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VAssistance: The Load Carrying Electric vehicle

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Abstract - *There is an increase in the transportation of goods in our day to day locality, like carrying books and electronics or lab components in schools and colleges, and we can see that to carry this load many institutes use man energy or else mechanical trolleys which again needs man energy to pull. So, the best solution to this problem, i.e. to reduce this, we have come up with a mechanical system named vAssistance. Basically, it's a five-wheeler system which will be driven on a PMDC motor with a load carrying capacity of up to 150kg. The system will consist of a high DC battery up to 24V. The main motive behind conceptualizing this project is that in today's modernized society every travelling vehicle runs on a non-renewable source of energy, but vAssistance doesn't use non-renewable resources to work, it purely works on the batteries and motor. In this paper, the development and designing of vAssistance are discussed. We have mainly focused upon the mechanical and electrical block diagrams of the system, and the different sensors which are used to detect various parameters, i.e. speed, load, battery level and banking of the surface on the LCD display.*

***Key Words*: E-vehicle, five-wheeler, sensors, non-renewable energy, load carrying.**

1. INTRODUCTION

It is a five-wheeled, battery-powered electronic vehicle that maintains its own balance with that of the load which is placed on the vehicle with the passenger who is riding it. It has two parallel wheels at the back, both the wheels are fixed wheel to the rod. There is a single wheel at the front which will help in giving the direction to vAssistance. We are also using two caster wheels in the middle for additional safety support to the system. vAssistance also has brakes, accelerator i.e. throttle and handgrips for making turns.

One of the important tasks of any mechanical vehicle of any kind is to be able to acquire knowledge about its environment. This can be done through the use of sensors. In our system we are also using various sensors to configure different parameters of the vAssistance i.e. we are using a magnetic reed switch for finding the speed of the vehicle, a MPU6050 chip to find the banking angle, load sensor to know how much load is present on the system, and a battery display to find the battery level. All these sensors are connected to an Arduino Mega and are programmed on Arduino IDE.

The project has been developed by taking consideration and awareness of the environment. No non-renewable energy can be used in the proposed system since the system completely runs upon electrical energy. The vAssistance runs on the battery that is powered by DC charging. The power is supplied to the motor, thereby supplying this power to drive the other gear components. The main moto of vAssistance is that it is user-friendly, economical and relatively cheap, no hazardous effects should be caused to the environment and the efficiency of this system should be best.

Finally, our aim is to build a fully functional five-wheeler vehicle which can be used as a means of transportation for a single person, and to design a small footprint electronic vehicle which will promote more environment-friendly and energy-efficient transportation methods to make a "SMART CITY".

2. PROPOSED SYSTEM

When we buy a cycle, it allows us to travels only by pedaling, but in vAssistance, it allows you to ride only till the battery is charged up. So, this project basically consists of a system having combinational benefits like a five-wheeler which allow the rider to use it in the electric mode by using motor and battery, also batteries can be charged using DC charging using plugging adapter. So, a battery is connected to the motor controller via ON/OFF switch, PMDC motor, brakes and throttle is connected directly to the motor controller and to the power lock of the motor controller a key is connected to start the system. The basic electrical block diagram of the vAssistance is shown in fig. 1

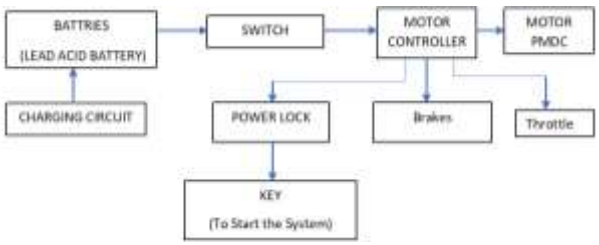

Fig -1: Electrical block diagram

3. DESIGNING

First, we started with the design of the mechanical diagram of the system. So, we decided the dimension of vAssistance and on AutoCAD we designed our orthographic design with

all the dimensions by taking into consideration, front and back wheel dimension i.e. 6-inch diameter front wheel and 8-inch diameter back wheel. As we are riding the vAssistance on steep slopes, so there should be the ground clarence. Therefore, apart from the motor, all the other components are placed on the cheesy.fig.2 is the AutoCAD design of the vAssistance. After completing the orthographic design to have the isometric design we used the SketchUp application, fig.3 is the SketchUp design of the vAssistance.

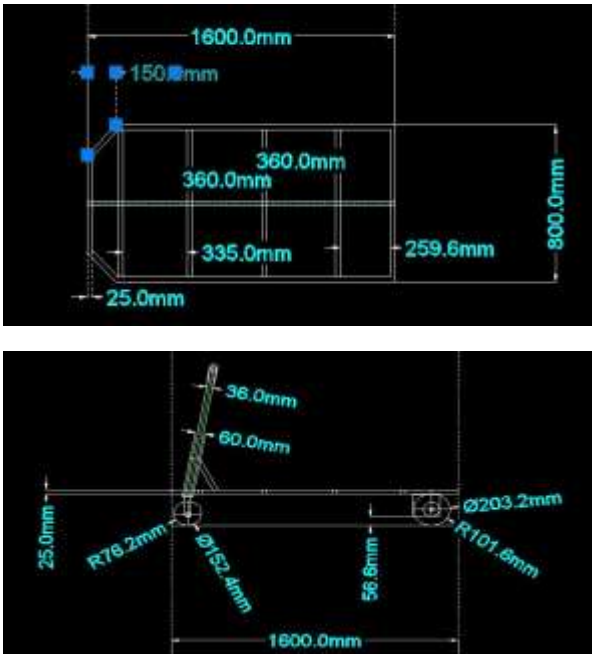

Fig -2: AutoCAD Design

Fig -3: SketchUp Design

Our designing goals where the speed of the vAssistance should be controlled by the rider, turning should be controlled by tilting the handlebar, for the reverse motion we use DPDT switch, balance and transport weighting is up to 150kg including the rider, be strong enough to handle the minor bumps and going up and down curbs at low speed and to propel the vehicle safety the maximum speed should be 15km/h.

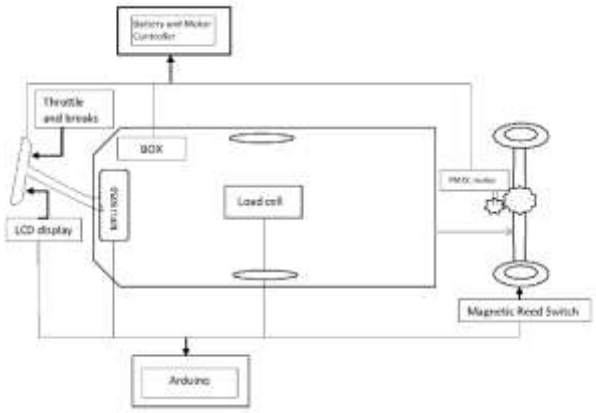

Fig -4: Block Diagram

It is very important for every system to know its own parameters at which they are working. To know all these parameters there are particular components i.e. sensors are available which need to build in the system. fig.4 is the block diagram of the system in which all the sensor and its connection and alignment are shown of our system.

Every system consists of inertial measurement unit, as initially the system should take all the inertial input. In vAssistance these inertial inputs are speed of the system, angle at which the system is riding on the surface and the amount of load system is caring. All these parameters are displayed in a 20X4 LCD and all these sensors and LCD is connected to Arduino mega and programmed on Arduino IDE.

Here for speed we are using magnetic reed switch, there are two types of reed switch i.e. Normally open (NO) and normally close (NC), in our system we are using normally open switch. To interface magnetic reed switch with Arduino we use voltage divider circuit. Here for the connection of the reed switch we are using 1K pull up resistor, so when the switch is open Vo is +5V and when it is closed it will give output as 0V. Since it is a magnetic switch the switch will get open in the presence of magnetic field.

Another important parameter which vAssistance needs to detect is the amount of load which is carried by the system. Since our designing goal was of the intaking a maximum load of 150kg with the rider. So, a 150kg load cell is used in the system. To drive this load cell we use a load cell driver i.e. HX711balance module. This chip is designed for a high-precision electronic scale, it also has two analog input channels. There are four wires coming out of load cell and these wires are connected to HX711 balancing module and further, it is connecter to Arduino to configure the load cell.

As we are designing the system for riding it on slopes also so it is important for us to know the banking angle so clear

ground clearance is maintained for that we are using an MPU6050 sensor. MPU6050 is an I2C module which consists of 3-axis Accelerometer and 3-axis Gyroscope help us to measure the banking angle.

As it is a battery-driven system so it is important to know the voltage level of the battery because as when the battery gets drain out, we need to charge it. So, it's very important to charge the battery time to time for that digital battery voltage indicator is used. This indicator is installed near our main LCD display.

4. CONCLUSION

In the course of this project, we have designed the public usage transport with the more efficient use of energy by providing the alternatives to form an eco-friendly system by the fusion of some relevant concepts like electric bike and a load-carrying vehicle by providing all the required parameters to drive the vehicle. This project was implemented with an idea to find an effective solution to the mechanical trollies which required man energy to pull. The main objective is to achieve use of less mankind energy and removing the fuel consumption especially for commuting over shortest distance.

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