ISSN: 2278 – 7798
International Journal of Science, Engineering and Technology Research (IJSETR)
Volume 5, Issue 7, July 2016

INTELLIGENT TIRE PRESSURE MONITORING SYSTEM BASED ON ANDROID

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Abstract: **Today millions of vehicles are running on the road everyday with very high speed. So the safety is very major issue for this vehicles driver. Many more accidents are happen due to the tire bursting. Tire burst because of low pressure or high tire temperature. To avoid this we must use tire pressure and temperature monitoring system. Because of tire is very important part of the vehicle which always moving and balancing the vehicle. Also because of low tire pressure it affects fuel economy, co_2 emission, lost balance of vehicle. In this system we are going to use pressure and temperature sensors those are connected with microcontroller. Microcontroller processes the given data and transmits via Bluetooth on android smart phone and dashboard.**

Index term: **AVR ATmega16, Bluetooth HS-05, LM35, MPXM2202, android.**

I. INTRODUCTION

In this Tire pressure monitoring system (TPMS) [4] it gives alert if the tire pressure is above or below the normal pressure value. In this system we are going to use Liquid Crystal Display (LCD), Light Emitting Diode (LED), [4] and a android smart phone, to show the result of the system. Instead of any wireless technology here we use Bluetooth [21] module HS-05 in this system. Bluetooth is the transmission tool between the controller and the smart phone. Bluetooth is embedded in all kind of smart phones and it can work in the absence of the Wi-Fi connections [9]. Smart phones are the programmable tools to have different kinds of applications that allow communicating with other devices and also gathering, analyzing and verifying data [9]. The sensor here we use are pressure sensor (MPXM2202) and Temperature sensor (LM35) [4] [12] [19]. These sensors are located inside each tire of the vehicle, because each tire required same pressure to maintain the balance of vehicle.

There are two types of TPMS system as, direct TPMS and indirect TPMS. Here we are using direct TPMS because it can measure accurate pressure of tire and gives update to the driver time to time. As compare to indirect TPMS direct TPMS is having accurate result [4].

this paper studies shows that the low tire pressure or high tire pressure is very dangerous. This under inflation causes excessive tire heat built up and also damage internal structure of tire. Over inflation may cause tire puncture or broken by sudden impact. Both these situations are very dangerous for vehicle and driver safety purpose. When if tire pressure is not proper it will get burst, this sudden bursting may causes on road accidents which is very serious and dangerous issue in a automobile sector. Also when the tire pressure is not proper or low will cause fuel economy, co_2 emission, and reduces the performance of vehicle. So avoid all this we have to study wireless tire pressure monitoring system [12].

II. SYSTEM OVERVIEW

Overall tire pressure monitoring system is shown in the following block diagram. The given system here is direct TPMS [12]. This system having two parts one is transmitter and another is receiver. For the real time sensing of the exact pressure and temperature inside the tire, the sensing devices are located inside each tire of the vehicle [12]. The measured information of tire pressure and temperature is display on the dashboard of the car and also on the smart phone of the driver. The power supply to the given system is 5v.

Here in the transmitter unit we use pressure sensor to sense the pressure of the tire, temperature sensor to sense the temperature of the tire, controller unit to process the upcoming data and transmit it over Bluetooth module, Bluetooth module to communicate wirelessly with the receiver unit. And the receiver unit having Bluetooth module which accept the data from transmitter unit and send it to the AVR controller, microcontroller it can analyze the data and show the result on the output devices. Display devices LCD and smart phone are the display devices to show the output to the driver. LED indicator warn the driver by glowing LEDs [22].

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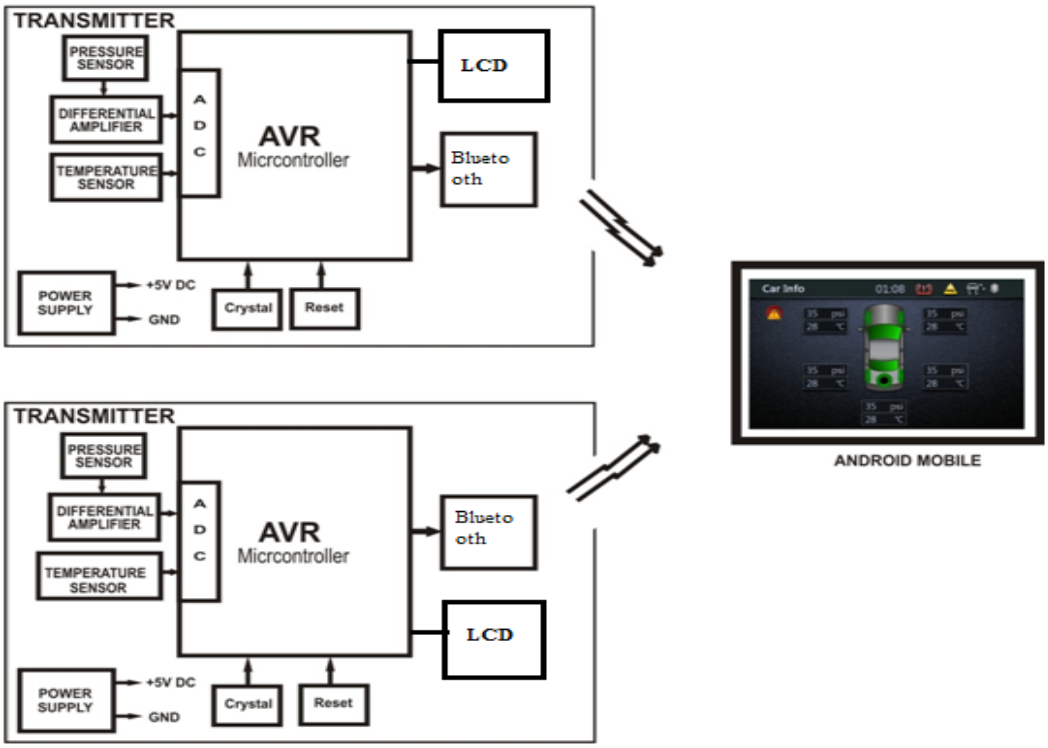

Figure 1: block diagram of tire pressure monitoring system

A. Pressure Sensor

The MPXM2202 device is a silicon piezoresistive pressure sensor providing a highly accurate and linear voltage output which is 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 is laser trimmed for precise span and offset calibration and temperature compensation.

B. Temperature Sensor

The LM35 series are precision integrated circuit temperature sensor, whose output voltage is linearly proportional to the Celsius (centigrade) temperature. The LM35 thus has an advantage over linear temperature sensor calibrated in ^{0} kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of $^+_-1/4^0$c at room temperature and $^+_-3/4^0$c over a full -55 to +150^{0}c temperature range. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supply, or with plus and minus supply. As it draws only 60µA from its supply, it has very low self-heating, less than 0.1^{0}c in still air.

C. Microcontroller

AVR ATmega16 microcontroller is used in this system. the AVR is a low power, high performance CMOS 8bit microcontroller with 4Kbytes of flash programmable and erasable read only memory (PEROM).It has in built analog to digital convertor. This inbuilt analog to digital converter (ADC) concerts the analog voltage coming from sensors to its equivalent digital value. The device is manufactured using Atmel's high density nonvolatile memory technology and is compatible with the industry standard MCS-51 instruction set and pinout. The on chip flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8 bit CPU with flash on a monolithic chip, the Atmel AVR is a powerful microcomputer which provides a highly flexible and cost effective solution to many embedded control applications.

D. Bluetooth Module

In this system we use HS-05 Bluetooth module for transmitting the data to mobile. These small size Bluetooth TTL transceiver modules are designed for serial communication (SPP- serial port profile). It allows target device to send or receive TTL data via Bluetooth technology without connecting a serial cable to your computer. This Bluetooth module interfacing with USART(Universal Synchronous Asynchronous Receiver Transmitter). It has transceiver range upto 10meters. Its temperature range is between -20^{0}c to +55^{0}c. Power supply required to this Bluetooth module is +3.3v dc 50mA. Rate of transmission and receiver is 2.1Mbps.

E. Dashboard

LED indicator and LCD display can be interfaced with the microcontroller along with android smart phone in

order to alert the driver. Wherever the values of pressure and temperature changed it will display on LCD as well as on mobile screen which is connected via Bluetooth to the system. When pressure become low the red LED indicator turn on, when pressure is normal green LED always on and when pressure is above the given range again red LED turn on.

III. SOFTWARE IMPLEMENTATION

AVR Studio

AVR studio is a development tool for the AT90s series of microcontroller. AVR studio enables the user to fully control execution of program of program on the AT90S. In- Circuit Emulator or on the build in AVR Instruction set simulator. AVR studio supports source level execution of assembly program assembled with the Atmel Corporation's AVR assemble and C programs compiled with IAR system's ICCA90 C complier for the microcontroller. AVR studio runs under Microsoft Windows95 and Microsoft Windows NT.

Steps to download the program in ATmega16 using AVR studio

- Insert the diskette in drive
- Press the start button on the Taskbar and select run
- Enter "A:SETUP" in the open field and press OK button
- Follow the instructions in the setup program

Steps we are using for Coding

– Start the AVR studio

Start-> program-> ATMEL AVR Tools-> AVR studio 4

– Create new project
– Choose Atmel AVR Assembler
– Type project and initial file name
– Choose the project location
– Create proper file in assembler
– Building the project
– Start debugging the code
– Save the project

IV. RESULT

Result on LCD display

Figure shows the transmitter and receiver is successfully connected and temperature and pressure readings are successfully display on the dashboard receiver.

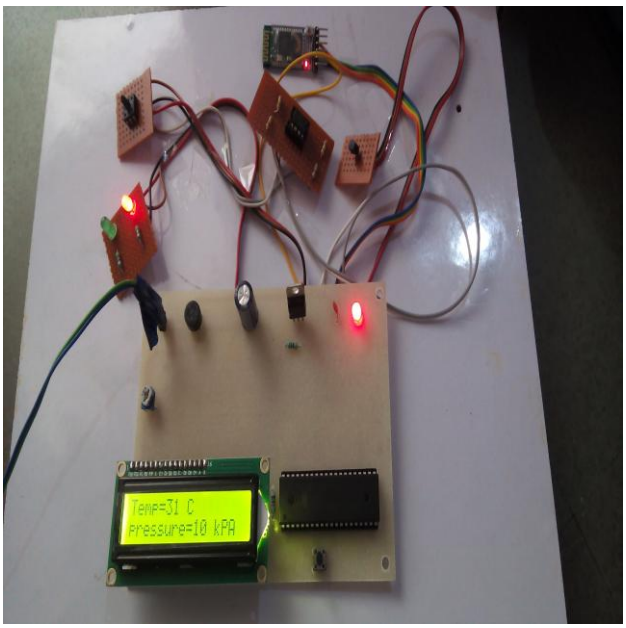

Figure 2: when tire pressure reduced then red LED on

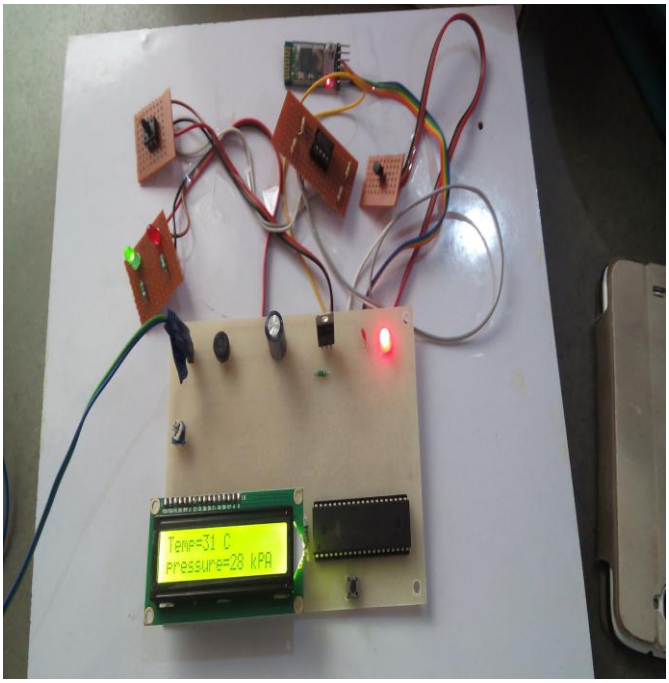

Figure 3: when tire pressure normal the green LED on

Above figure shows the result on LCD display

Result on Android Mobile

Figure shows that the bluetooth connected successfully and values of temperature and pressure's are display successfully on mobile screen.

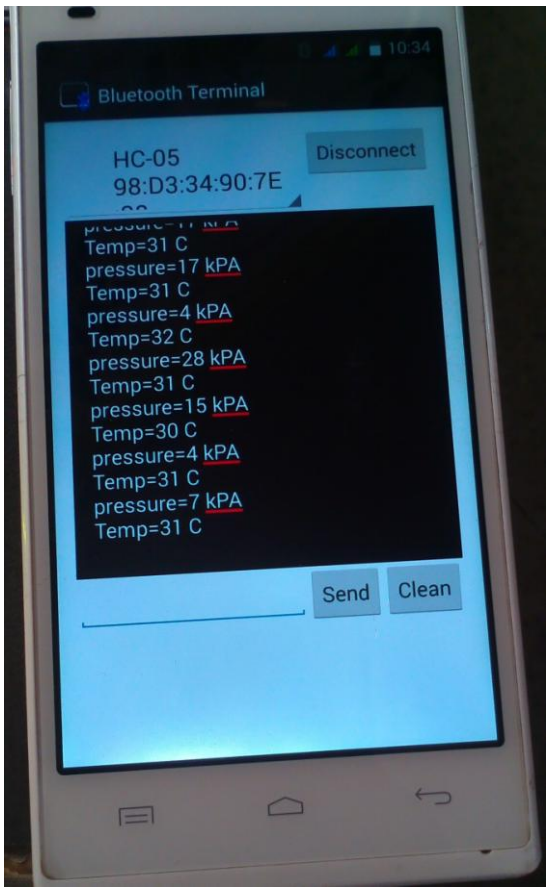

Figure 4: Information received on mobile through Bluetooth

V. CONCLUSION

Implementation of tire pressure monitoring system using ATmega16 microcontroller reduces the component required to develop the system and using the Bluetooth it is possible to see the result on android smart phone.

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