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Wi-Fi Tyre Pressure and Temperature Monitoring and Alert System

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Abstract-*The current process involves various shortcomings which includes manual labor, high chances of casualties, more time consumptions. This invention aims to monitor the tyre pressure in real time and alerting the user on its registered device about the drop in pressure, this invention provides individual tyre pressure details and alerting the user about the same, which in turn helps preventing various fatal accidents as well as damage to the vehicle. The sensor interacts with the tyre providing us with the real time data and excluding the manual implementation of the tyres. Along with the prevention of accidents it also keeps the user up to date with the tyre pressure irrespective whether the vehicle is being used or not, which comes in handy for preparing the vehicle for the future usage. This invention also displays the individual tyre pressure in various pressure measurement units such as bar, Psi, mmHg, etc. This invention also has a feature of turning the ignition of preventing further movement of the vehicle provided if the tyre pressure falls below a certain predetermined threshold limit.*

Key Words*: *Tyre, IOT, Pressure, Temperature, Artificial intelligence

1. Introduction

The proposed invention focuses on checking the tyre pressure in order to maintain it within the required specifications mentioned by the manufacturer, important for good performance and preventing sudden failure of tyres such as tyre bursting causing damage to the vehicle or in worst case scenario loss of control. This automated tyre pressure measurment will be carried on by a sensing device attached inside the rim of the wheel, giving the pressure measurments to the microcontroller and wifi . Usage of wifi is in order to notify the driver if there is a need to refill the as low pressure can be catastrophic. Under normal circumstances manual inspection is still prevalent but it is very time consuming and the driver also has to make sure of periodic checking and refilling of tyres in order to maintain pressure. The proposed invention will certainly save a lot of time as there is no need to go for a manual inspection making the current system obsolete, it also relieves the driver from having to worry about the periodic checking of tyres. Other major drawback of manual refilling is the human error which in many cases might leave the tyre under pressure or over pressure which could again cause the problems for the driver.

2. Working of the Invention

2.1 Detailed Description of the Invention

The main components such as data acquisition, a chip integrated with microcontroller and Wi-Fi dongle, a central chip integrated with microcontroller and Wi-Fi module, a Relay and output display device (User's device).

The data acquisition is taken out by a pressure and temperature sensor (For E.g. BMP280) which is integrated with the inner curved surface of the rim inside the tyre. This pressure sensor collects real time data of the tyre pressure.

Here's some detailed information about the component to enhance our understanding on the reasons behind why it is used, BMP280 comes with a smaller footprint, lower power consumption, lower noise management, higher resolutions for pressure and temperature, lower RMS noise, newly added interface 25 SPI, more measuring modes, higher measuring rate and newly added filter against environmental interference.

The setup including a Pressure and Temperature sensor, integrated micro controller with Wi-Fi module, battery and Thermo Electric charger is attached to the curved surface of the rim inside the tyre, Where the data acquisition of the real time tyre pressure and temperature takes place.

Once this data is acquired by the Pressure and Temperature sensor [1] (For E.g. BMP280), this sensor is then connected to an integrated chip of microcontroller and a Wi-Fi module which records and transmits the recorded real time data further in the circuit. This chip is NODEMCU(ESP8266), which is said to be the heart of the present invention.

This microcontroller is mainly used because it supports RTOS and operates to 80 MHz to 160 MHz adjustable clock frequency, NODEMCU has 128 KB RAM and 4MB of flash memory to store data and programs. It has high processing power with inbuilt Wi-Fi. This chip will be set up with a program which will involve the description of pre-determined threshold limits.

The whole set up the Pressure and Temperature sensor and Wi-Fi module is connected to a battery whose charging is

facilitated by the Thermo Electric charger attached to it. The Wi-Fi module ill then transmits the data to the screen of Phone Application device.

Another function of this setup is to send an alert notification to the Phone Application device, when the real time tyre pressure drops the upper reference threshold (For E.g. 24 Psi).

The Central Wi-Fi module is also an integrated chip with micro-controller and the Wi-Fi module, this integrated chip which in turn is connected to the Relay [2]. When the Real time pressure drops the cut-off reference threshold (For E.g. 18), the relay will cut off the ignition prohibiting further movement of the vehicle.

The setup of Temperature and Pressure sensor, Wi-Fi module, battery and the Thermo Electric charger, is attached to the inner curved surface of the rim, inside the individual tyre of the vehicle and the setup of Central Wi-Fi module and Relay works in harmony to provide us with the desired output on the Phone Application device.

2.2 Arduino R3 Code [3]

The following written code in Arduino IDE for sensor unit:

```
#define BLYNK_PRINT Serial
#include <SPI.h>
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#include <Adafruit_Sensor.h>
#include <Adafruit_BMP280.h>
#include <Wire.h>
#define BMP_SCK
#define BMP_MISO
#define BMP_MOSI
#define BMP_CS
BlynkTimer timer Adafruit_BMP280 bmp
char auth[] = "xxxx";
char ssid[] = "yyyy";
int flag=0;
void sendSensor()
{float p = bmp.readPressure()/6895;
float t = bmp.readTemperature();  {
Serial.println("Failed to read from BMP sensor!"); return; }
Blynk.virtualWrite(V5, p);
Blynk.virtualWrite(V6, t);
}
void notifyOnButtonPress(){
if ((bmp.readPressure()/6895)<105 && flag==0)
{ Serial.println("Air pressure in the tyre is low!");
  Blynk.notify("Air pressure in the tyre is low!");
  flag=1; }
else if ((bmp.readPressure()/6895)>105)
{ flag=0; } }
void setup(){
bmp.begin(); //
Blynk.begin(auth, ssid, pass);
Serial.println(F("BMP280 test"));
if (!bmp.begin(0x76))
{ Serial.println(F("Could not find a valid BMP280 sensor, check wiring!"));
while (1); }
bmp.setSampling(Adafruit_BMP280::MODE_NORMAL,
Adafruit_BMP280::SAMPLING_X2,
Adafruit_BMP280::SAMPLING_X16,
Adafruit_BMP280::FILTER_X16,
Adafruit_BMP280::STANDBY_MS_500);
timer.setInterval(1000L, sendSensor);}
void loop()]{
Serial.print(F("Temperature = "));
Serial.print(bmp.readTemperature());
Serial.println(" *C");
Serial.print(F("Pressure = "));
Serial.print(bmp.readPressure()/6895);
Serial.println(" Psi");
Serial.println();
delay(2000);
Blynk.run();
timer.run();}
```

The following written code in Arduino IDE for relay unit:

```
#define BLYNK_PRINT Serial
#include <SoftwareSerial.h>
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#define relay D4
char auth[] = "xBnVGal9zhw_cR3HKjfWgJUQTTt6TnlH";
char ssid[] = "Pranshii";
char pass[] = "pranshi20";
BLYNK_WRITE(V0)
{
int pinValue = param.asInt(); if (pinValue == 1) {
const byte RelayON[] = {0xA0, 0x01, 0x01, 0xA2};
Serial.write(RelayON, sizeof(RelayON));
}
else {
const byte RelayOFF[] = {0xA0, 0x01, 0x00, 0xA1};
Serial.write(RelayOFF, sizeof(RelayOFF)); } }
void setup(){ Serial.begin(9600);
Blynk.begin(auth, ssid, pass);} void loop(){
Blynk.run(); }
```

3. Description of Drawings:

Figure 1 shows a block diagram for this invention in which all the components are represented Pictorially detecting the flow for the current invention. This figure includes components labelled in the following sequence as rim, Pressure and Temperature sensor, Wi-Fi module, battery, Thermo electric charger, Central Wi-Fi module, Relay, Ignition Circuit and Phone Application device, battery.

The whole setup including Pressure and Temperature Sensor, Wi-Fi Module, Battery and Thermal Electric Charger are attached to individual rim of the vehicle. The tire pressure and temperature are collected by the Temperature and Pressure sensor attached to the rim.

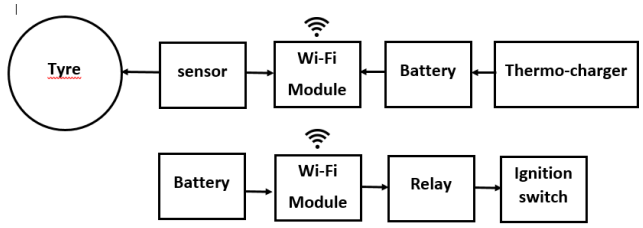

Figure 1 Block Diagram

The primary function of this setup is to monitor the real time pressure and temperature, of the individual tire with the help of the Pressure and Temperature and send an alert to the Phone Application Device with the help of the Wi-Fi Module, if the real time pressure drops below the upper limit of reference threshold (For E.g. 20 PSI).

Another setup including the Central Wi-Fi module, Relay and the ignition Circuit is setup within a certain proximity of the vehicle. Its primary function is to cut off the ignition when the real time pressure reaches the cut off reference threshold (For eg.10 PSI).

The entire setup attached the rim runs on a battery and this battery is connected to a Thermo-Electric Charger, this charger facilitates the charging of the battery in order to maintain the perpetuity of the Pressure and Temperature 30 sensor and the Wi-Fi Module.

The data is collected by the Pressure and Temperature measuring sensor in real time, which is further transmitted in the circuit. This data of the tire's temperature and pressure in real time is transmitted further with the help of a Wi35 Fi Module, this data is transmitted to the Phone Application Device.

The data displayed on the Phone Application Device reflects the real time pressure and temperature of the tire, keeping the user up to date with the state of the tire.

The data transmitted from the Wi-Fi Module to the Phone Application Device, is monitored and if the real time pressure drops below the upper limit of the reference threshold (For E.g. 20 PSI) an alert notification is sent on the Phone Application Device, indicating the low tire pressure.

If the tire pressure drops below the Cut-Off reference threshold the Central Wi-Fi module receives the data and the relay attached to it cuts off the ignition preventing the vehicle to move forward.

Figure 2 shows the circuit diagram of the current invention whose components including Temperature and Pressure sensor, Wi-Fi Module, Battery, Thermo Electric Charger, Central Wi-Fi module, Relay, Ignition Circuit, Phone Application Device and battery works in harmony to help us achieve the goal.

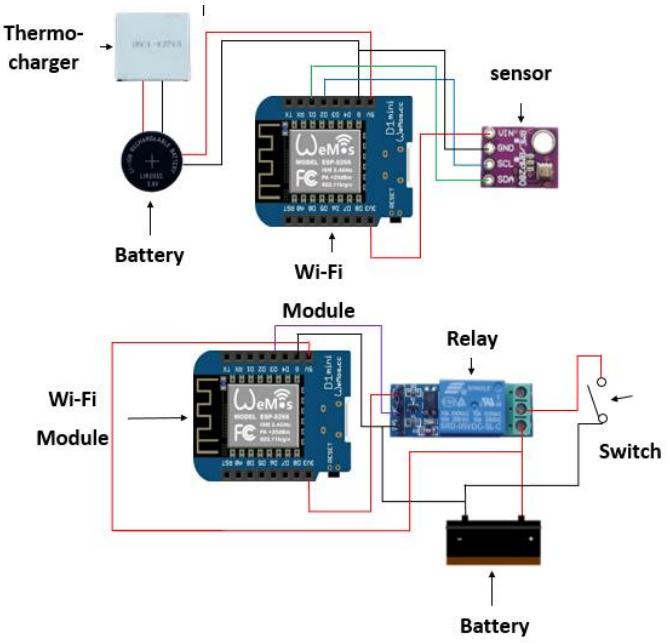

Figure 2 Circuit Diagram

In the circuit diagram the connections of the Pressure and Temperature sensor and the Wi-Fi Module are as follows, the VIN port of Pressure and Temperature sensor is connected to the 3.3 V port of the Wi-Fi Module with a red wire. The GND port of the Pressure and Temperature sensor is connected to the GND port of Wi-Fi module with the help of a black wire. The SCL port on the Pressure and Temperature sensor is connected to the Digital port D2 on the Wi-Fi Module with the help of a blue wire. The SDA port on the Pressure and Temperature sensor is connected to Digital port D1 on Wi-Fi Module with green wire.

Further the negative terminal of the battery is connected to the GND port of the Wi-Fi Module with a black wire. The positive terminal of the battery is connected to the 5V port of the Wi-Fi Module. The negative terminal of the battery is connected to the negative of the Thermo Electric Charger with a black wire and the positive terminal of the battery is connected to the positive terminal of the Thermo Electric Charger with a red wire.

he Phone Application Device displays the real time pressure and temperature with the help of the data received by the Wi-Fi Module, sent wirelessly. The data is father monitored and if the real time pressure drops below an upper limit reference threshold an alert notification will be sent to the Phone Application Device.

Another set up including the Central Wi-Fi module, Relay and the ignition Circuit is placed in the proximity of the earlier mentioned set up of the Pressure and temperature sensor, Wi-Fi Module, Battery and Thermo Electric chargers attached to the inner surface of the rim on each wheel of the vehicle.

The function of the setup with Central Wi-Fi module, Relay is to cut off the ignition Circuit, to stop the further movement of the vehicle if the real time pressure drops the cut-off reference threshold.

The connections of the Central Wi-Fi module with the relay are as follows the Signal port in Relay is connected to the 5V port of the Central Wi-Fi module with the red wire. The 5V VCC port on the Relay is connected to the Digital port D3 of the Central Wi-Fi module with a purple wire. The GND port of the Relay is connected with the GND port of the Central Wi-Fi module with a black wire. The GND port of the Relay and the Central Wi-Fi module, is connected to the negative terminal of the Battery with a black 5 wire. The NC port of the Relay is connected to the 5V port of the Central Wi-Fi 33 modules and the positive terminal of the battery with a red wire. The COM port of the Relay is connected to the ignition Circuit with a red wire. The negative terminal of the batter (, is connected to the ignition Circuit with a black wire.

4. CONCLUSIONS

It has been proposed to automate tyre pressure measurement by including a sensing device in a wheel which can then be interrogated wirelessly to provide a measurement of tyre pressure. This can reduce the time required compared to a manual reading, but can still take time due to a requirement to travel from wheel to wheel measuring the pressures. Ensuring that the tyre pressure indicated by any automated measurement is accurate and/or reliable is also important. This is not just that the measurement is accurate, but also that the display itself shows an accurate representation of the pressure. This becomes more important when using wireless interface because of the increased possibility for the display to be corrupted, perhaps from malfunction or malicious software on a display device.

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