

HYBRID POWERED SELF BALANCING PERSONAL TRANSPORTER

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Abstract - The personal transporter is self-balanced with an aid of a motion Processing Unit (MPU6050) which include a gyroscope and an accelerometer sensor for automated calibration and orientation. The personal transporter is driven by two 350 watt DC motors that's powered by using 25volt~10amp lithium- ion (Li-ion) battery and 20watt~12volt solar panel. The solar panels are one of the charging source. by means of using solar strength added through solar panels the using range of this transporter has been prolonged. A solar charger controller is used to modify the charging output of the solar panels. A Motor driving force Module is connected to DC motors, it act as a Differential to govern the speed and path of rotation of the DC cars. A dead man's switch is used as a safety characteristic, to keep away from any accident in case a driving force fall off from the transporter whilst driving. private transporter currently available is highly-priced, so we have determined to design and fabricate it at low-cost. The goal of the venture is to layout and deliver zero pollutants, compact, handy, sensorized, and cost-effective cars.

Key Words: DC motors, gyroscope, accelerometer, solar panel, lithium-ion.

1.INTRODUCTION

In 2001, Dean Kamen invented the first electric powered, self-balancing personal transporter. it is a zero-emission vehicle, hence its use in every day life will cause no harm to the environment. it's far quicker than pedestrians and might pass across the streets hastily. because it runs on electric powered electricity, it's far green and comparatively cheap to keep. however the personal transporter presently to be had in the marketplace is high-priced to buy, in an effort to make it much less-costly and comparatively greater efficient this challenge is being fabricated. The concept of this challenge is stimulated by means of the currently available personal Transporter through using a Hybrid supply of strength to run it.

The personal transporter is driven in forward and backward path with the aid of motive force leaning the handle in the direction of the respective direction. And can be turned in both direction by simply tilting the handle towards the corresponding direction. The device that keeps the personal transporter in upright function at the same time as driving, is called MPU (motion Processing Unit). The MPU is commonly consist of Gyroscope sensor and Accelerometer sensor,

each those sensors calibrates the location and orientation of the personal transporter to keep it balanced and in upright position. The Microcontroller acts as the brain of the personal transporter. It receives the important data from Motor driver Module and MPU, and commands them correspondingly.

This Hybrid Powered vehicle is the one of the most convenient and environment-friendly mode of transport. As it is convenient to experience, it is able to also be driven by youngsters of unique age and old people. it can run with the rate of 25-30 Km/h.

1.1 COMPONENTS:

1.1.1. CHASIS:

Chassis plays an important role in this vehicle, as it has to withstand the load of the driver and all the components that has to be mounted on it. The factors that were taken under consideration while selecting the material for chassis are:-It should have considerable amount of strength and hardness. It should be of light-weight. It should be easily Machine-able to carry out various machining operations. It should be cost-effective. Fig-1

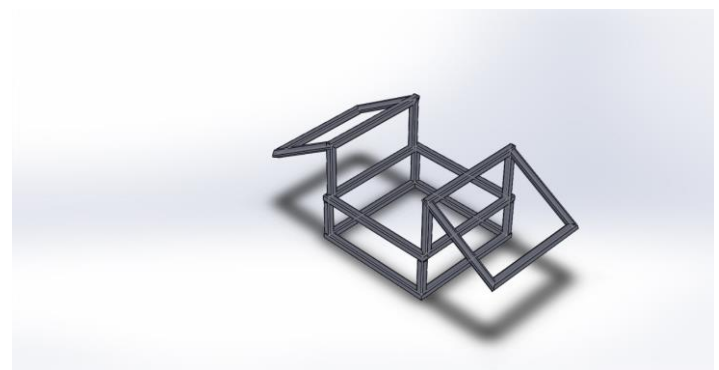


Fig-1:Chasis.

1.1.2. DC MOTOR:

The major reason for selecting this PMDC motor is due to its high power output and torque. It has high load carrying capacity. It has required magnitude of speed,

since this project has a driving speed of 25-30 Km/hr.Fig-2



Fig-2: DC motor.

1.1.3. BATTERY:

Battery is a used as main power source. Factors that were taken under consideration while selecting the suitable battery, Fig-3

✓ **SPECIFICATIONS :-**

- OUTPUT VOLTAGE :- 25 V
- RATED CAPACITY :- 10 Amp
- CHARGING TIME :- 4 Hours.



Fig-3: Battery.

1.1.4. TYRES:

The tyres are one of the essential member of a vehicle as it transfer a vehicle's load from the axle through the wheel to the ground and to provide traction on the surface over which the wheel travels.Fig-4

- ✓ **Specifications :-**
- RIM SIZE: - 16 in.
- ASPECT RATIO :- 90/90
- SPEED RATING :-100kph.



Fig-4: TYRES.

1.1.5. SOLAR PANEL:

Solar panel is an assembly of photovoltaic cells mounted in a framework. These photovoltaic cells uses sunlight as a source of energy and generate DC electricity. It is also known as PV module. In this project, solar panels are being used as an additional power source or in other words, as a power backup source. Two Solar panels are being used, each mounted on the either sides of the vehicle, above the tyres.Fig-5



Fig-5: Solar Panel

1.2 ELECTRONIC COMPONENTS:

1.2.1 AURDUINO:

The signal from the gyroscope is coupled with the Arduino. That signal gets verified with Arduino. The output from the Arduino is given as input signal to the motor driver circuit.

Fig-6 AURDUINO.



Fig-8: Bts 7960 motor driver.

1.2.2. MPU 6050:

In this project, MPU6050 sensor is used. Because, it has an additional feature of on-chip Temperature sensor. It is a complete 6-axis Motion Tracking Device. It is a combination of 3-axis Gyroscope, 3-axis Accelerometer and Digital Motion Processor. The supply to the sensor is given by the battery. The gyroscopic sensor is used to sense all the 3 axis X, Y, Z axes at the same time. The MPU6050 consists of 3-axis Gyroscope with Micro Electro Mechanical System (MEMS) technology. It is used to detect the rotational velocity along the X, Y, Z axes. When the gyroscope is turned left, the low signal is given to the Arduino, based on the Arduino programming one relay gets ON and the chariot turns left and vice versa. For forward motion of the chariot, both relay gets ON and the chariot moves forward. Fig-7

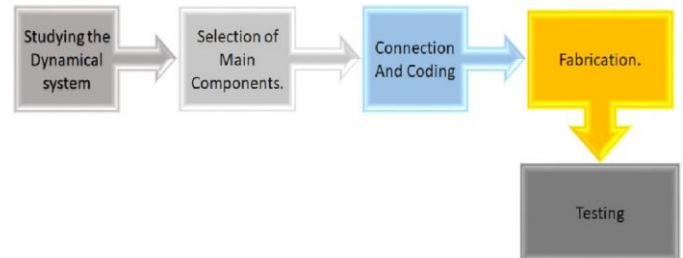


Fig-7: MPU 6050

1.2.3. BTS7960 MOTOR DRIVER:

The Motor Driver 7960 is a fully integrated high current half-bridge, to drive motor. Motor Driver act as an interface between the motors and the control circuits. The function of motor drivers is to take a low current control signal and then turn it into a higher current signal that can drive a motor. Fig-8

2. METHODOLOGY:



2.1. HOW IT WORKS?

It mirrors simple human actions. To move it in forward and backward direction, the driver has to simply lean in the respective direction. To turn it, the driver has to tilt the handle towards the desired direction.

2.2. BLOCK DIAGRAM:

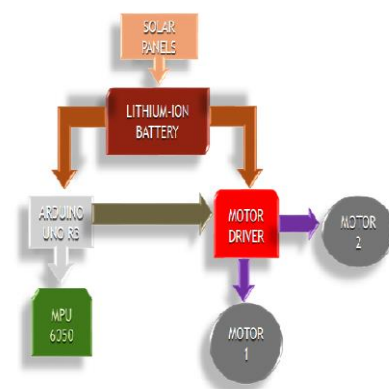


Fig-9: Block diagram.

The above figure shows the flow diagram of the hybrid two wheeler self-balancing vehicle. The polymer-lithium-ion battery is connected to solar panel through a charge/ discharge switch to control the flow of solar power and deliver it when required. The battery is directly connected to the control module which consists of the microcontroller. The microcontroller obtains and process the data from the Motion Processing Unit (MPU) which includes Accelerometer and Gyroscope sensors. The primary function of these sensors is to send information about current orientation which includes pitching, yawing and rolling angles of the vehicle to the microcontroller. Thus, the motors are controlled by microcontroller after processing all these data.

A D.C motor is driven by solar energy. Solar energy is a natural resource available free of cost and in adequate quantity. The balancing of vehicle is achieved by using balancing wheels and other functions are carried out by using different electrical components. Whereas for turning and braking two separate switches are used which is connected to motor controller which controls speed of motor? A motor controller is attached at lower side of platform. Here battery, motor & pedestal bearing is mounted over platform. And using chain sprocket system transmission system is done and transmission is done to separate wheels using shaft.

2.3. TORQUE CALCULATIONS:

Maximum weight of rider = 80 kg

Chassis weight including batteries = 40 kg

Therefore, Total weight=120 kg (approx.)

Coefficient of friction between road and tire = 0.3

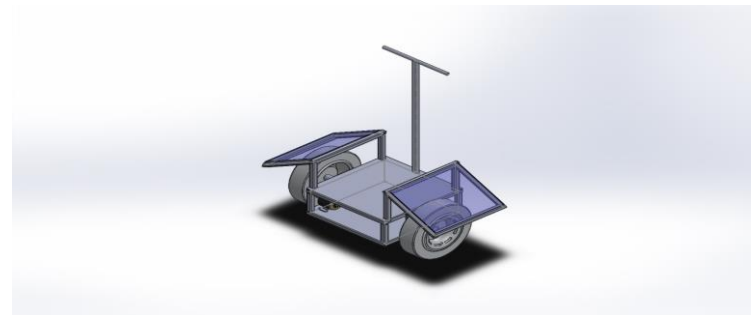
Torque required = Friction Force * Radius Of Wheel

$T = 120 * 0.3 * 25\text{cm}$ $T = 9 \text{ kgf-m}$ (Approx.)

As two motor are used.

Therefore torque required by each motor = 4.5 kgf - m(Approx.)

2.4. 3D CAD MODEL:



3. PROBLEM DEFINATION:

The present two wheeler self-balancing vehicle is expensive, less efficient and uses only one power source to operate i.e. electric. This made us to think and design such a two wheeler self-balancing vehicle which is comparatively cheap, more efficient, and will uses two power sources i.e. electric and solar. Thus, making it more economical, environmental friendly and beneficial to the society.

4. CONCLUSION

Design and fabrication of personal transporter with motor aimed zero pollution environment for considerable distance at very lower cost or zero cost. Solar energy are used at the place of top of mudguard to overcome the space issues to make it compact. Combination of solar energy and electric charging also known as hybrid technology will play an active role in personal transporter in the future.

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