A Project Report on

Design,Analysis and Fabrication of Tyre Pressure Controlling System

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'येथे बहुतांचे हित ।'

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C E R T I F I C A T E

This is to certify that following studends have successfully completed the project-II entitled '**Design,Analysis and Fabrication of Tyre Pressure Controlling System**' under my supervision, in the partial fulfillment of Bachelor of Engineering - Mechanical Engineering of Savitribai Phule Pune University.

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We take this opportunity here to thank all those who had helped us in making this project a reality.

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ABSTRACT

As per the Ministry of Road Transport and Highways, India, in the past 5 Years 35-40% of accidents on highways are due to tyre bursts.

According to American Automobile Association (AAA), about 80 percent of the cars on the road are driving with one or more tires under inflated. Tyres lose air through normal driving (especially after hitting pot holes) seasonal changes in temperature. AAA statistics show that tyres that are under inflated by as little as 2 psi reduce fuel efficiency by 10 percent.

The tyre must be inflate properly in appropriate pressure in order to obtain a good vehicle performance , handling, mileage, as well as to maintain a good life span of tyre. Due to improper inflation of tyre it causes the rapid wear & tear of tyre which reduces its life span. Hence to obtain the good performance, handling & good mileage it is required to inflate tyre in desired pressure, in different operating conditions as well as temperature.

The aim of this project is to develop and design an Automatic and wireless tyre inflation system that permits the vehicle to adjust the tyre pressure to desired optimum values at critical times and avoid accidents at all times due to punctures. This is a life safeguard pre-warning system that works on Bluetooth which is activated as soon as the tyre pressure falls below the threshold level.

Earlier, TPMS was used to monitor and measure the tyre pressure using Arduino Uno and a wired Barometric sensor, along with LCD. The alert worked on buzzing sound by warning the driver.

With proper execution, this can become a highly successful commercial product. It provides much better and cost effective reliability over TPMS. Since pressure is maintained constant at all times, tyres' efficiency is fully utilised leading to better fuel consumption.

Chapter 1
INTRODUCTION

1.1 INTRODUCTION

According to American Automobile Association (AAA), about 80 percent of the cars on the road are driving with one or more tires under inflated. Tyres lose air through normal driving (especially after hitting pot holes) seasonal changes in temperature. AAA statistics show that tyres that are under inflated by as little as 2 psi reduce fuel efficiency by 10 percent.

The tyre must be inflate properly in appropriate pressure in order to obtain a good vehicle performance , handling, mileage, as well as to maintain a good life span of tyre. Due to improper inflation of tyre it causes the rapid wear & tear of tyre which reduces its life span. Hence to obtain the good performance, handling & good mileage it is required to inflate tyre in desired pressure, in different operating conditions as well as temperature. To eliminate such troubles we designed the tyre inflation system to deliver the air pressure in the tyre when pressure drops. The tyre is inflated even in running of a vehicle.

The main beneficiaries of this advancement in technology that will allow for tyre pressure to be adjusted for driving conditions will be the vehicle owners. Despite an initial investment in the technology, they will experience a reduction in tire wear and an increase in fuel economy; both of which will result in saving money in the long run.

It is acceptable to say that society as a whole will benefit from the resulting design. The reduction in tyre disposal in landfills and decrease the rate of consumption of natural resources will truly benefit society. Also, the improvement in vehicle safety will benefit all people who drive a vehicle on the roadways.

Compressor is used in this system to collect the air from atmosphere, compress it and deliver to the tire for inflation. Under inflated tires tend to wear at the edges more than at the center as the pressure is not sufficient at the center to bear the load. As against this for over inflated tires wear is higher at the center due to bulging of tires. Wearing of the threads causes the skidding of the tire hence leads to major danger accidents. All of related studies shows that under inflation from axle tires result in under steer tendencies while rear axle under inflation creates over steer behavior hence disturbing the car handling.

This system is addressed to be automatic as it automatically checks the tire pressure by using pressure gauge and if tire pressure is decreased below ideal condition than the compressor starts to supply the air to refill the tire. It also predicts about the puncture when there is continuous reduction of its set optimal value. The advantage of the system is that it does not require any special attention from user side once after the system being installed. It discards the requirement of checking tire pressure manually, thus saving time and labor.

With the recent oil price hikes and ever increasing environmental issues, the system addresses a potential development in a gas mileage, tire wear reduction, and an improvement in handling and tire performance in adverse condition.

This kind of systems are all- ready being installed in military vehicles and commercial cars for safety purpose and to feel the luxury driving but this system is being introduced for all types of customer vehicles with the absolute motive to give safety assurance and comfort driving.

Now with the installation of this system one can drive vehicle under all worst sudden varying environmental conditions like heavy rainfall, snowfall, deserts. Specially at remote places this kind of system proves to be most helpful as repairing devices for maintenance of the automobile are very critically available .At some crucial times like war conditions or any flood condition there is no time to refill the tire with air hence Automatic tire controlling and self- inflating tire system is very essential to be encouraged to install in every automobile to face all tire related issues and enjoy safe and comfort driving.

1.2 PROBLEM STATEMENT

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As we are aware that maintenance of correct tyre pressure is extremely important for the enhancement of tyre life. Due to drop in the pressure the tyre goes underinflated and reduces fuel economy, quickest tyre wear, not proper rolling, discomfort ride etc. So to solve out all these problems we make an **Tyre Pressure Cotrolling system**, which will properly inflate the tyre all the times

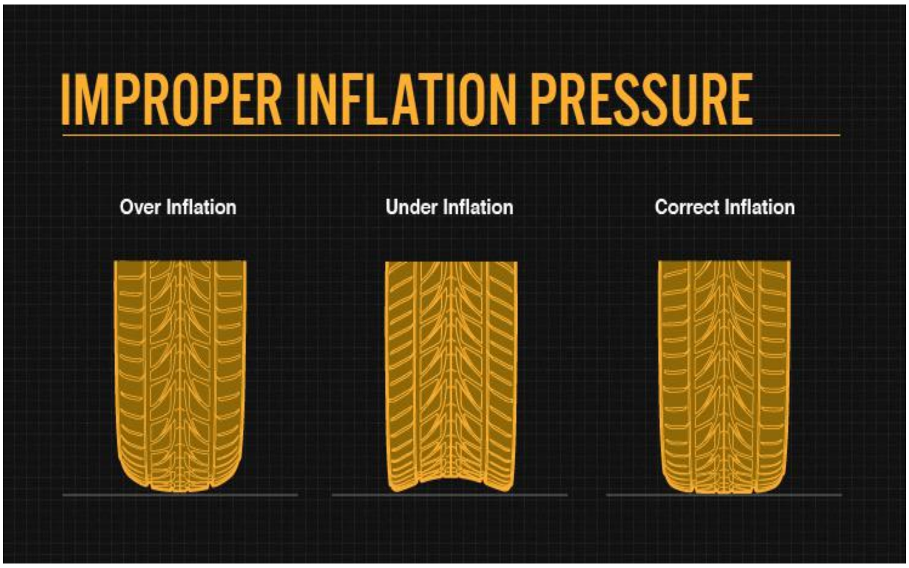


Fig 1.2.1 : Problem due to improper inflation

Table 1.2.1 : Problem arises due to under-inflation and over-inflation

Sr. No.	Problem Cause	Problem Cause
1	Shoulder Wear: Both Shoulders wearing faster than the center of the tread	Underinflation
2	Diagonal wear: A part of the tread are wearing diagonally faster than other parts.	Underinflation
3	Centre Wear: The center of the tread is wearing faster than the shoulder.	Overinflation

CHAPTER 2
LITERATURE REVIEW

2.1 LITERATURE REVIEW

Vishweshver J.,et al. in their paper described about design proposes and successfully implements the use of a portable compressor that will supply air to all four tyres via hoses and a rotary joint fixed between the wheel spindle and wheel hub at each wheel.[1]

Sudarshan Bhalshankar in his paper descibed about design and fabricate of system which ensures that tyres are properly filled at all times. With help of pressure switch K35,portable compressor that will supply air to all tyres via hoses and a rotary joint fixed between the wheel spindle and wheel hub at each wheel.[2]

Lukman Medriavin, et al. in their paper stated about the design a method to integrate a TPMS and a Pressure Sensor Base (PSB) with a particular reaction required to fulfill tires automatically. The proposed TPMS has an electronic device unit directly attached to a tyres valve. This unit includes pressure sensors, microcontrollers, Bluetooth transmitters and batteries.[3]

R.P.Bachute, et al. in their paper stated about development of an Automatic Air Inflation in Vehicle Tyre.Main aim of this project is that when the air is decreased to the automobile vehicles then the sensor signal alert the person for usage of air tank to fill the air in the tyre. Then the air pressure will get increased in the tyre of the vehicle & it is same as the process of indicating the sensor signal through the person using solenoid valve to reduce the excess air in the tyre.[4]

Misba Inamdar, et al. in their paper desciebed about detailed survey which has come with result that drop-in tire pressure by just few psi leads to the reduction in gas mileage, tire life, safe driving and vehicle performance. Unawareness of exact pressure requirement, sudden environmental changes are also some of causes for tire running with improper pressure.[5]

Prathamesh Salvi, et al.in their paper described about development of automatic and self-inflated Tyre system for stabilization of air in Tyres that ensures that Tyres are properly inflated all the times. This concept is based on the use of nozzle which helps to increase air thrust to overcome internal pressure of tyre , to regulate and maintain the Tyre pressure in running condition[5]

Apurav Hinge and Puspendra Upadhyay, in their paper stated about a review study on self inflated tyre system. The main aim of the author in this research paper is to spread and incorporate this technology in all public vehicles which was only present in commercial and military vehicles as of now.[6]

Kamlesh R. et al. in their paper described about a design of a Self Inflating Tyre (SIT) System which is the combination of Electronic Engineering i.e Electronic Control Unit (ECU) & Mechanical Engineering i.e. Pneumatic Control Unit (PCU). SIT properly inflated the tyre pressure; therefore it's improving the tyre life. SIT is designed for the slow leakages and small punctures.[7]

Indrajeet Burase, et al. in their paper stated about performance of research survey and concluded that the dynamically self inflating tire system would be capable of succeeding as a new product in the automotive supplier industry.[8]

N. Dinesh, et al. in their paper described about the development of an automatic, self-inflating tire system. Such a system ensures that tires are properly inflated at all times and project design is successfully tested and implemented with the help of centralized compressor. The compressor will supply air to all four tires via hoses and a rotary joint fixed between the wheel spindle and wheel hub at each wheel.[9]

Ajay B. Patekar, et al. in their paper described about design and successfully implements the use of a portable compressor that will supply air to all four tyres by using hoses and a rotary joint fixed between the wheel spindle and wheel hub at each wheel. The rotary joint is used to allow compressed air channeled through hoses without tangling them.[10]

Sivaraosa, et al. in their paper descibed about design of a model to mathematically derive the critical amount of required pressurized air for ATIS intermediary chamber design. Finite element analysis was also performed onto the designed chamber considering critical engineering elements to ensure safe operation with the pressure of 8449kPa. ATIS is postulated to automatically replenish adequate amount of pressurized air into the tyre when the tyre pressure drops 10% below the desired pressure. [11]

Indrajeet Burase, et al. in their paper stated about their study show that a drop in tyre pressure by just a few PSI can result in the reduction of gas mileage, tire life, safety, and vehicle performance, we have developed an automatic, self-inflating tire system that ensures that tyres are properly inflated at all times[12]

Ryosuke Matsuzaki and Akira Todoroki,in their paper discussed key technologies of intelligent tires focusing on sensors and wireless data transmission. Intelligent automobile tires, which monitor their pressure, deformation, wheel loading, friction, or tread wear, are expected to improve the reliability of tires and tire control systems. However, in installing sensors in a tire, many problems have to be considered, such as compatibility of the sensors with tire rubber, wireless transmission, and battery installments[13]

Dheeraj Kumar, et al. in their paper described about design and develop a tire pressure monitoring system which monitors the vehicle tire pressure and thus provide air pressure and temperature data to the driver through LCD display.[14]

Mrs.V.Sundarajayalakshmi, et al. in their paper described about method to implement tyre pressure monitoring and accident avoiding system in vehicles. At exceptional state to ensure the safety of driving, which is life safeguard pre-warning system for passengers and drivers.[15]

2.2 SURVEY ON RENAULT MODELS

Table 2.2.1 : Renault Model in which TPMS available.

Sr. No	Vehicle Model	Detail
1	Renault Kadjar.	The renault kadjar tyre pressure monitoring system (tpms), alerts the driver when one or more tyres have deflated. On the instrument panel display, the tpms symbol will alert the driver if a tyre has become deflated or if there's a fault with the system.
2	Renault Clio.	Four pressure sensors built into the valves (one per wheel) the sensors transmit a radio signal,computer which collects, decodes and processes sensor signals, and then determines which message to display, a display integrated to the instrument panel, a UCH located behind the passenger compartment relay/fuse box.
3	Renault Scenic.	This tyre pressure reset guide applied to the Renault Scenic / Grand Scenic model version 4, 2016 onward. The tyre pressure monitoring system alerts the driver via a symbol in the dashboard display of insufficient pressure. This is due to a sensor being located in each of the for road wheels

Table 2.2.2 : Model where TPMS is not available .

Sr. No	Vehicle Model
1	Renault Kiger
2	Renault Triber
3	Renault Duster
4	Renault Kwid

2.3 COMPARISON BETWEEN TPMS AND TPCS

Table 2.3.1 : Comparison between TPMS and TPMS

Sr.No	TPMS	TPCS
1.	It only monitor the pressure inside the tyre.	It can monitor as well as control the tyre pressure.
2.	It cannot compensate pressure drop in tyre	It work with compressor to compensate pressure drop in the tyre
3.	In case of pressure drop, it gives an alarm	In case of pressure drop, it gives an alarm and compressor start work
4.	In case of puncture, we cannot cover distance.	In case of puncture, we can cover some distance.
5.	Security is less compare to TPCS.	Security is more compare to TPMS.
6.	Cost is less compare to TPCS.	Cost is high compare to TPMS.

2.4 COMPARISON BETWEEN INTERNAL AND EXTERNAL PRESSURE SENSOR

Table 2.4.1 : Comparison Between internal and external pressure sensor

Sr.No	Internal pressure sensor	External pressure sensor
1.	It have clamp in valve	It does not required any valve
2.	Battery life is 5+ year.	Battery life is 1+ year.
3.	It is able to fill air in the tyre.	It is able to fill the are in tyre.
4.	It require replacement.	It does required replacement.
5.	Pressure accuracy is ±1 psi.	Pressure accuracy is ±1 psi.
6.	It required professional to install it.	We can install by our self.

2.5 BACKGROUND

A central tyre inflation system (CTIS) was first used in production on the American DUKW amphibious truck, which was introduced in 1942.

This technology is extensively used in many off-road transport operations. In many countries, especially Australia, New Zealand and South Africa, CTIS is used in logging, mining, and power line maintenance, as it significantly reduces environmental impact when transporting logs, or travelling on gravel or dirt roads.

From 1984, General Motors offered CTIS for the Chevrolet Blazer and various pickups.There have been attempts at employing central tire inflation systems on aircraft landing wheels (notably on the Soviet Antonov An-22 military transport) to improve their preparedness for unpaved runways.

Fig 2.5.1 : trailer with CTIS

Several trucks used by the U.S. military are equipped with CTIS. The feature is also common in Soviet and Russian military trucks

The Czech Tatra T813's central inflation and deflation system was designed to maintain pressure even after multiple bullet punctures. Military-spec Tatra trucks are equipped with CTIS as standard.

Fig 2.5.2 : The Tatra T813 prototype

The Tatra T813 prototype had CTIS as early as 1960; it later became standard for all Tatra military trucks

CHAPTER 3
DESIGN

3.1 PROJECT OBJECTIVE

3.1.1 Maintains the required tyre pressure:

The function of the system is to maintain and adjust the pressure in all the tyres of the system according to varying loading and driving conditions.

3.1.2 An Automatic System:

An automatic system further saves human energy & time in filling the air in tyres when they are in under inflated conditions.

3.1.3 Builds a Low cost system:

The installation of such a system in vehicles is a low cost

3.1.4 Improves fuel efficiency & tyre life:

This system helps in less consumption of fuel and also improves tyre life by reducing chances of wear in tyre.

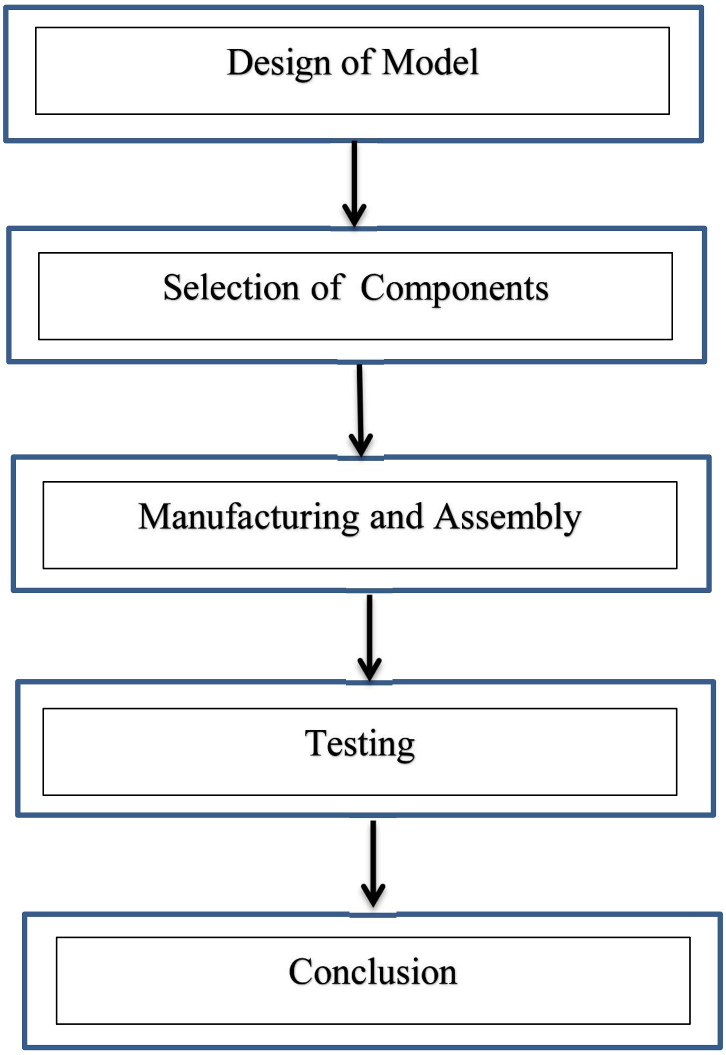
3.2 METHODOLOGY

After referring several papers we got many ideas. This system consists of portable air compressor, pressure sensor, electronic control circuit (Arduino Uno),relay,electronic buzzer, tyre tube,relief valve and battery. After getting ideas of different components needed, we will start making rough design and final design on AutoCAD.

By referring this design we will buy the standard component required for the projects. After this we will start manufacturing work in workshop. Along with this electronics part will also be done. In electronics we will have to build controller circuit to get signal from pressure.

After this, assembly of different components will be done. Later testing will be started for getting various results.

3.2.1 Steps for Methodology



3.3 LAYOUT OF CONTROL SYSTEM

The layout actual control system is shown in fig.As shown in figure,main control unit which is Arduino Uno takes tyre pressure data with help of pressure sensors and after processing i.e. Comparing ideal value which are already given in programme it give control signals to compressor to start and to contol the DCV (Directional Control Valves) according to tyre of which pressure is less or punctured.

The main control unit (Arduino Uno) is programmed using Embedded C programming language which actully compare the singnal of pressure sensors with ideal give values in programme and according to result control the components.

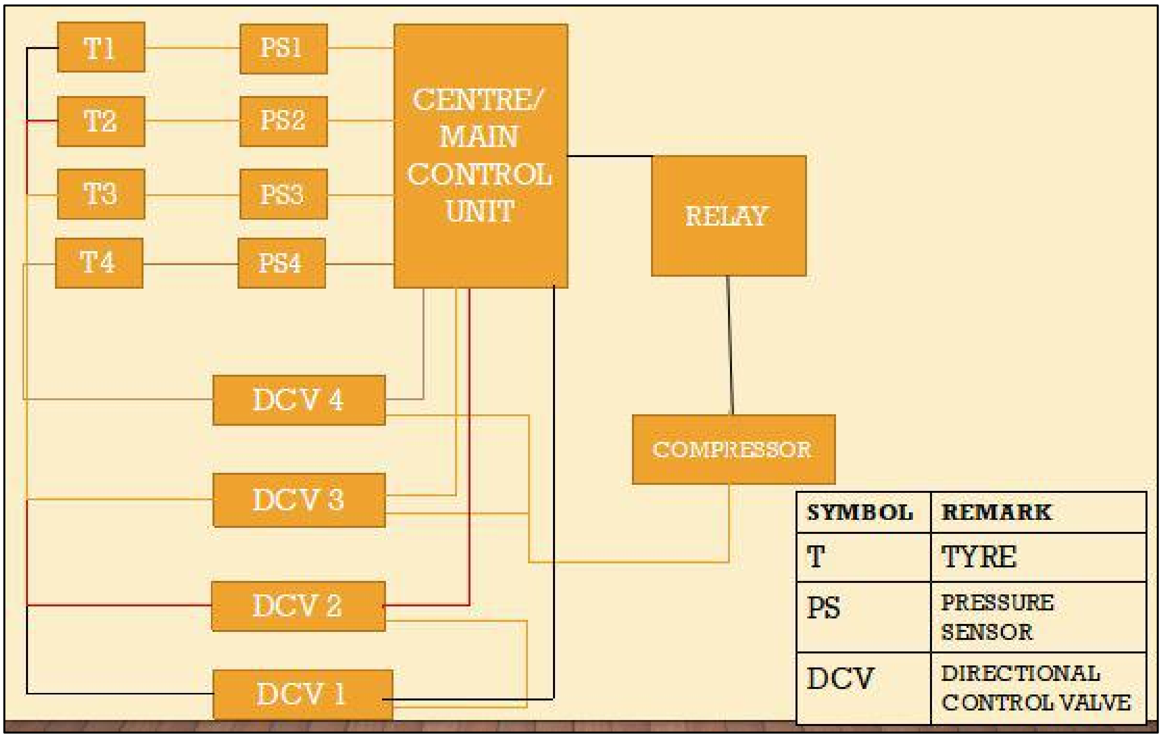


Fig 3.3.1 : Layout of Control System

3.4 AUTOCAD MODEL OF EXPERIMENTAL SET-UP

An actual Model of experimental set up of project is designed with help of AutoCAD designing CAD software.The fig shows AutoCAD interface with model of experimental set up of project.

AutoCAD is a commercial computer-aided design (CAD) and drafting software application..

AutoCAD is the original CAD software used by millions around the world. It can be used to create precise 2D and 3D drawings and models, as well as electrical diagrams, construction drawings, and more.

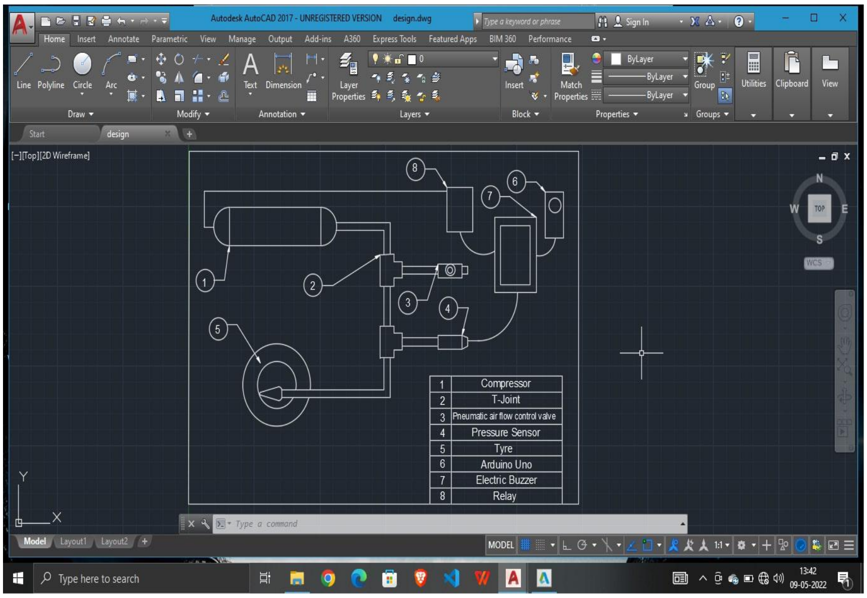


Fig 3.4.1 : AutoCAD model of Experimental Set-up

The general layout of experimental set up of project is shown in the fig. As figure represents various components used such as compressor, arduino uno, pressure sensor , tube, Air flow release valve etc which are properly marked and labeled.

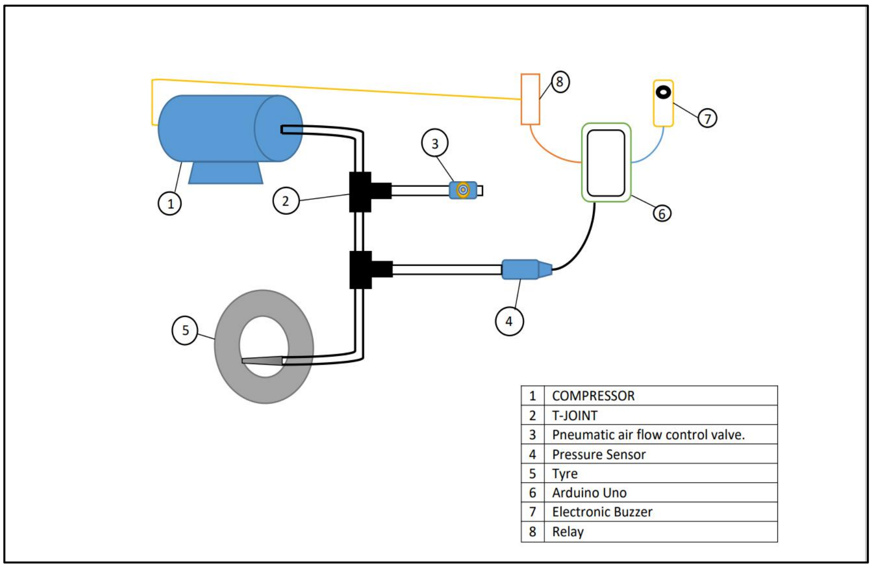


Fig 3.4.2 : The general layout of experimental set up

3.5 RENAULT DUSTER MODEL WITH TPCS

The detailed servey is performrd on Rnault company cars which are actully available in indian car markets. The objective of this servey is to find out the availability of TPMS in various cars.

Renault Duster Model is shown in fig below is equiped with TPCS which is advance version of TPMS .TPMS is integrated part in TPCS.

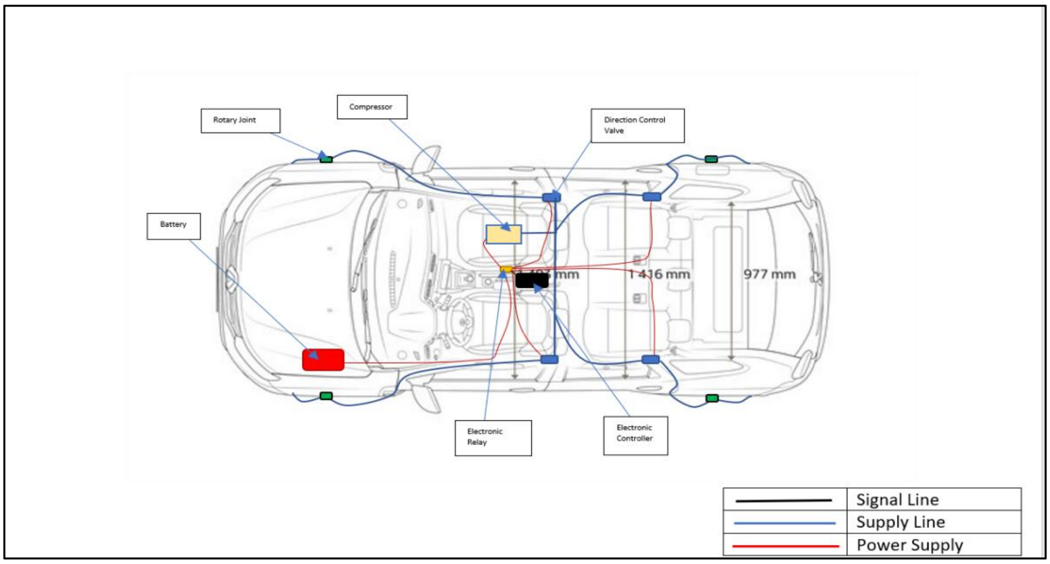


Fig 3.5.1 : Renault Duster Model With TPCS.(Top View)

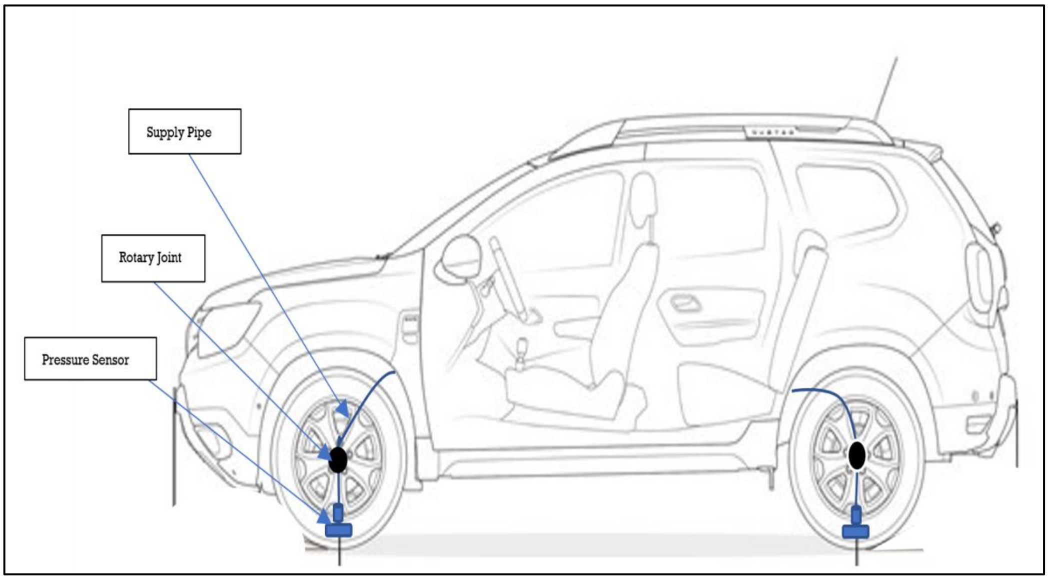
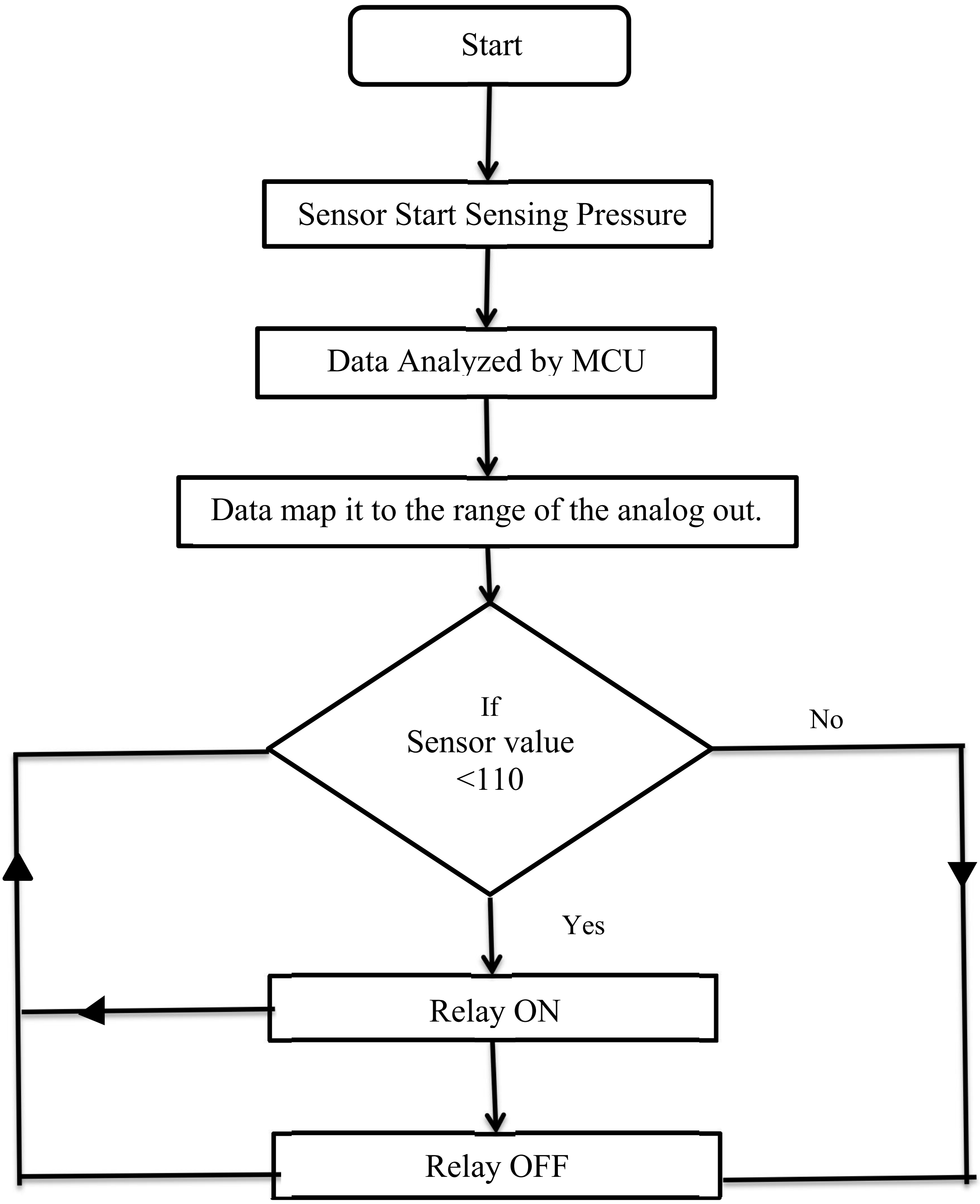


Fig 3.5.2 : Renault Duster Model With TPCS.(Side View)

3.6 FLOWCART OF PROGRAM

A flowchart is a diagrammatic representation of an algorithm. A flowchart can be helpful for both writing programs and explaining the program to others.
A flowchart for program for arduino uno is shown in below.



3.7 ANALYTICAL CALCULATIONS

3.7.1 Selection of Compressor

Calculation for Selection of Compressor

For tyre pressure of 30 psi

Where, 1 psi = 0.06895 bar

Therefore, 30 psi = 30×0.06895 bar

= 2.0685 bar

= 2.1 bar (approx.)

Therefore, we are selecting 12V D.C, 6.895 bars or 100 psi compressor for tyre pressure of 30 psi.

3.7.2 Unit Conversion

Calculation for Unit Conversion

Sensor : 1.0 MPa =145 Psi ,

Output : 0.5 v to 4.5 v α pressure ,

1 Byte = 1024 Bits ,

Controller : 0 V = 0 Bits ,

5 V = 1023 Bits ,

1 Bits = 4.8 mV

Anolog

Output : 0 V → 0

4.8 mV → 1

9.6 mV → 2

Therefore ,

0.5 V = 102 ,

5.0 V = 1023 ,

Hence,

[0.5 V to 5.0 V] α Pressure ,

[102 to 1023] α Pressure ,

↓ ↓

0 Psi to 145Psi

We conclude from the calculations that the pressure switch is activated as soon as the pressure falls below 110 bits (528 mV), where 1 Bit = 4.8mV.

CHAPTER 4
EXPERIMENTAL SET-UP

4.1 PROGRAM FOR ARDUINO UNO

The program written below is used to control the various components of system by MCU (Arduino Uno).This program is programed in embbed C programming language.

```
// These constants won't change. They're used to give names to the pins used:
const int analogInPin = A0;  // Analog input pin that the Pressure sensor is attached to

int sensorValue = 0;        // value read from the Pressure sensor
int outputValue = 0;

void setup()

{
  // initialize serial communications at 9600 bps:
  Serial.begin(9600);  //Debugging
  pinMode(7, OUTPUT);      //Relay connected to pin 7

}

void loop()
{
  // read the analog in value:
  sensorValue = analogRead(analogInPin);
  // map it to the range of the analog out:
  outputValue = map(sensorValue, 102, 1023, 0, 145);
  // change the analog out value:

  if (sensorValue < 110)
```

```
 {
  //delay(3000);

 digitalWrite(7, LOW);   //Relay OFF
  delay(10);
 }

 else

 digitalWrite(7, HIGH);   //Relay OFF
 delay(10);

 // print the results to the Serial Monitor:
 Serial.print("sensor = ");
 Serial.print(sensorValue);
 Serial.print("\t Tyre Pressure (PSI) = ");
 Serial.println(outputValue);

 // wait 1000 milliseconds before the next loop for the analog-to-digital
 // converter to settle after the last reading:
 delay(1000);
}
```

4.2 COMPONENTS OF THE SYSTEM

These are the components and specification used for manufacturing of the project

1) Portable Air compressor
2) Flexible air hose
3) Arduino Uno
4) Relay
5) Electronic buzzer

6) Pressure sensor
7) Pneumatic Air Flow Controller Valve
8) Tyre tube (inner tube)

4.2.1 Portable Air compressor

The system uses compressor to get the air from atmosphere & to compress it to a required pressure. A 12V DC compressor has being used in our system. It is perfect for cars, bikes and inflators. It operates from the cigarette lighter socket of a DC-12V. Proper design has been set up for installing hose and cord. It is ideal for inflating all vehicle tires and other high-pressure inflatables. The following table shows the specification of our portable compressor.
A compressor is a device which is used to compress the air at high pressure by using power from the electric motor or the IC engine. It stores air into the smaller volume place so that the pressure of the air increases above atmospheric pressure.

Fig 4.2.1(a) : Portable Air compressor

Calculation for Selection of Compressor

For tyre pressure of 30 psi

Where, 1 psi = 0.06895 bar

Therefore, 30 psi = 30×0.06895 bar

= 2.0685 bar

= 2.1 bar (approx.)

Therefore, we are selecting 12V D.C, 6.895 bars or 100 psi compressor for tyre pressure of 30 psi

Air Compressor Specifications

Table 4.2.1(a) : Specification of Compressor

Voltage	DC 12V
Amperage	14A
Duration	12-15Min
Max Pressure	7kg/cm (150PSI)
Displacement	35L/Min

4.2.2 Flexible air hose

Hose, flexible piping designed to carry liquids or gases. Early hoses were made from leather, which was never wholly satisfactory and was supplanted in the 19th century by natural rubber. Rubber layered on a pole or mandrel produced a flexible and watertight hose; the addition of canvas strengthened the fabric, and helically wound wire gave a degree of rigidity.

Fig 4.2.2(a) : Flexible air hose

4.2.3 Arduino Uno

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P . It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worring too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

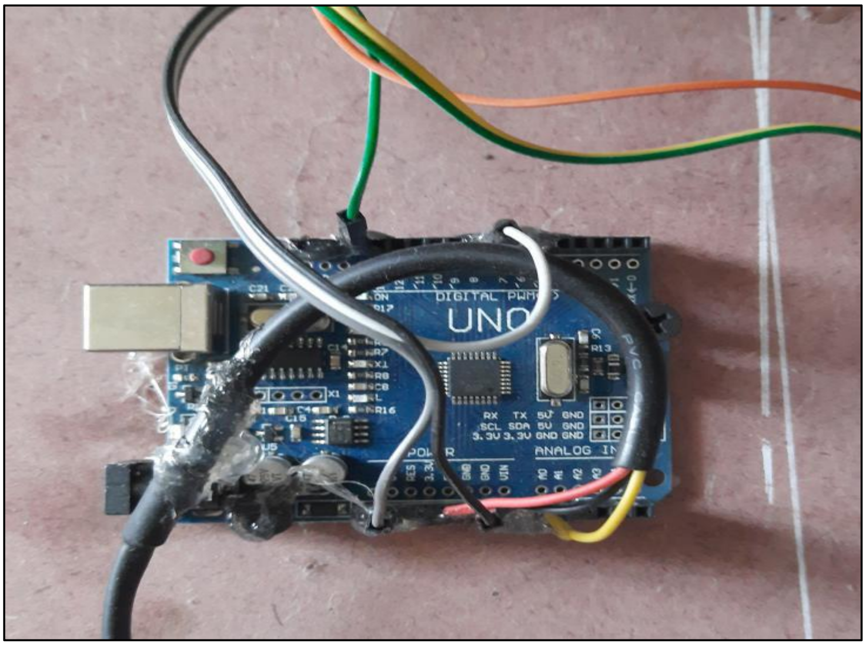


Fig 4.2.3(a) : Arduino/Genuino Uno

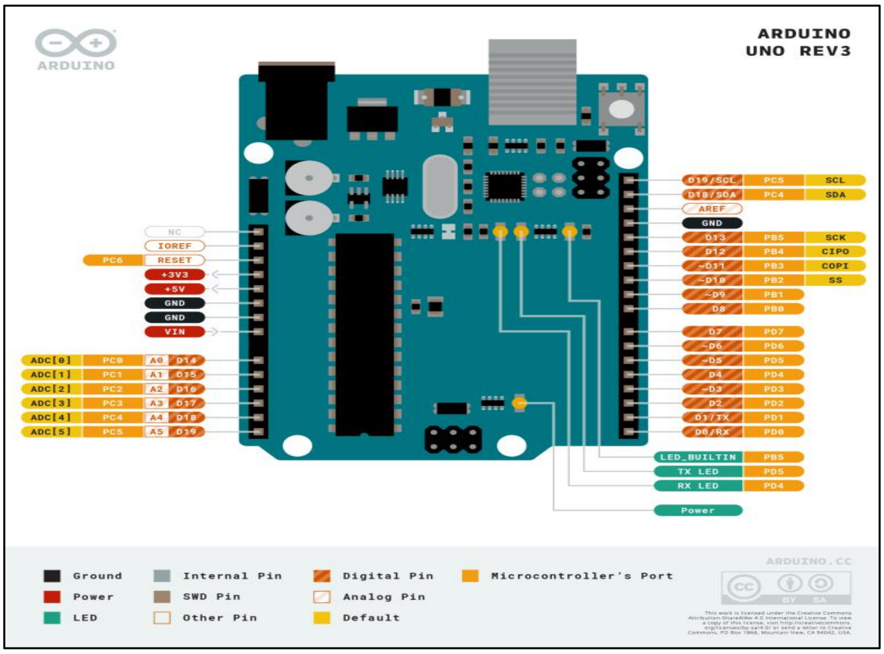


Fig 4.2.3(b) : Arduino/Genuino Uno pin block diagram.

Specifications

Table 4.2.3(a) : Specification of Arduino Uno

OPERATING VOLTAGE	5V
INPUT VOLTAGE (RECOMMENDED)	7-12V
INPUT VOLTAGE (LIMIT)	6-20V
DIGITAL I/O PINS	14 (of which 6 provide PWM output)
PWM DIGITAL I/O PINS	6
ANALOG INPUT PINS	6
DC CURRENT PER I/O PIN	20 mA
DC CURRENT FOR 3.3V PIN	50 mA
FLASH MEMORY	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
CLOCK SPEED	16 MHz
LED_BUILTIN	13
LENGTH	68.6 mm
WIDTH	53.4 mm
WEIGHT	25 g

4.2.4 Electronic relay

Relay is an electronically operated switch. Its three terminals are NC, NO, COM. When the relay coil is not activated, the relay will act as an open circuit, when we activate the relay coil, it will act as a closed circuit.

Relays can be also used as a protecting device, e.g Buchholz relay. It is an oil and gas actuated relay that is used to protect the transformer from the short circuit. When there is a fault in the transformer, due to fault current, the gas in the transformer gets hot and the bubbles will occur and which is given by the chamber pipes to the relay and the alarm circuit will be triggered based on the intensity of the defect.

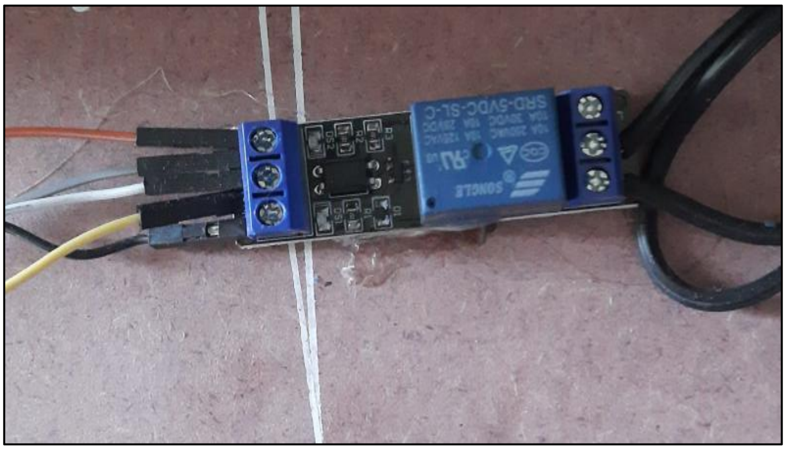


Fig 4.2.4(a) : Single-Channel Relay Module

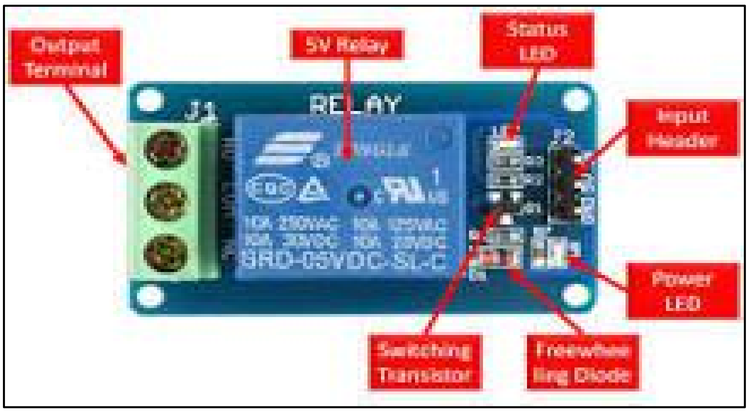


Fig 4.2.4(b) : Relay module pin description

Table 4.2.4(a) : Specification of Single channel Relay Module

Supply voltage	3.75V to 6V
Quiescent current	3.75V to 6V
Current when the relay is active	70mA
Relay maximum contact voltage	250V AC or 30V DC
Relay maximum current	10A

Table 4.2.4(b) : Relay module pin description

Pin Number	Pin Name	Description
1	Relay Trigger	Input to activate the relay
2	Ground	0V reference
3	VCC	Supply input for powering the relay coil
4	Normally Open	Normally open terminal of the relay
5	Common	Common terminal of the relay
6	Normally Closed	Normally closed contact of the relay

4.2.5 Electronic buzzer

A buzzer or beeper is an audio signaling device,which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

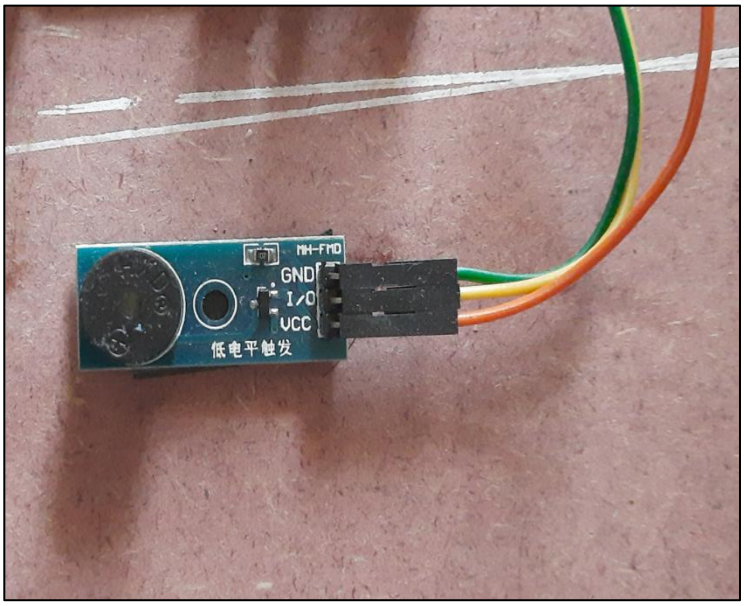


Fig 4.2.5(a) : Electronic buzzer

Specifications

- No oscillation source,need square wave(frequency 2K-5K) to drive
- Audion 9012 drive;
- Work Voltage: 3.3-5V
- Set bolt hole,easy to assemble
- PCB Dimension: 3.3cm x 1.3cm
- Pin definition   Vcc 3.3~5V
- GND the Ground
- I/O I/O interface of SCM

4.2.6 Pressure sensor

A pressure sensor measures pressure of gases or liquids. It generates a signal as a function of the pressure imposed; in our system such signal is electrical. Pressure sensors can also be uses to measure other variables such as fluid/gas flow, speed and water level. Pressure sensors can alternatively be called pressure transducer, pressure transmitters, pressure senders, pressure indicators, piezometers and manometers among other names.

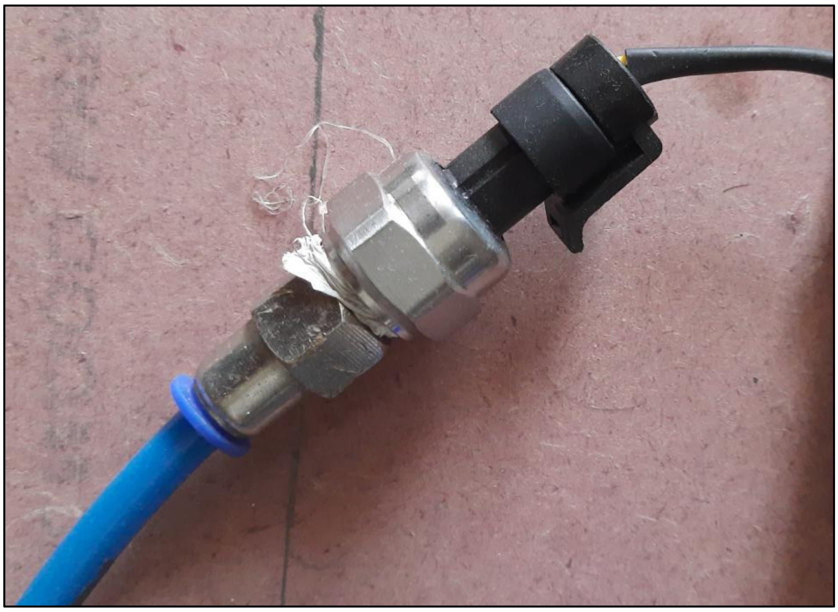


Fig 4.2.6(a) :1.0MPa Stainless Steel Pressure Transducer Sensor

It can be analogue or digital as per requirement of the vehicle and accuracy. Analogue sensors are less accurate as compare to digital. In this case we are going to use digital type air pressure sensor due to its accuracy and no extra settings as well as tuning is required. It will sense the drop in pressure as it is connected to the pressure line and it will send the signal to the control circuit so that air vale will open and tyre can regulate back at the normal pressure

Fig 4.2.6(b) : Stainless Steel Pressure Transducer Sensor

Table 4.2.6(a) :Specification of 1 MPa Stainless Steel Pressure Transducer Sensor

Sensor Type	Analog Pressure Sensor
Material	Stainless Steel
Thread Size	G 1/4"
Pressure Range (MPa)	0 – 1.2
Operating Voltage (VDC)	5
Output Voltage (VDC)	0.5 ~ 4.5
Accuracy	1% FS
Length (mm)	50
Width (mm)	20
Height (mm)	20
Weight (gm)	70
Shipment Weight	0.075 kg
Shipment Dimensions	6 × 3 × 2 cm

4.2.7 Pneumatic Air Flow Controller Valve

Flow Control Valves are used to reduce the rate of flow in a section of a pneumatic circuit, resulting in a slower actuator speed. Unlike a Needle Valve, a Flow Control Valve regulates air flow in only *one direction*, allowing free flow in the opposite direction.

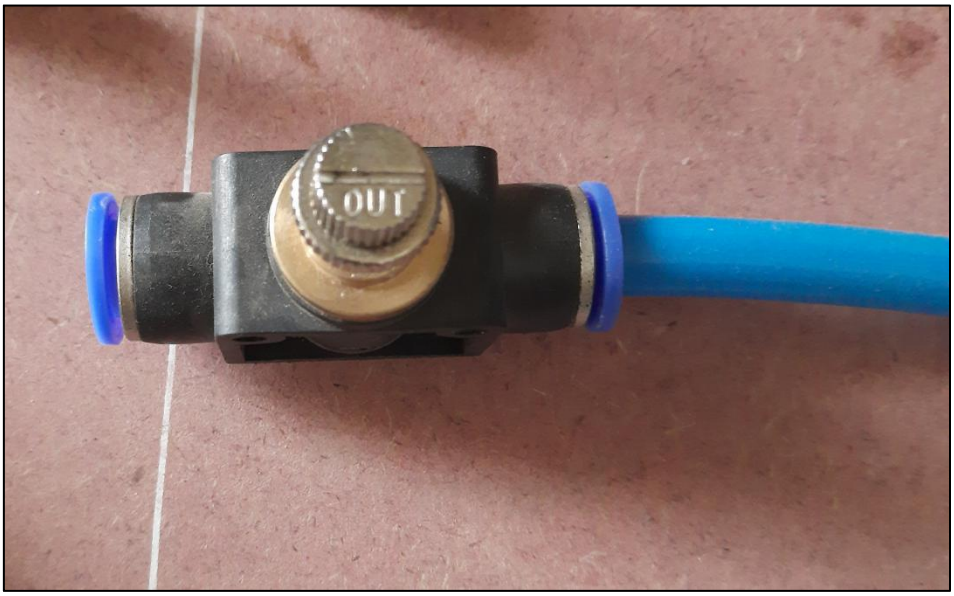


Fig 4.2.7(a) : 6MM Pneumatic Air Flow Controller Valve

Specifications

- Product Name : Air Flow Control Valve
- Model :LSA-6
- Net Weight : 55g
- Color : Black,Blue
- Material : Plastic,Metal
- Surface Treatment : Spray paint
- Two Tube Size (OD) : 0.24" = 6mm
- Body Style : Speed Controller Union Straight
- Operating Pressure : 0-1MPa
- Operating temperature : 0 - 60 Degree Celsius
- Dimension : 46.7mm x 39.5mm x 13.8mm / 1.84" x 1.56" x 0.54"(L x W x H)

4.2.8 Tyre tube (inner tube)

An inner tube is an inflatable ring that forms the interior of some pneumatic tires. The tube is inflated with a valve stem, and fits inside of the casing of the tire. The inflated inner tube provides structural support and suspension, while the outer tire provides grip and protects the more fragile tube.

Fig 4.2.8(a) : Inner tube

Table 4.2.8(a) : Specification of tyre inner tube.

Type	Inner Tube
Tensile Strength	11MPA
Weight	1.31KGS
Tube size	8.25R16 inner tube
Rubber Content	25%-60%

4.3 Experimental Set -up of project

This is Final experimental set - up is assembled and manufactured after designing of model on AutoCAD and completion of selection of components.

the components used for manufacturing of the experimental set - up are Portable Air compressor,flexible air hose, arduino uno, relay, electronic buzzer, pressure sensor, pneumatic air flow controller valve , tyre tube (inner tube).

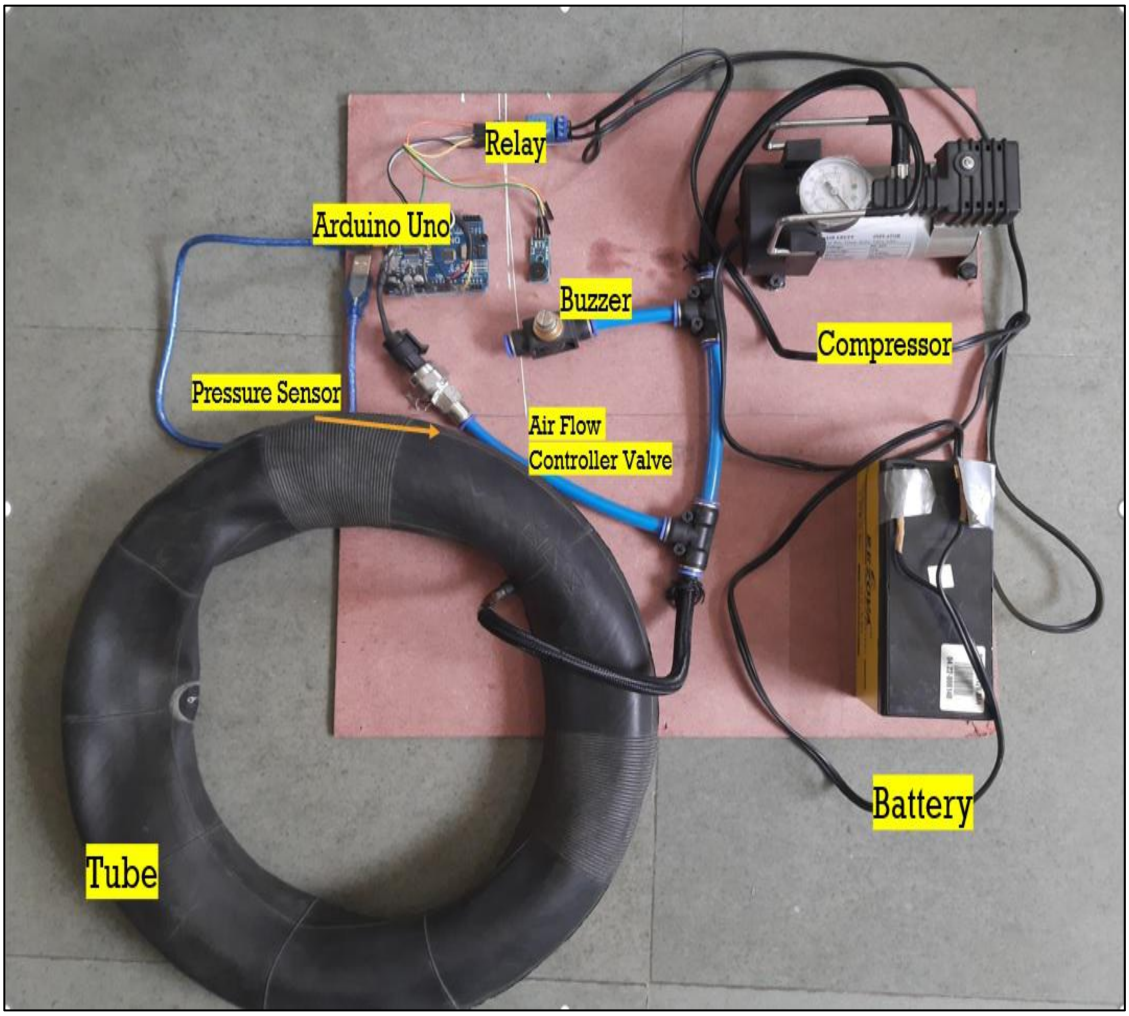


Fig 4.3.1 : Experimental Set -up of project

4.4 SYSTEM WORKING

Compressed air from the air compressor is transferred by using duct pipe to the system. Compressor is 12V DC compressor of 100 psi capacity. Air hoses from the compressor are connected to all the wheels of the vehicle. Compressed air from the compressor is transferred to the rotary joint through inlet port. Rotary joint is the device which allows flow of the compressed air through rotary part without leakage. Rotary joint is the device which is rotates along with the wheel to avoid the tangling of the hoses. Digital air pressure sensor is used to detect the drop or reduction in tyre pressure.

This pressure sensor will sends the signal to the microcontroller which allows the valve to be open so compressed air is released from the compressor and travels to the tyre. This compressed air is used to regulate the tyre pressure to the required level. As the pressure level reaches at ideal level sensor sends signal to the controller to turn off the valve and air flow will be restricted. Compresser worked on 12V DC battery, it is reciprocating type hence it is easy to obtain the desired pressure level at any time.

4.5 TRIAL

4.5.1 Program execution

When pressure drop in tyre tube is sensed by pressure sensor, it send signal to main control unit and program execution take place.

During program execution, main control unit check and compile the pressure sensor data by comparing it with given ideal values and take action according to program.

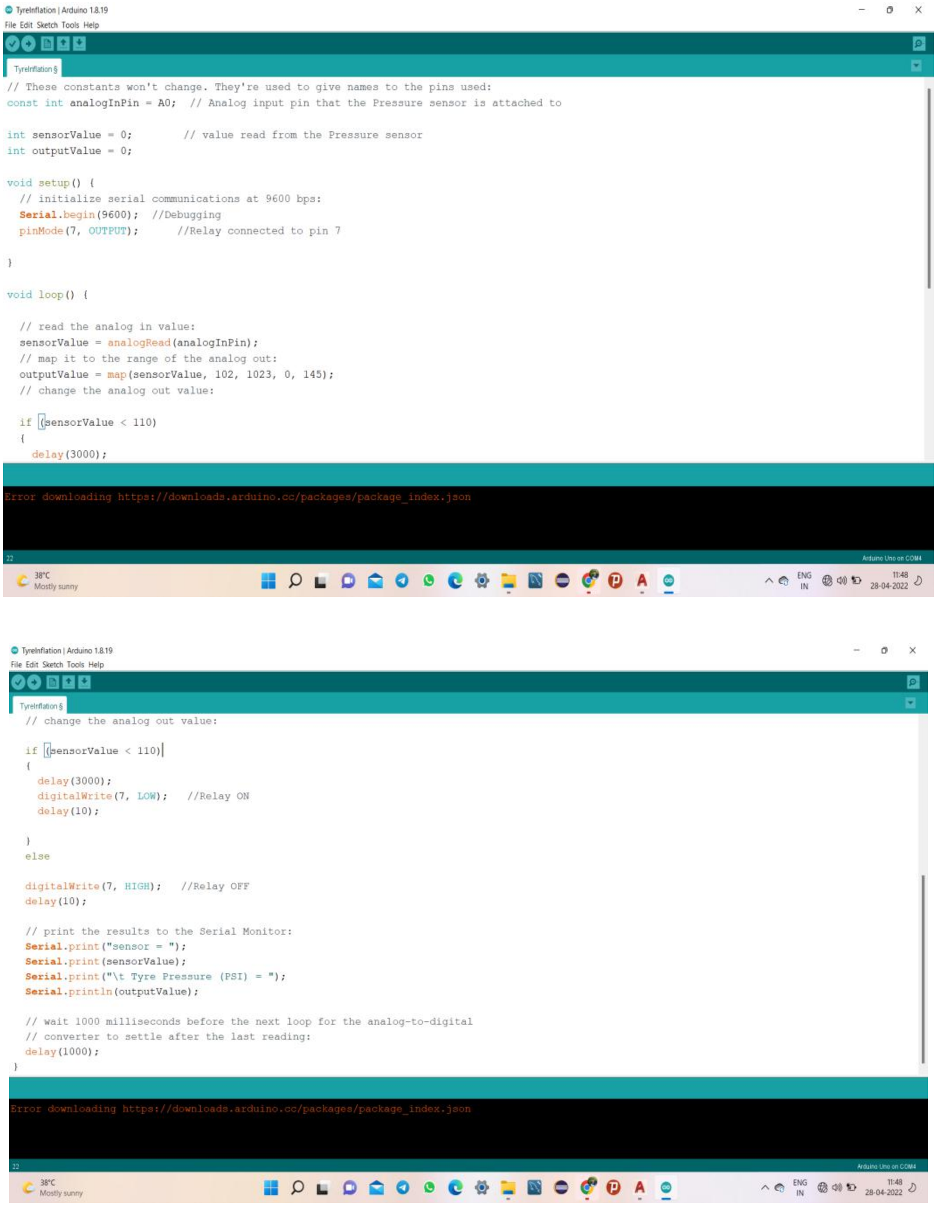


Fig 4.5.1(a) : Program execution during trial

4.5.2 Trial Outcome

The pressure drop from tube is sensed by the pressure sensor and compensated with the help of compressor. Simultaneously it gives live readings to laptop (Digital Display) and also buzzer get on.

If pressure drop below 120-unit, compressor get on and compensate the pressure drop and increase above 120-unit.

Given below is the live reading taken while experimentation.

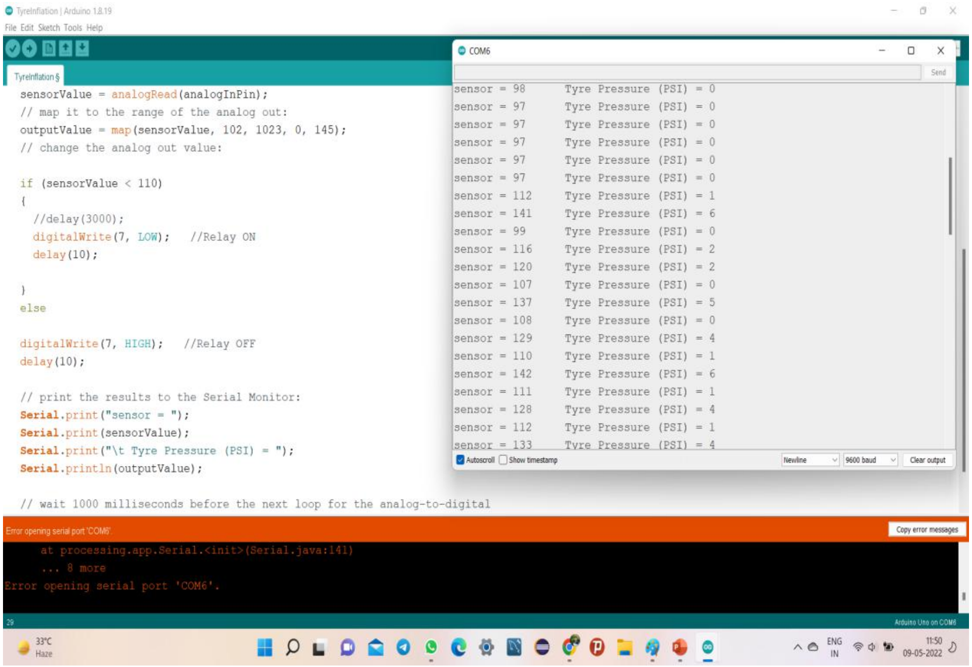


Fig 4.5.2(a) : Trial outcome

4.6 ADVANTAGES

Tyre Pressure Controlling System is a new product in the automobile market hence it has lot of opportunities into the market. It addresses the requirement of the consumer or the vehicle owner to increase the performance of the vehicle.

1) There will be a considerable reduction in tyre wear and tear due to uniform tyre pressure.

2) It increases fuel mileage hence the economy.

3) It increases overall safety of the passengers and vehicles.

4) As this device is new to the market and not used frequently in vehicles hence it has favorable market condition.

5) It will transfer the compressed air to the tyre with minimum leakage.

4.7 LIMITATION

1) As it totally depends on micro controlling system and sensors, there is chance of system failure.
2) This system can be compensate limited amount of pressure leakage.

4.8 APPLICATIONS

1) It can be used in various types of vehicles such as military vehicles, ambulance, police vehicles, fire vehicles, trucks, trailers and all type of automobiles so there will be no need of checking the tyre air time to time.
2) It can be used in very costly vehicles where maintenance of standard is important.
3) It can be used in tractors as well as sports cars it has wide market in automobile sector.

Fig 4.8.1 : Appliaction of TPCS in Agricultural Tractor

CHAPTER 5

RESULT

When the pressure drop take place inside the tyre tube due leak of air,this pressure drop in tyre tube is sensed by the pressure sensor and digital data is provided to main control unit (Arduino Uno) and this pressure drop is compensated with the help of compressor which is activated by main controller unit signal after program exection.While program exection Arduino uno iscompare the sensor dsts with actual required for proper tyre inflation. Simultaneously it gives live readings to laptop (Digital Display) and also buzzer get on. If pressure drop below 120-unit, compressor get on and compensate the pressure drop and increase above 120-unit.

Given below is the live reading taken while experimentation.

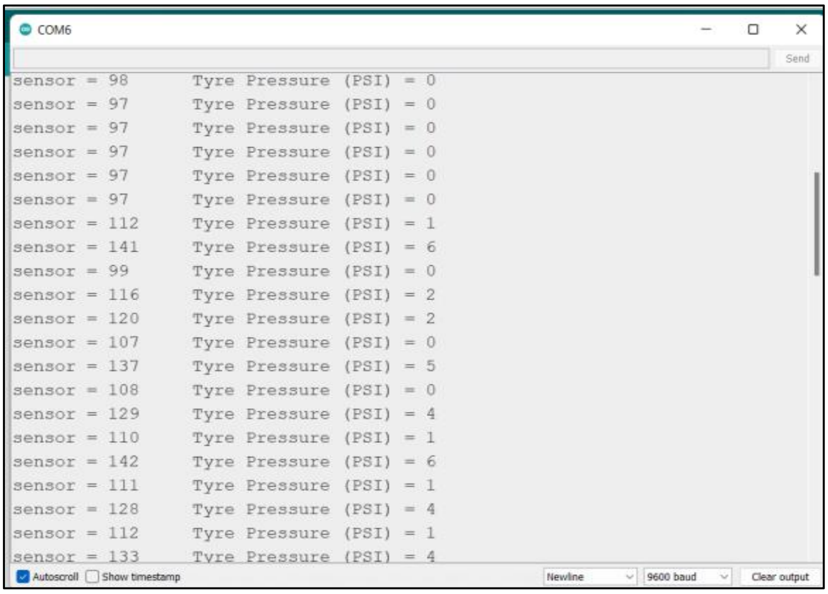


Fig 5.1 : Reading taken while experimentation.

CHAPTER 6

CONCLUSION

6.1 CONCLUSION

We can conclude that Tyre Pressure Controlling system utilizes integration techniques to provide a solution to measures real-time tyre pressure,and also alerts the driver about improperly inflated tyres. This system is an essential feature in all the vehicles.

The system ensures calibrated tyre pressure which is important for reduce number of accidents, proper handle of vehicle.

Using this system, driver can increase or decrease required air pressure in vehicle's tyres, without stopping the vehicle to do so.

Also, using this system in military purposes, it can help driver to increase or decrease pressure without getting out of the vehicle.

Using this system, overall performance of vehicle will increase like

- ➢ Increased fuel efficiency.
- ➢ Increased life span of tyres.
- ➢ Compatibility to driver in long journeys.

6.2 FUTURE SCOPE

1) With addition of some sensor, we can adjust the tyre pressure according to the road surface, climate(temperature) and increase the safety of the driver and passengers.

2) With the help of nano technology, we can minimize the component size which will be occupy less space in the car during installation.

3) With design analysis and study, we can design more suitable and simple design for TPCS.

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