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Electric Vehicle

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***Abstract*: This paper provides an overview of recent work in Electric Vehicle in the region. The paper describes the development and the comparison of different parts of components. The major components are battery technology, charger design, inverter, motor controller, and sensors are examined. This component of electric vehicle are analyzed and speed control strategy of motor is proposed. The design scheme of controller based on the brushless DC motor. The main inverter and hardware circuit of driving part is designed and software control program is proposed. In response to designing and supplying an inverter kit to provides PWM pulse to the brushless DC motor. The system design is based on mechanically coupling brushless DC motor as the primary power source to drive the Vehicle and electrically wiring the motor together with a DC rechargeable battery and applying a programmed microcontroller as a control mechanism for effective and efficient transmission from source to motor. The paper finally shows the Electric Trike prototype as a conclusion of the papers.**

***Keywords*: Battery, Brushless DC motor, Three phase inverter, Aurdino Uno, Sensors.**

1. Introduction

In the world we see that there are many types of cars and bikes. So we know that world's population is growing day-by-day and the number of trees decreasing which we call as deforestation. Due to this, many harmful chemicals are emitted in the atmosphere. Keeping this all situation in mind, we have implemented a project called as E-Vehicle.

We are making Electric Vehicle (E-Vehicle) for agricultural purpose as well as for handicap persons. This vehicle runs on the electricity. The vehicle is mostly preferable to the farmers. Because, cost of the car is very low and also maintenance required for the vehicle is very low as compared to other car. Main feature of our project is to run E- vehicle on electricity so, the pollution will be reduced also requirements of fuel is reduced. Due to that, our environment makes ever green. The goal of the Electric Vehicle Project is to bring increased mobility to disabled persons in India and also used for agriculture purpose. Hand-powered Vehicles are used by many of the disabled in this community, but some current users of the hand-powered Vehicles do not have the physical strength or coordination to propel themselves on the Vehicle with their arms and hands.

2. Methodology

The design of the electric vehicle is adaptable to the current hand-powered Vehicles with little modification. The design consists of an electric motor, a drive system, motor and steering controls, and a power supply. See picture below for design schematic:

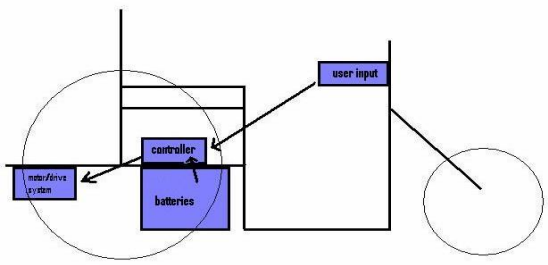

Fig. 1. Design schematic

An electric motor was chosen because high fuel costs prohibited the use of a combustion engine and because of the availability of electricity in India. A solar array that provides electricity for the Handicap Center provides the ideal source of electricity for battery recharging.

The first aspect of our design that was addressed was the drive system or means of power transmission. Power must be transmitted from the electric motor to a rear wheel of the Vehicle. Second, a method of motor control was decided on. The controls for motor speed and braking were incorporated into a simple mechanical joystick to facilitate operation by users with limited dexterity. The hand-power system was replaced with a steering system that disables the hand-power capability of the Vehicle. Third, power is supplied to the motor by a battery pack.

All the above components (motor, transmission, controls, batteries) were designed to be able to be installed on the existing hand-powered Vehicles. Everything necessary to convert a hand-powered Vehicle to the Electric Vehicle is simple to install, and the conversion is reversible.

3. Block Diagram

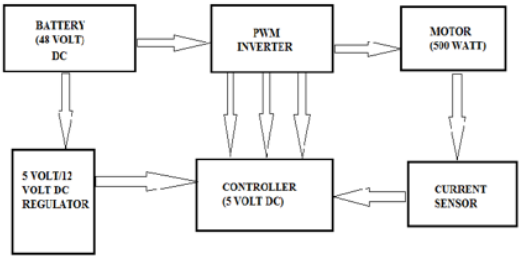

Fig. 2. Block diagram

A. BLDC Motor

Brushless DC motor is widely used in Electric Vehicle. The motor has three phases and commutation is performed electronically. To run the motor a three phase inverter is necessary. Sensing rotor position is very important to generate proper switching sequence for three phase inverter. Three phase inverter is simulated and hardware in this paper. This drive system can change the speed of motor as well. Microcontroller is very useful because of its several features such as faster speed, small cheap size, low cost and most importantly easier trouble shooting. In this design microcontroller is used to generate required switching for three phase inverter. Microcontroller senses the signal from motor and PWM signal which is generated from an electronic circuit. The generated pulse from an electronic circuit. The generated pulse from microcontroller is send to the gate driver circuit which drives. Three phase inverter is implemented for a 48 volt, 12amp, 500 watt BLDC motor. Thus, motor runs successfully by the inverter.

Operating Principle of BLDC Motor and Inverter Design:

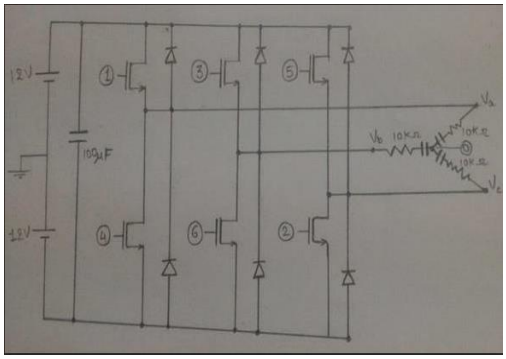

Fig. 3. Equivalent circuit of BLDC Motor with three phase inverter

Here, R & C represents motor resistance and capacitance respectively. V_a, V_b and V_c are the back Emf of BLDC motor. 24-volt battery supply and 100micro Farad is the capacitor of the inverter. This inverter consists of six switches 1to6. The three phase output is taken from a, b and c.

To run the motor, the desired switching of operation is shown in below fig. 3, Firstly 1 and 4 switches are turned ON and the current flows from battery to motor (Bold red line). During this switching the motor inductor stores energy and in the next cycle switch 1 is turned OFF and switch 4 is still ON. The inductor releases its energy via switch 4 and freewheeling diode of switch 2(Dotted green line). This operation is described for 1 step (60 degree). Similarly, there will be total six steps (because 1 cycle is 360 degree). In the describe state switch 4 is always ON and switch 1 is operated by PWM.

BLDC Motor operation is dependent on the rotor position which is detects zero crossing point of back EMF induced in motor winding. Necessary switching is done is based on back EMF signal. But sensor less BLDC, elimination of position sensor and its connection between control unit and motor.

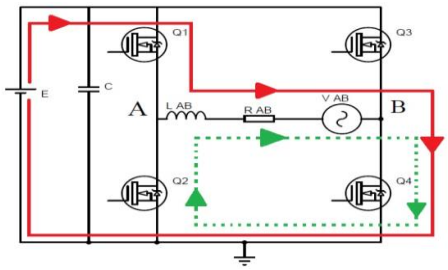

Fig. 4. Operation of motor

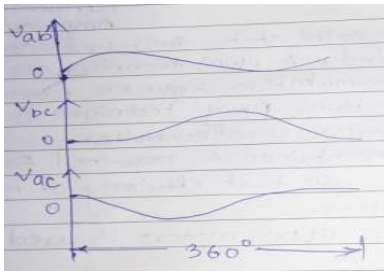

Fig. 5. Waveform of Back-EMF

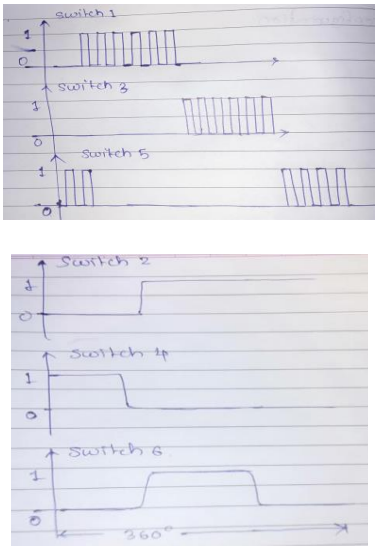

Fig. 6. Switching of Motor

B. PWM Inverter

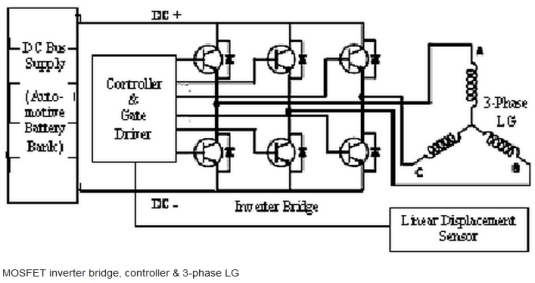

Fig. 7. Inverter

Inverter drives for automotive applications transform the DC voltage from the battery to an AC sinusoidal waveform at a designated frequency fed to the motor. In other words, output voltage and frequency are controlled electronically.

By the width of pulses of voltage to the motor. The duty cycle of the output is changed such that the power transmitted is exactly that of a sine- wave. Basically, this technique requires six inverter power devices to switch continuously on and off to create an AC voltage. To make this possible, the inverter uses a switching or carrier frequency set in a range from 2- 15kHz. The electric motor, such as an BLDC, convert this constructed electrical energy into mechanical energy.

C. Battery

Fig. 8. Battery

We are offering our customers long life Super Power Rechargeable Li-ion E-Bike Battery Pack 48V 20Ah, which are available following,

Specifications
Parts included
Warranty-2 Year
Lithium Battery with case
Built-in BMS board
Charger(48V)

Advantages:

- Fast charging.
- Large overcharge tolerance and safe performance.
- Self-balance.
- Simplifying battery management system (BMS) and battery charger.
- Longer cycle life.
- High temperature performance.
- Best offer.
- Long life cycle.
- Top quality.
- *High energy.*

Application:

- E-Bike
- E-Scooter
- Electric Scooter

D. Controller

Fig. 9. Controller

In this project we have to use this controller in this project we have to make this controller.

E. Arduino

Arduino is an open source electronics platform based on easy to use hardware and software, Arduino board are able to read inputs light on a sensor, figure on a button, or a twitter message and turn it into an output activating a motor turning on a LED publishing something online.

Fig. 10. Arduino Uno

4. Hardware used

Fig. 11. Vehicle

5. Conclusion

In this paper three phase inverter is designed to run a BLDC motor. The operating principle of BLDC motor switching is done by providing PWM pulses to inverter. Necessary gate driver IC is also used for operation of the inverter. The six pulses are generated through microcontroller (Arduino Uno) by giving program. Thus, results motor runs successfully.

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