# Designing the Mono Wheel by Using Self Balancing Techinque

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### ABSTRACT

Mono wheel is design used to be a personal vehicle to carry a human operator that stands on and drive it. In industries humans should walk long distance to travel from one work site to another work site which will consume lot of human energy. By using this mono wheel we can reduce human energy. We can use this mono wheel in industries to travel from one place to another place. In recent years, because of the global pollution and energy shortage, automobiles and motorcycles are no longer the best for transportation. The device which we proposed will consume energy from battery which will reduce pollution and it is very small compared to other vehicle. The proposed mono wheel will work on self-balancing technique. To implement the concept of self-balancing we are going to use microcontroller which get input from two sensors to measure the angle by using gyroscope and vibrations by using accelerometer. Self-balancing technique is one of the intelligent characteristics for dynamical system to achieve to play many important application in many humanoid robots and military projects.

The sensor which we are using is MPU6050 sensor where MEMS Accelerometer and a MEMS gyroscope are integrated in a single chip. We are using the new techniques to reduce the designing cost and improve the performance. The microcontroller we are using is mini Arduino ATmega328 running at 16MHz with external resonator. We are using DC motor to rotate the wheel. It can be used as a mini personal vehicle it can travel at a speed of 20 km/h.

*Keywords:* Arduino Mini pro, Motor Drive, Go-kart wheel, self-balancing technique.

## 1. INRODUCTION

At present because of the surging consciousness of pollution and energy shortage crises, automobiles and motorcycles are no longer the best for transportation.

As the price of petroleum products growing now-a-days, there is a need for cheaper and more efficient form of transport. In addition, saving energy in order to determine the problem of remnant fuel depletion is becoming increasingly important. Even industries and manufacturing companies that spread over huge areas restrict the usage of means of transport by their employees within their area to avoid the risk of pollution due to emissions of harm air. To meet those needs, research on eco-friendly transportation has been increased. Electrical vehicle technology as a step towards fulfilling these goals. So Mono wheel is one of the eco-friendly device that help the employees to travel long distances in companies.

Mono wheel move with the help of Dc battery. It work on the principle of self-balancing technique with the help of micro-controller. In this the components were used such as DC motor, Motor drive, sensors. Controlling such a system is a difficult task and thus it is the topic of research. It will move front if the user lean in forward direction and backward in backward direction.

A rider holds the steering while standing on it. The vehicle through an on board system balances itself and also responds to commands obtained by the movement of the rider. For example, if the rider

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tilts forward, the vehicle will accelerate in the forward direction and backward direction. By tilting the steering, we can take left and right turns. The tilt angle is calculated by accelerometer and gyro sensors.

The self-balance technique is done by using microcontroller. Program is written in C language for the microcontroller. The microcontroller will execute each and every step of program and it give the require output to move the dc motor. In sensor MPU6050, accelerometer and MEMS gyrometer are integrated in a single chip. The microcontroller we are using is mini Arduino ATmega328 running at 16MHz with external resonator. We are using DC motor to rotate the wheel. It can be used as a mini personal vehicle it can travel at a speed of 20 km/h. The applied force can be sensed by the MPU-6050 sensor which contains a MEMS accelerometer and a MEMS gyro in a single chip. Accelerometer is used to sense the change of velocity with respective time. Gyroscope is used to sense the change in angle. We are using DC motor to rotate the wheel by using chine drive. Motor drive is used to supply amplified power to DC MOTOR. By using Arduino algorithm which is used to control entire action.

The direction of the rotation of motors is controlled by the motor controller. Power supply plays a vital role in any electrical system. Batteries are used to provide power to the system. In this paper, we design and develop a one wheel self-balancing personal transporter. The readings from the sensors are collected and are given to the controller. The controller continuously processes the output and provide the relevant motor power required to drive the wheels in the certain direction.

## 2.    BLOCK DIAGRAM

Figure 1 shows the block diagram of one wheel self-balancing personal vehicle. Micro controller take the data from the accelerometer and gyro sensors. The motor used in the vehicle are controlled based on the data given by the controller. The vehicle is to be built before it is controlled. The electrical compounds require to construct the vehicle consists of sensor modules, control module, motor driver.

The 12V battery is used to provide power to the whole circuit. The rechargeable battery is useful so that it can be charged and used to drive for certain distance. In this system the sensors used are accelerometer and gyroscope sensors. The Atmega16 microcontroller is used to act as control unit. The accelerometer to be used is by analog devices available as a breakout board. It is selected because of sensitivity. The values of gyroscope sensor are combined with the accelerometer outputs to know the tilt angle of the vehicle by the rider.
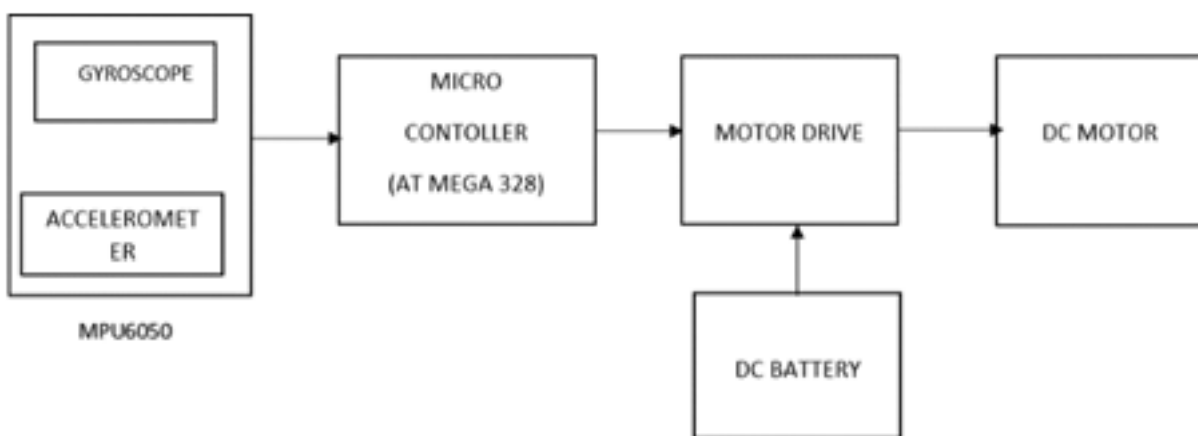


BLOCK DIAGRAM OF MONO WHEEL

**Figure 1: Block Diagram**

## 3.  CIRCUIT CONNECTION

Figure 2. Shows the circuit diagram of the work. We are connecting the MPU 6050 sensor which contain the combine pack of accelerometer is used to sense the vibrations and gyro meter is used to sense the angle this sensor is connected to the pin no 28, 27 of microcontroller which are internally analog to digital converter pins by executing the each step of the programme the microcontroller will give the output by sensing the to the motor driver. Motor driver is connected to the pins 9 and 10 of the microcontroller which will act as the gate by receiving the 1bite as the output from the microcontroller it will give 12v to the motor and receiving 0bite as the output it will not provide output to microcontroller. This motor driver is also used to move.

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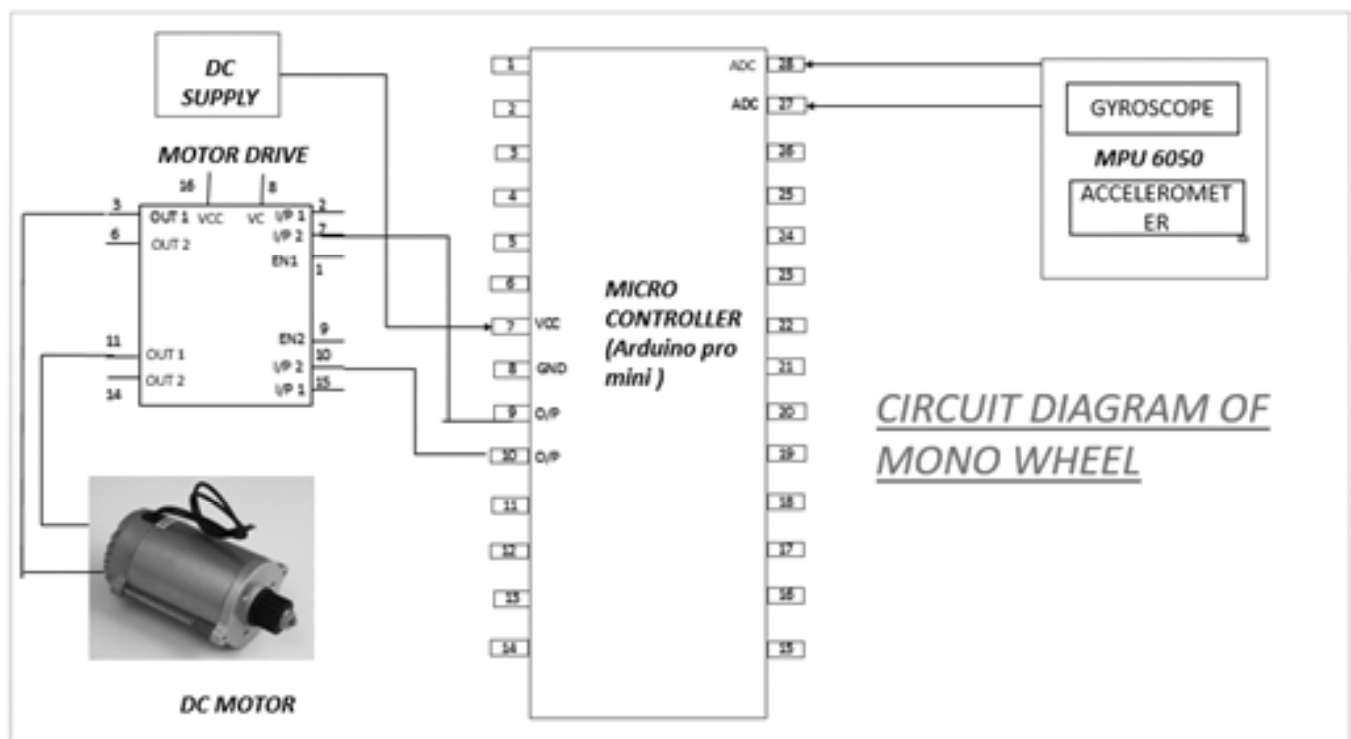


**Figure 2: Connection Diagram**

The motor run clockwise and anti-clock wise direction depending on the output of the microcontroller. We are connecting the motor to the pin no 3, 11 of the motor driver. To supply the voltage to entire circuit we are connecting the 12v DC battery to the pin no 7 of microcontroller.

The flow chart (Figure. 3) shows the control program structure of the self-balancing personal vehicle. In this program structure, the output result from the accelerometer and gyroscope sensors are sent to microcontroller. These are fused to get the exact tilt of the vehicle. Controller receives commands from rider and controls the vehicle motion in its direction. User can control the vehicle motion in 4directions: Forward, Backward, Left and Right.

## 4.  ALGORITHM

STEP-1:   MPU-6050 sensor will measure the both angle and acceleration.

STEP-2:   Output from sensor is collected by micro controller as input.

STEP-3:   Micro controller will adjust the angle and acceleration according to the set value given.

STEP-4:   If angle is "0" no output is given, if angle is less than 180 it will move forward, if angle is greater than 180 it will move backward.

STEP-5:   Motor diver will collect the output from microcontroller and provide the required voltage to motor.

STEP-6:   Motor will receive voltage from motor driver and move forward or backward as order given from microcontroller.

The flow chart describes the process under done in the microcontroller at first the MPU-6050 sensor will senses the both angle and acceleration and sends the output to microcontroller and it will measures the input angle and acceleration and change them to predetermined measurement and provide the required output to the motor driver this motor diver receive the 5v as output and act as a gate between battery and motor and supply 20v to motor. According to the information provided by the micro controller the motor move front and back directions.

## 5.   DISSUSUION

Now a days it became big problem to travel long distances in industries like from one control room to another control room. If we use motor vehicles which will cause pollution that will effect a lot of thing in
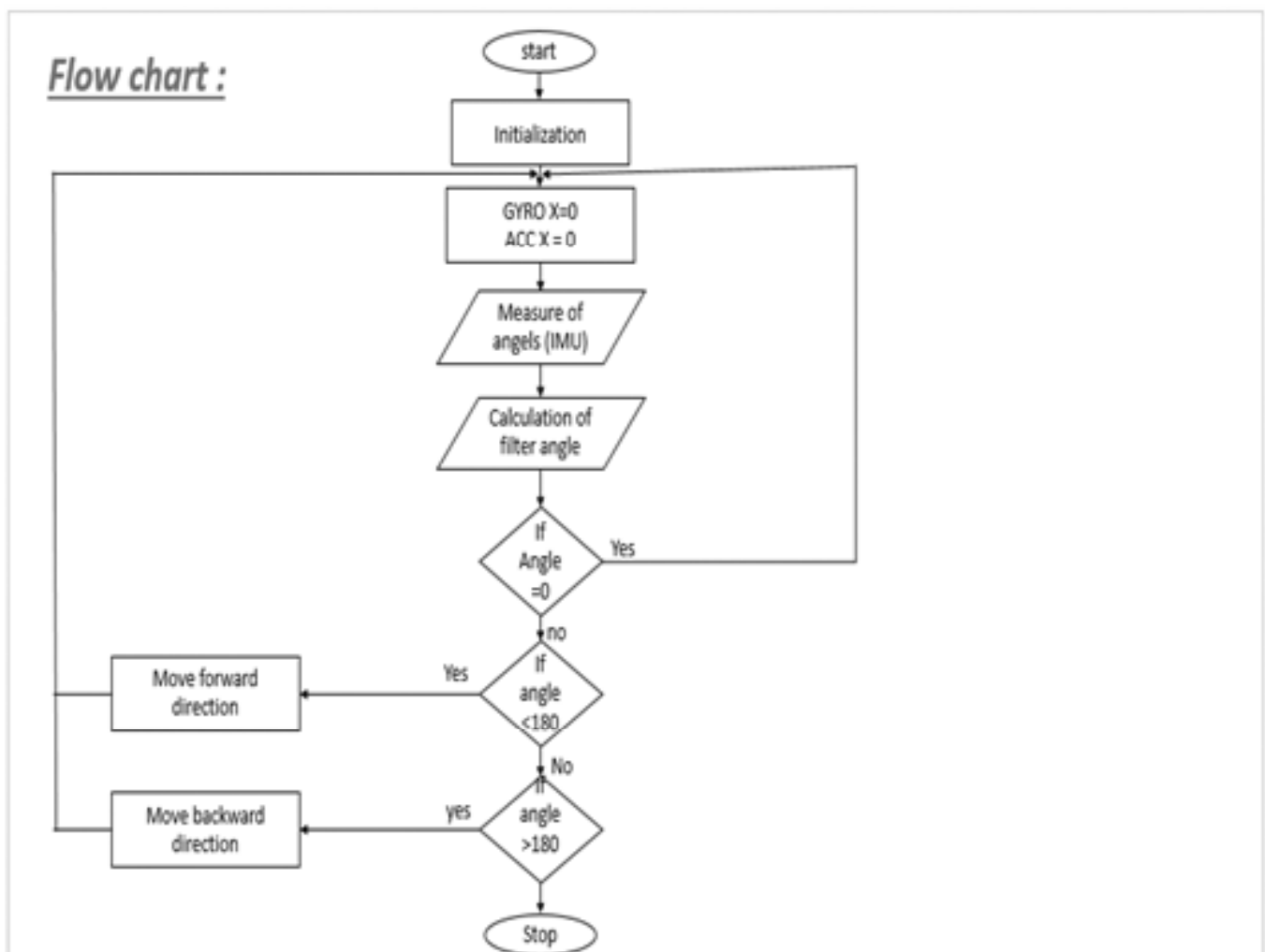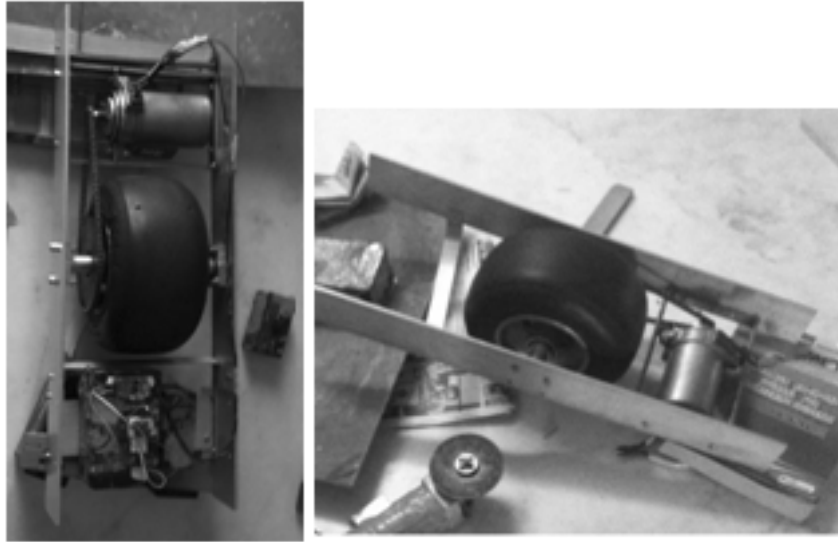


**Figure 3: Flow Chart**

**Figure 4:**

industries. Mainly in space centre from lab to another lab the distance will be very long and scientists will get tried to move in such large areas. If they use petroleum vehicles it cause huge pollution that will affect many instruments in space centre to avoid this we can use a personal vehicle which consume only electrical energy rather than petroleum products. Mono wheel is small vehicle while compare to other transport devices. The main unique thing form other vehicle is that it consists only one wheel. The design is completely different from other vehicles it is eco free device.

## 6.    RESULT

The design of mono wheel is simple. We can easily operate this device without any complexity it is very small in size with a single wheel. The self-balancing technique using with microcontroller make this device simpler. The above will show the mono wheel with internal connection. we use Go-kart wheel so that we can easily balance the device with no complexity.

## 7.    CONCLUSION

This design and the development of mono wheel is self-balancing personal transporter which has ability to carry single person to move from one place to another within the large campus. The vehicle will balances itself by moving the device in forward direction or backward direction base on the readings from sensors. Thus the mono wheel is much helpful in the large campuses like airports, universities, space centres and in large industries etc. This system reduces the work of humans as well as no pollution it provides eco-friendly environment.

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