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# Development and Modification of Wheel Alignment Setup for Cost-Effective and User Friendly Solution

**Hardik Jitendrabhai Gohil[1], Chintan Tinesh Patel[2], Aman Suresh Ruparelia[3], Dhaval R. Patel[4],Saumitra S. Jha[5], Jayendra P. Vasani[6]**

*[1-5]UG student, Department of Automobile Engineering, L. D. College of Engineering, Ahmedabad, Gujarat, India*
*[6]Asst. Prof., Department of Automobile Engineering, L. D. College of Engineering, Ahmedabad, Gujarat, India*

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**Abstract:** *This development identifies with the estimation of directing calculation for arrangement like caster, camber and toe. The invention uses sensor for measuring the angles of the wheel and the readings can be seen on mobile/computer screen and LCD screen. This machine furnishes the perusing with precision of two decimal spots, so that exactness is higher contrast with ordinary one. The weight and cost is likewise diminished radically, so the item is financially suitable. By limiting the quantity of parts the versatility of framework is additionally expanded. The item is so natural to utilize that the individual can identify any misalignment at home and avoid visit to alignment shops/garage.*

***Key word*: -**Caster, Camber, Toe, Alignment, Gyro sensor, Accelerometer.

## INTRODUCTION: -

This development identifies with the estimation framework utilized for wheel arrangement like camber, caster and toe.

This framework contains customizable wheel stand, estimation sensors, microcontroller, rechargeable DC battery charging circuit and an LCD display. The framework is financially reasonable, versatile and give precision with two decimal spots.

The wheel clamp is movable one with the goal that it may be utilized on different edges notwithstanding of distinctive size. The wheel stand has a square which contains the sensor and the microcontroller. The sensor detects the adjustment in the development of the wheel in three measurements and gives the information to the regulator which gathers the data furthermore; does some further estimation and interaction with it.

At last, the caster, camber and toe angles can be seen on LCD screen. The rechargeable battery here gives the capacity to the microcontroller and the rechargeable battery can be re-energized basically by plug in the pin to the charging circuit. [1]

## 2. Working of the Invention

### 2.1 Detailed Description of the Invention

The current innovation includes four principle parts to be specific information procurement, preparing microcontroller, remote communicator and a showcase board. Information Acquisition identifies with the gyro sensor present in the driver's seat clip which facilitates the difference in the wheel points in three measurements. The accelerometer estimates the rotational speed increase of the wheel toward any path. Wi-Fi microcontroller is the preparing gadget which measures the information that has been obtained by sensor and applies the important equations and gives the yield in required unit. This gadget additionally shows information to the LCD screen or on portable screen remotely. Wi-Fi microcontroller is a remote communicator [2].

Show board is utilized to get the important readings of wheel arrangement like caster, camber and to rechargeable battery gives the power to the microcontroller and sensor for vital working. Charging circuit is accommodated re-energizing the rechargeable battery at whatever point required just by connecting the charger. On/off switch for interfacing and separating the circuit

The fundamental goal of this development is to get the necessary points with precision of two decimal spots. To decrease the number of parts from the conventional one. And make the machine much cheaper than the old one and easy to use. Utilizing a 12 V DC rechargeable battery, microcontroller is provided with power. All the sensor is handed-off power by power links by means of Wi-Fi microcontroller.

Figure 2 shows the circuit outline in which the battery positive terminal is associated with +B port of charging circuit and negative terminal is associated with – B port of charging circuit by red link.

Red link from charging circuit +OUT port is associated with VIN port of miniature regulator microcontroller and dark link from – OUT port is associated with GND port of miniature regulator by means of switch. Red link from sensor VCC port is associated with battery positive

terminal. GND port of sensor is associated with GND port of miniature controller through dark link. Blue link from sensor SCL port is associated with D22 port of miniature regulator. Green link from sensor SDA port is associated with D21 port of miniature regulator. Dark link from screen GND port is associated with GND port of micro10 regulator. Red link from VDD port is associated with 3V3 of miniature regulator. Blue link from screen SCK port is associated with D22 port of microcontroller. Green link from screen SDA port is associated with D21 port of miniature regulator. First and foremost, the wheel clip will be put at the square which is naturally set at zero-zero position. Subsequent to turning on the circuit, the sensor will be set at the zero situation taking all things together the pivot. Accordingly, readings will be 0,0,0 for every one of the points. When vehicle comes to the platform the wheel clamp (2) is adjusted according to the wheel size and fitted on the wheel. Presently the sensor will quantify the adjustment in the point of the wheel as for zero position. For the most part, the toe and camber of the vehicle are flexible, yet caster isn't customizable.

Presently guiding lock will be applied so it remains fix all through the cycle. Following couple of moments of mounting the quantities for camber and toe can be seen on the screen. By and large, the camber is needed in degree and toe is needed in mm.

so camber Sensor gauges the points in degree and this point is duplicated with wheel width to get the toe in mm. for egg

Angle= x degrees

Wheel width = z mm

Toe= z*sin(x) mm

For estimating caster, the wheel is turn 20 degree on one or the other side and camber esteem is noted, assume camber is 'a' degree. At that point the wheel is turned 20 degrees on inverse side and noticed the camber esteem by then, let assume 'b' degree. At that point the estimation of caster is (a-b) degree.

This deliberate quantity can be seen on portable screen or LCD screen with the help of Wi-Fi microcontroller remotely. Charging circuit charges the Rechargeable battery basically by stopping the charger.

### 2.2 Arduino R3 Code [3]

The following written code in Arduino IDE:

```
#include <Wire.h>
#include "Wire.h"
#include <MPU6050_light.h>
#define BLYNK_PRINT Serial
//#include <Blynk.h>
#include <ESP8266WiFi.h>
 #include <BlynkSimpleEsp8266.h>
charauth[] = "iJH16lxGTydY6qLXSEMsPuHmt3HdE5i9";
charssid[] = "POCOPHONE";
char pass[] = "amanrocks21";
MPU6050 mpu(Wire);
unsigned long timer = 0;
intgyro_x, gyro_y, gyro_z;
longgyro_x_cal, gyro_y_cal, gyro_z_cal;
booleanset_gyro_angles;
longacc_x, acc_y, acc_z, acc_total_vector;
floatangle_roll_acc, angle_pitch_acc;
floatangle_pitch, angle_roll;
intangle_pitch_buffer, angle_roll_buffer;
floatangle_pitch_output, angle_roll_output;
longloop_timer;
int temp;
void setup()
{
Serial.begin(115200);
Wire.begin();
Wire.setClock(400000);
Blynk.begin(auth, ssid, pass);
byte status = mpu.begin();
Serial.print(F("MPU6050 status: "));
Serial.println(status);
while(status!=0){ }
Serial.println(F("Calculating offsets, do not move
MPU6050"));
delay(1000);
mpu.calcOffsets();
Serial.println("Done!\n");
Wire.begin();
setup_mpu_6050_registers();
for (intcal_int = 0; cal_int< 1000 ; cal_int ++){
MPU-6050 for 1000 times
read_mpu_6050_data();
gyro_x_cal += gyro_x;
gyro_y_cal += gyro_y;
gyro_z_cal += gyro_z;
delay(3);
}
gyro_x_cal /= 1000;
gyro_y_cal /= 1000;
gyro_z_cal /= 1000;
loop_timer = micros();
 }
void loop()
{
mpu.update();
if((millis()-timer)>10)
{
Serial.print("\tToe : ");
Serial.println(mpu.getAngleZ());
timer = millis();
read_mpu_6050_data();
gyro_x -= gyro_x_cal;
gyro_y -= gyro_y_cal;
gyro_z -= gyro_z_cal;
```

```
angle_pitch += gyro_x * 0.0000611;
angle_roll += gyro_y * 0.0000611;
angle_pit 5 ch += angle_roll * sin(gyro_z * 0.000001066);
angle_roll -= angle_pitch * sin(gyro_z * 0.000001066);
acc_total_vector =
sqrt((acc_x*acc_x)+(acc_y*acc_y)+(acc_z*acc_z));
angle_pitch_acc = asin((float)acc_y/acc_total_vector)*
57.296;
angle_roll_acc = asin((float)acc_x/acc_total_vector)* -
57.296;
angle_pitch_acc -= 0.0;
angle_roll_acc -= 0.0;
if(set_gyro_angles){
angle_pitch = angle_pitch * 0.9996 + angle_pitch_acc *
0.0004;
angle_roll = angle_roll * 0.9996 + angle_roll_acc * 0.0004;
}
else{
angle_pitch = angle_pitch_acc;
angle_roll = angle_roll_acc;
set_gyro_angles = true;
}
angle_pitch_output = ((angle_pitch_output * 0.9 +
angle_pitch * 0.1)+9);
angle_roll_output = angle_roll_output * 0.9 + angle_roll *
0.1;
Serial.print(" --- Camber = ");
Serial.print(angle_roll_output,HEX);
Serial.println();
Blynk.virtualWrite(V2, angle_roll_output);
Blynk.virtualWrite(V3, mpu.getAngleZ());
delay(100);
}}
void setup_mpu_6050_registers(){
Wire.beginTransmission(0x68);
Wire.write(0x6B);
Wire.write(0x00);
Wire.endTransmission();
Wire.beginTransmission(0x68);
Wire.write(0x1C);
Wire.write(0x10);
Wire.endTransmission();
Wire.beginTransmission(0x68);
Wire.write(0x1B);
Wire.write(0x08);
Wire.endTransmission();
}
void read_mpu_6050_data()
{
Wire.beginTransmission(0x68);
Wire.write(0x3B);
Wire.endTransmission();
Wire.requestFrom(0x68,14);
while(Wire.available() < 14);
acc_x = Wire.read()<<8|Wire.read();
acc_y = Wire.read()<<8|Wire.read();
acc_z = Wire.read()<<8|Wire.read();
temp = Wire.read()<<8|Wire.read();
gyro_x = Wire.read()<<8|Wire.read();
gyro_y = Wire.read()<<8|Wire.read();
gyro_z = Wire.read()<<8|Wire.read();
}
```

### 3. Description of Drawings:

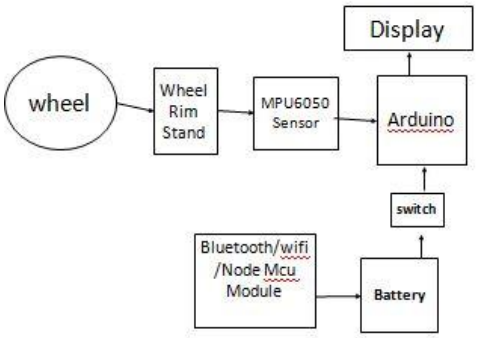


**Figure 1**
**(Block diagram)**

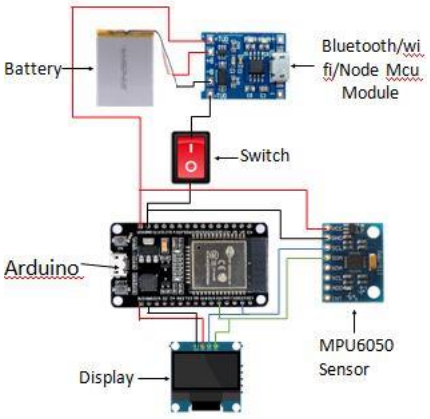


**Figure 2**
**(Circuit Diagram)**

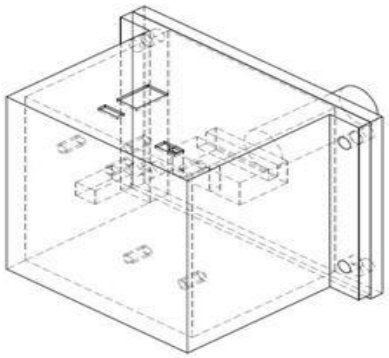

**Figure 3**
**(Representative Diagram)**

Figure 1 (block diagram) shows the square chart of the current development.

Figure 2 (circuit diagram) shows the circuit chart of the current development.

Figure 3 (representative diagram) shows the chart of the current development.

Customizable wheel clamp is mounted on the wheel. The wheel clamp can be changed by wheel size for mounting on the wheel. On this wheel clamp the square is fitted which contains gyro and speed increase sensor and Wi-Fi microcontroller. The sensor is shot and fixed with the block. So that any blunder because of vibration doesn't influence the perusing. The sensor is associated with microcontroller which is fuelled by battery. The charging circuit re-energizes the rechargeable battery. The LCD screen will show the perusing which will be mounted outside the square.

Figure 2 shows the circuit outline in which the battery positive terminal is associated with +B port of charging circuit and negative terminal is associated with – B port of charging circuit by red link. Red link from charging circuit +OUT port is associated with VIN port of miniature regulator microcontroller and dark link from – OUT port is associated with GND port of miniature regulator through switch. Red link from sensor VCC port is associated with battery positive terminal.

GND port of sensor is associated with GND port of miniature regulator through dark link. Blue link from sensor SCL port is associated with D22 port of miniature regulator. Green link from sensor SDA port is associated with D21 port of miniature regulator.

Dark link from screen GND port is associated with GND port of microcontroller. Red link from VDD port is associated with 3V3 of miniature regulator. Blue link from screen SCK port is associated with D22 port of microcontroller. Green link from screen SDA port is associated with D21 port of miniature regulator.

## 4. CONCLUSIONS:

We have built the machine which is cost effective and easy to use for measuring wheel alignment for wheels of vehicles. This machine gives very precise and accurate result in comparison to the currently used machine. It has high portability and requires less manpower. This machine has a greater life expectancy and requires very less maintenance.

We have upgraded the easiness for measurement reading by connecting it through wi-fi so one can easily correct and see the result on their mobile simultaneously.

## 5. REFERENCES: -

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[2] S. Chatur, "Computer based Wireless Automobile Wheel Alignment system using Accelerometer Sonali Chatur," pp. 62–69, 2015.

[3] Arduino, "Arduino - Reference," Lang. Ref., p. 1, 2016, [Online]. Available: https://www.arduino.cc/en/Reference/HomePage.

## 6. BIOGRAPHIES

**Mr.Hardik J. Gohil,** is a final year student of Department of Automobile Engineering, L.D. College of Engineering, Gujarat Technological University.

**Mr.Chintan T. Patel,** is a final year student of Department of Automobile Engineering, L.D. College of Engineering, Gujarat Technological University.

**Mr.Aman S. Rupareliya,** is a final year student of Department of Automobile Engineering, L.D. College of Engineering, Gujarat Technological University.

**Mr. Dhaval R. Patel,** is a final year student of Department of Automobile Engineering, L.D. College of Engineering, Gujarat Technological University.

**Mr. Saumitra S. Jha,** is a Second year student of Department of Automobile Engineering, L.D. College of Engineering, Gujarat Technological University.

**Prof. Jayendra P. Vasani**, is presently associated with the L. D. College of Engineering, Ahmedabad as an assistant professor in the Automobile engineering Department.