistive pressure sensors provide a

very accurate and linear voltage output, directly proportional to the applied pressure. This standard, low cost, uncompensated sensors permit manufacturers to design and add their own external temperature compensation and signal conditioning networks. Compensation techniques are simplified because of the predictability of Free scale's single element strain gauge design**.** A pressure sensor usually acts as a transducer; it generates a signal as a function of the pressure imposed.

C. Radio frequency transmitter and receiver

In the system, how to effectively transmit and receive the wireless radio frequency signal is a key technique and this costs most of power. When choosing a wireless radio frequency module. We must consider power consumption, bandwidth, speed and capability as well. So we choose the ST-TX01-ASK is an ASK Hybrid transmitter module. ST-TX01-ASK is designed by the Saw Resonator, with an effective low cost, small size, and simple-to-use for designing. This module lies inside the tire. It operates in the voltage rate of 2-12V.

The ST-RX02-ASK is an ASK Hybrid receiver module. A effective low cost solution for using at 315/433.92 MHZ. Both these It has large ranges of frequency bandwidth, operation voltage and temperature, high speed data trans- receive capability. The module also has many advantages such as low power consumption, high accuracy and wide range of communication. It ranges upto 500ft depending upon the power supply of the transmitter. It is extremely small in size and light in weight. The receiver is operated at 5V.

D. Encoders and Decoders

In the presented system we are using HT12A/HT12E as encoders The 212 encoders are a series of CMOS LSIs for remote control system applications. They are capable of encoding information which consists of N address bits and 12_N data bits. Each address/data input can be set to one of the two logic states. The programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal. The capability to select a TE trigger on the HT12E or a DATA trigger on the HT12A further enhances the application flexibility of the 212 series of encoders. The HT12A additionally provides a 38 kHz carrier for infrared systems.

HT12D/HT12F as decoders The 212 decoders are a series of CMOS LSIs for remote control system applications. They are paired with Holtek_s 212 series of encoders (refer to the encoder/decoder cross reference table). For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen. If no error or unmatched codes are found, the input data codes are decoded and then transferred to the output pins. The VT pin also goes high to indicate a valid transmission. The 212 series of decoders are capable of decoding information's that consist of N bits of address and 12_N bits of data. Of this series, the HT12D is arranged to provide 8 address bits and 4 data bits, and HT12F is used to decode 12 bits of address information.

III. WORKING PRINCIPLE

The working of this system is quite simple to understand. Let us consider a simple flow chart in order to **understand the working.**

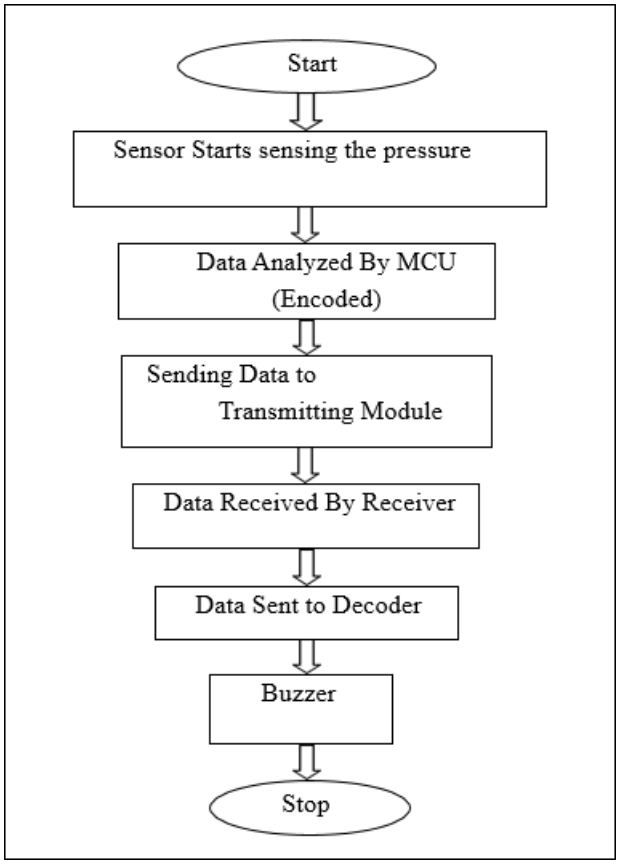

Figure 3: Flow chart of working principle

When the sensor starts sensing of pressure it transmit the value of pressure along with temperature to the RF transmitting module and the microcontroller analyze these values and transmit these data with the help of RF Transmitter to the RF Receiver and the current pressure data are displayed on the LCD screen. RF communication works by creating electromagnetic waves at a source and

being able to pick up those electromagnetic waves at a particular destination. These electromagnetic waves travel through the air at near the speed of light. The wavelength of an electromagnetic signal is inversely proportional to the frequency; the higher the frequency, the shorter the wavelength. The RF communication system then utilizes this phenomenon by wiggling electrons in a specific pattern to represent information. The receiver can make this same information available at a remote location i.e. communicating with no wires. The voltage regulators can also be utilized here for the proper functioning of the components.

IV. RESULTS

The calibrated pressure and temperature data measurements are being observed and displayed on the LCD Screen. As the pressure varies and reaches below the lower limit it alerts the driver by a buzzer.

Figure 4: Value of pressure on LCD screen

V. CONCLUSION

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. This system utilizes integration techniques to provide a solution to measures real-time tire pressure and also alerts the driver about improperly inflated tires. This system is an essential feature in all the vehicles. The system ensures calibrated tire pressure which is important for tire life; reduce number of accidents, proper handling of vehicle and vehicle's fuel consumption. The durability of tires can also be increased if we use Nitrogen gas. The tires that are filled with nitrogen gas can lasts up to Six Months.

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