CONTROLLER OF E-RICKSHAW

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Abstract: In the coming years the electronics industry is going to boom as embedded system is finding application in more and more everyday applications .Because of increase in population the problems like pollution, etc. will also increase. This will be because of the increment in the number of vehicles. In this project, the controller of electric rickshaw is made. We know that the electric rickshaw is indeed an ecofriendly mode of transportation. Here by using an Arduino, the controller is designed. This will include the throttle control, break system control, charge control, ignition point control and motor (BLDC) control.

***Index Terms* - Arduino, BLDC motor, Inverter**

I. INTRODUCTION

Electric rickshaws (also known as electric tuk-tuks [1] or e-rickshaws [2]) have been becoming more popular in some cities since 2008 as an alternative to auto rickshaws and pulled rickshaws because of their low fuel cost, and less human effort compared to pulled rickshaws. They are being widely accepted as an alternative to petrol/diesel/CNG auto rickshaws. They are 3 wheelers pulled by an electric motor ranging from 650-1400 Watts. They are mostly manufactured in India and China, only a few other countries manufacture these vehicles. Battery-run rickshaws could be a low-emitter complementary transport for the low-income people, who suffer most from a lack of transport facility, if introduced in a systematic manner according to experts. It receives input from the throttle and the controller decides the speed to be provided to the motor [1].We here are using PWM technique for the design. This includes an inverter system to convert DC supply in 3 phase AC supply to drive the BLDC motor. For simplicity the controller is split in to two major sections. One, the controller section which consists of a microcontroller unit and the second is the section of output buffer unit which performs the inverting operation[2].The basic layout from the design perspective is as shown below along with its wiring diagram.

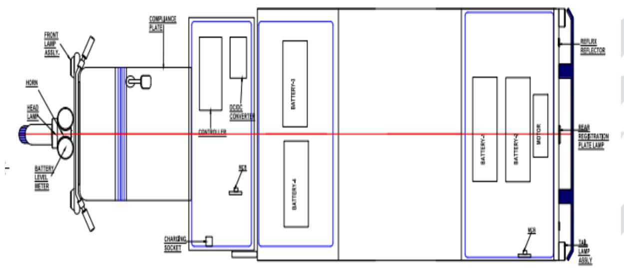

Fig. 1.1 Rickshaw

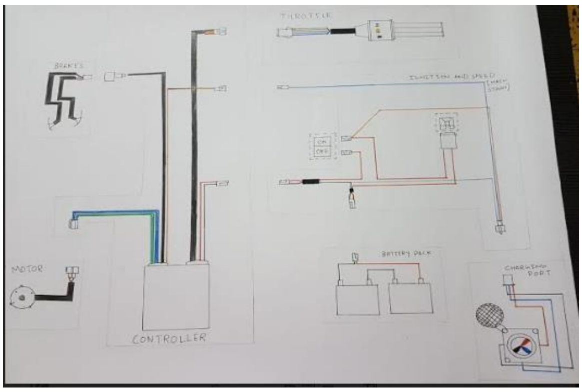

Fig. 1.2 Block Diagram

II. RESEARCH METHODOLOGY

(ii)BLDC motor

The brushless DC (BLDC) motor is becoming increasingly popular in sectors such as automotive (particularly electric vehicles (EV)), HVAC, white goods and industrial because it does away with the mechanical commutator used in traditional motors, replacing it with an electronic device that improves the reliability and durability of the unit[3].Another advantage of a BLDC motor is that it can be made smaller and lighter than a brush type with the same power output, making the former suitable for application where space is less. The downside is that BLDC motors do need electronic management to run. For example, a microcontroller – using input from sensors indicating the position of the rotor – is needed to energize the stator coils at the correct moment [3][4]. Precise timing allows for accurate speed and torque control, as well as ensuring the motor runs at peak efficiency. The specification of the BLDC motor which is used in this project is as follows:

1. DC/AC/Number of phases: DC 3 Phase
2. Brush/Brushless: Brushless
3. Voltages : 48Vdc
4. Rated Power: 800W
5. Speed:2000-500rpm
6. Rated torque:10Nm
7. Efficiency: >90%
8. Low noise, high torque.
9. Excellent performance

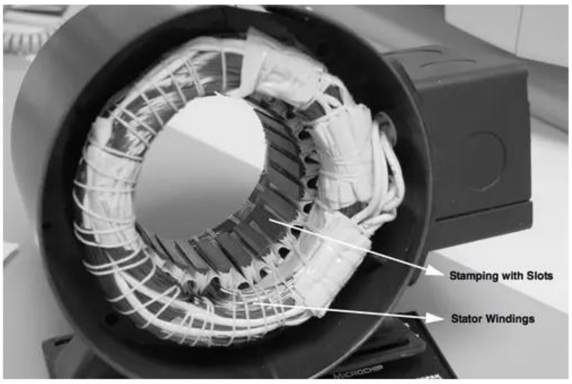

Fig 2.1 BLDC motor

(iii)Inverter:

The circuit diagram of the inverter used in this project is shown below:

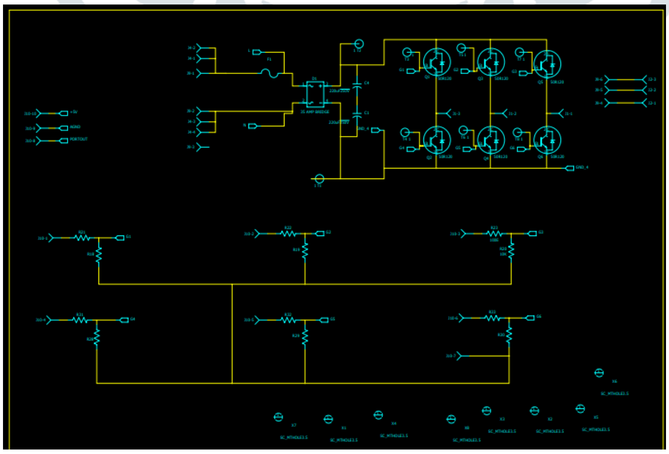

Fig. 3.1 Inverter circuit

The working principle of the inverter is as follows:

A power inverter, or inverter, is an electronic device or circuitry that changes direct current (DC) to alternating current (AC). The input voltage, output voltage and frequency, and overall power handling depend on the design of the specific device or circuitry. The inverter does not produce any power; the power is provided by the DC source.A power inverter can be entirely electronic or may be a combination of mechanical effects (such as a rotary apparatus) and electronic circuitry [5]. Static inverters do not use moving parts in the conversion process. Circuitry that performs the opposite function, converting AC to DC, is called a rectifier [4]. An inverter does the opposite job and it's quite easy to understand the essence of how it works. Suppose you have a battery in a flashlight and the switch is closed so DC flows around the circuit, always in the same direction, like a race car around a track. Now what if you take the battery out and turn it around. Assuming it fits the other way, it'll almost certainly still power the flashlight and you won't notice any difference in the light you get—but the electric current will actually be flowing the opposite way[4]. Suppose you had lightning-fast hands and were deft enough to keep reversing the battery 50–60 times a second. You'd then be a kind of mechanical inverter, turning the battery's DC power into AC at a frequency of 50–60 hertz.

IV) Controller

The actual footage of the controller is as shown below:

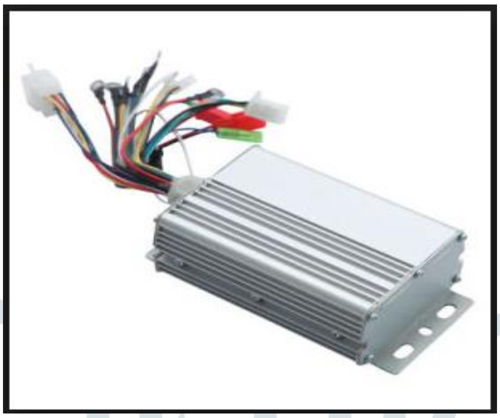

Fig.4.1 Controller

The controller is a device that serves to govern some predetermined manner the performance of the electric motor. This includes the manual or automatic switch on or off of the motor [6].Some of the function done by the controller of the electric device is regulation of speed, limiting torque; protection against the overload, etc.The controller is FLASH controller. The motor controller is connected to the battery pack. It feeds input to the BLDC motor, lamp, ac/dc convertor and
Speedometer/indicator [6][7].From the diagram we can clearly see the construction of the controller. The different wires coming out of the controller are for different systems which are present in e-rickshaw. These systems are break system, forward and backward movement, front panel, batteries and the back panel.

(v)Conclusion:

This design is thus designed for the controlling of the electric rickshaw with proper design conditions. Considering all the performance parameters like efficiency, durability, accuracy, etc. this project is satisfactory. With the results, we can exactly see the same thing

II.ACKNOWLEDGMENT

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REFERENCES

[1]Brushless DC Motor Primer," Muhammad Mubeen, July 2008.
[2]Brushless DC (BLDC) Motor Fundamentals," Padmaraja Yedamale, Microchip Technology application note AN885, 2003.
[3]Using the PIC18F2431 for Sensor less BLDC Motor Control," Padmaraja Yedamale, Microchip Technology application note AN970, 2005.
[4]AVR1607: Brushless DC Motor (BLDC) Control in Sensor mode using ATxmega128A1 and ATAVRMC323, Atmel application note, 2010.
[5]FCM8201 Three-Phase Sine-Wave BLDC Motor Controller," Fairchild Semiconductor application note AN-8201, 2011.
[6]Microcontroller based control system for electric vehicle,_2016 5th International Conference on Informatics, Electronics and Vision (ICIEV)
[7] Designing of a control scheme for the solar rickshaw in comparative study with conventional auto rickshaw,_2014 4th International Conference on Engineering Technology and Technopreneuship (ICE2T)