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Tire Temperature and Pressure Monitoring System Based on ATmega16 Microcontroller

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Abstract: **Now a day millions of peoples using vehicles. That's why safety of human life is very important. Nowadays more than 70% accidents are happen due to tire blasting on running condition of vehicle. To avoid this we have to develop tire pressure and temperature monitoring system, which continuously update latest tire pressure and temperature and alert driver time to time to avoid accidents. Also the accuracy of pressure and temperature in the tire is very important to avoid road accidents. In this paper discusses designing of tire pressure and temperature monitoring system for vehicles. To design this system we have using 8 bit ATmega16 microcontroller which having inbuilt ADC and having lots of functionality to configure with other hardware. Also to measure pressure and temperature we use pressure sensor and temperature sensor.**

Keywords: **ATmega16 microcontroller, pressure sensor, temperature sensor, LCD display, Bluetooth module.**

1. INTRODUCTION

Today with the rapid growth in number of vehicles the traffic accidents are also increasing which causes damages to vehicles as well as human body. The most important reasons of serious traffic accidents are tire bursting. Tire bursting is very difficult to prevent and hence it is one of the major concerns for the driver. It is observed that tire burst is mainly due to abnormal tire pressure and higher tire temperature. It also observed that the death rate is 100% when the speed of the vehicle is too high from normal speed. Therefore the abnormal tire pressure affects the quality and the safety of the automobile driving [7]. Research shows that if the tire pressure maintained near to its standard value then the road accidents will be prevented. Many researchers and engineers are working on tire pressure monitoring system (TPMS). Currently TPMS can be divided in to two types; one is based on the wheel speed called as indirect TPMS. And other is based on the pressure sensor called as direct TPMS. This system makes use of pressure sensor which installed in each tire to measure the tire pressure directly and display and monitors the pressure of each tire [2].

In TPMS sensors are installed in each tire of the car to measure pressure, and central wireless Bluetooth unit. The central control unit picks up the signal and LED glow on the dashboard of the vehicle, to warn a driver when tire pressure is below permissible limit. The central control unit calculates pressure and temperature changes [7]. According to the TREAD Act passed by US congress in 2008, it is necessary for all automobile manufactures to install this tire pressure monitoring system in their vehicles produced or sold in the United States [8].

2. EXPERIMENTAL SETUP

TPMS stands for tire pressure monitoring system, in which we are going to monitor pressure and temperature of the tire. Fig.1 shows that general overview of TPMS system having central receiver and each tire transmitter. Tire pressure monitoring system is installed in each tire of the vehicle because to maintain balance of vehicle. Basically TPMS having two sections one is transmitter module or tire pressure and temperature monitoring system, and another one is receiver module. Transmitter module contains pressure sensor, temperature sensor, microcontroller unit, and Bluetooth module.

While the receiver module contains microcontroller unit, LCD display, Bluetooth module, android smart phone and the buzzer unit.

TPMS uses the pressure sensor to monitor the tire pressure. When the pressure value is increases or decreases from the given normal range, the system sends warning signal to the driver. Same with the temperature, when the temperature value is also make abnormal from the given range, the system sends out warning signal to the driver. The wireless transceiver module which transmits or receives Bluetooth signals is interfaced with microcontroller unit using Serial Peripheral Interface (SPI) bus [2].

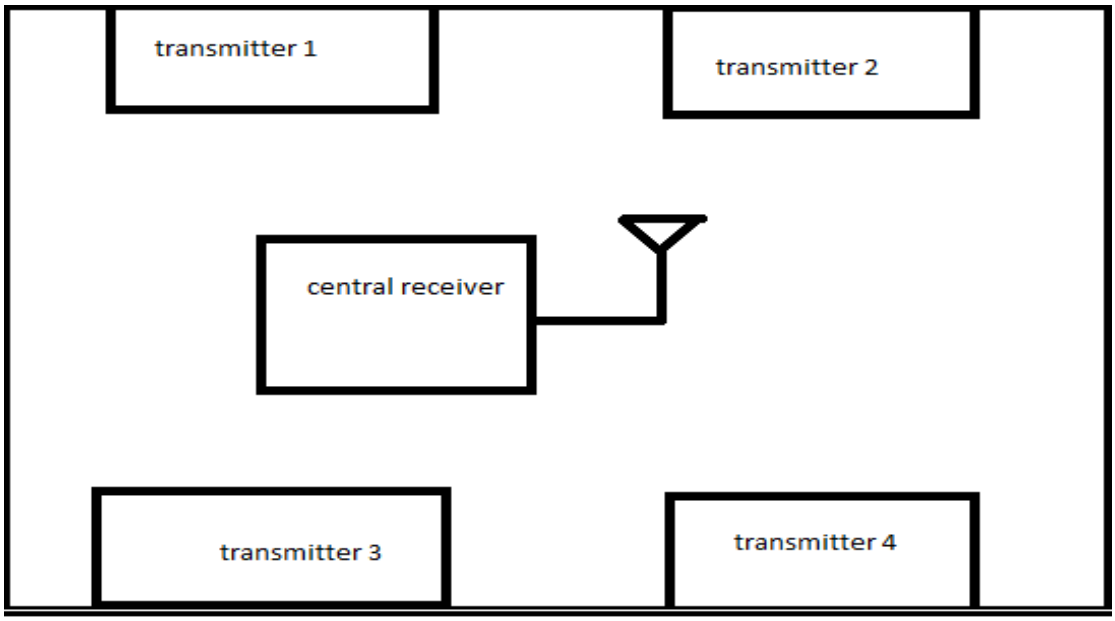

Figure 1: Overview of TMPS Transmitter and Central Receiver Unit [2]

The tire pressure monitoring system developed by ATmega16 AVR microcontroller, HS-05 Bluetooth module, LM35 temperature sensor, and MPX2202 pressure sensor. To designing tire pressure monitoring system size of the system and power consumption are the major issues.

2.1 Transmitter Unit

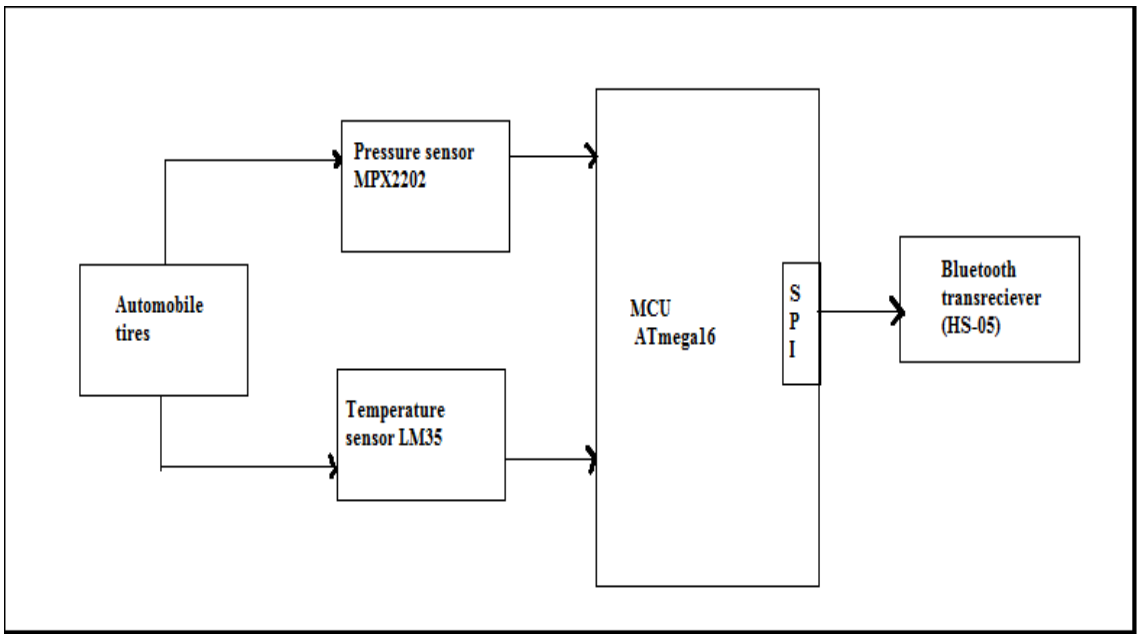

Figure 2: Transmitter Unit of TPMS

Above fig2 shows transmitter unit of TPMS in which pressure sensor (MPX2202) and temperature sensor (LM35), Bluetooth transceiver (HS-05) and microcontroller unit (ATmega16) are used for observing and maintaining the tire of vehicle. MCU is most important system; it receives pressure from pressure sensor and temperature from temperature sensor and sends this signal via Bluetooth (HS-05) to host.

2.1.1 Sensors

In this system MPX2202 is used for pressure measurement.MPX2202 is a silicon piezoresistive pressure sensor providing highly accurate and linear voltage output directly proportional to the applied pressure. The sensor is a single, monolithic silicon diaphragm with the strain gauge and a thin-film resistor network integrated on chip. The chip can measure tire pressure up to 200pka and is temperature compensated over $0\ ^0$C to 85^0 C [2] [3].

In this system LM35 series is used, which is low cost and precision integrated circuit temperature sensor whose output voltage is proportional to centigrade temperature scale. It is produced by national semiconductor and can operate over -55^0C to 150^0C temperature range. Its output is linearly proportional to centigrade temperature scale and it output changes by 10mV per ^{0}C.

2.1.2 Microcontroller Unit

In this system ATmega16 microcontroller unit is used. The AVR is a low power, high performance CMOS 8 bit microcontroller with 4Kbytes of flash programmable and erasable read only memory (PEROM). It supports Serial Peripheral Interface (SPI) protocol. Also it has in built ADC. This in built analog to digital converter (ADC) converts the analog voltage coming from sensors to its equivalent digital value.

2.1.3 Bluetooth Module HC-05

In this system we interface HC-05 bluetooth module with AVR ATmega16 microcontroller. The communication between HC-05 bluetooth module and ATmega16 microcontroller takes place through UART serial communication protocol. The ATmega16 microcontroller will send the string to the Bluetooth module. The Bluetooth module transmits the received strings to the android mobile. And android mobile displays the received strings.

2.2 Receiver Unit

Receiver unit consists Bluetooth module, MCU, LCD display, android mobile.

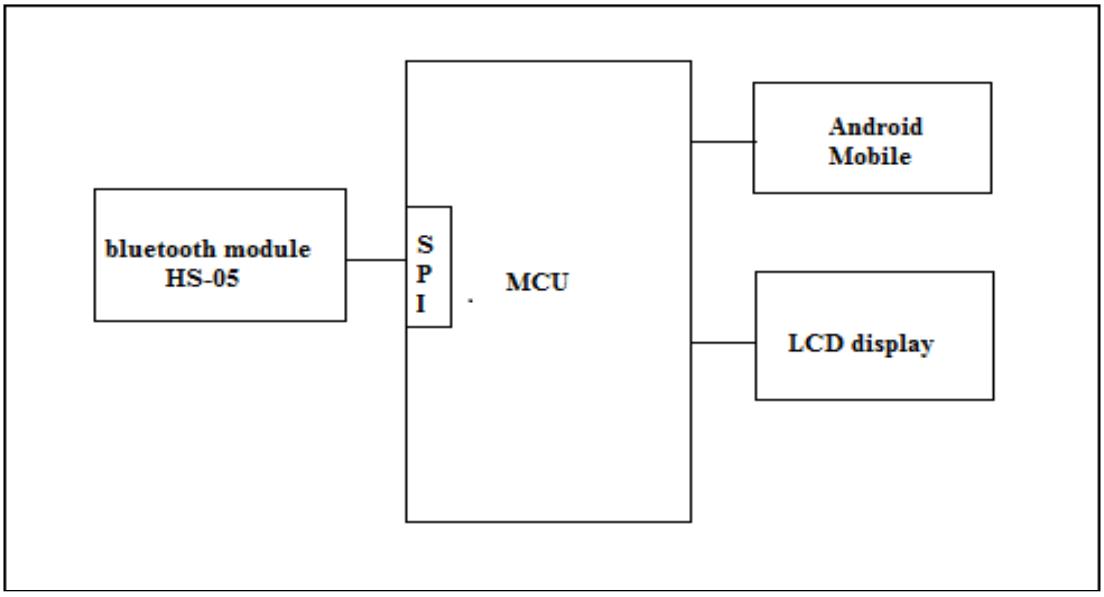

Figure 3: Receiver Unit of TPMS

2.2.1 LCD Display

A liquid crystal display (LCD) is a thin, flat electronics visual display that uses the light modulating properties of liquid crystals. LCD is used to provide textual information from microcontroller. the basic function of the LCD is to display the action performed by the microcontroller. the LCD used here is 16x2 character LCD display. A 16x2 LCD means it can

display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two register, namely, command and data.

2.2.2 Android Mobile

android is a mobile operating system (OS) currently developed by google, based on linux kernel and designed primarily for touch screen mobile devices such as smart phones and tables

3. CONCLUSION

Implementation of tire pressure monitoring system using SPI reduces the components required to developed system and using Bluetooth it is possible to see parameter on android Smartphone. Also Monitoring and maintaining proper tire pressure increases driver safety and improves vehicles performance in a number of ways. Properly inflated tires improve handling, decrease tire wear, reduce breaking distance, and improve fuel economy.

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