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DESIGN AND DEVELOPMENT OF SOLAR BASED E-RICKSHAW

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ABSTRACT

In the current state of technological development, the future of vehicles seems to be with the hybridization of various energy sources. This sort of development in vehicles seeks to take the benefits from the best quality of each energy source and it is especially useful in urban driving vehicles. In cities of India one of the major medium of transportation is auto rickshaws, which is producing a huge amount of air pollution as well as green house gases like CO_2 . Fuel, which is used is a non-renewable source and also which costs high as a result of that transportation charges increases. It would also affect the economy as well as the users of the auto rickshaw. Thus they should go for an reliable source as know that current trend of using the reliable source like solar which is available in plenty in country like India. Adopted SOLAR ENERGY as the additional sources in addition to the conventional IC ENGINES. they using the solar panel, controller and DC motor setup to convert the light energy as an electrical energy which is fed to the DC motor to obtain mechanical motion. The mechanical motion was transferred to wheels through chain drive in the propeller shaft which leads to cheap and effective transmission. Finally, fabricated a concept auto rickshaw with the help of modified transmission system and energized with solar energy to ran it.

Keywords: BLDC, Microcontroller, Voltage Regulator, Hardware Module Of Controller, Working Model.

I. INTRODUCTION

Tricycles or cycle rickshaws are driven by manual paddling, which is a very strenuous job for rickshaw pullers, on the other hand, auto rickshaws are driven by fossil fuel, which produces to much environmental pollution,, especially in the busiest streets of a city, where the average running speed can't be more than 15kmph. The solar e rickshaws which contribute less towards air pollutions and are completely driven by renewable energy.

II. SOLAR ENERGY UTILIZATION

Specification of solar module used

Whenever the designing of any system is considered the main thing that needs to be noticed will be the specification. In this project, panel specification need to be given for that the knowledge of surface area of the auto, power need to be produced by the panel and cost etc. plays a major role thus the following tabulation is referred in the Table. 1.

Table. 1 Specifications of solar panel

Type	**Mono-crystalline silicon**
Surface area	**12 sqft**
Power produced	**100 watts**
Voltage	**24 V**
Amps	**4.23 A**
Cost	**Rs.8000**

III. BRUSHLESS DC MOTOR

Brushless DC electric motor (BLDC motors, BL motors) also known as electronically commutated motors(ECMs, EC motors) are synchronous motors that are powered by a DC electric source via an integrated inverter/switching power supply, which produces an AC electric signal to drive the motor. A typical brushless motor has permanent magnets.

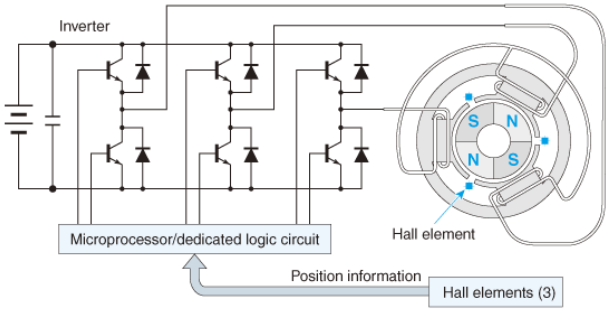

Fig.1. Schematic Diagram of BLDC with its controlling circuitry

which rotate around a fixed armature, eliminating problems associated with connecting current to the moving armature. An electronic controller replaces the brush / commutator assembly of the brushed DC motor, which continually switches the phase to the windings to keep the motor turning. Brushless D.C. motors have got higher power density than A.C. along brush D.C. motors. BLDC motors can also be less dangerous in touch with fluids than brush D.C. motors, and it also preferred because of its lifespan, higher efficiency, and low maintenance.

The wiring consists of four connections, namely A, B, C and Neutral/Common and each phase is divided into two equally separated windings. Six electrical commutations written in symmetric diagram allows one full rotation of BLDC motor driven in stepping mode. The driving method resembles method of driving a stepper motor. Mechanically, the respective six commutations in the symmetric diagram above can be illustrated as:

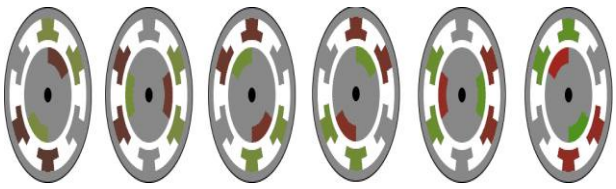

Fig.2. Six step operation of BLDC Motor

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IV. TRANSMISSION SYSTEM

When a vehicle is running, various resistances oppose it. In order to keep the vehicle moving at a uniform speed, a driving force or tractive effort equal to the sum of all the opposing forces has to be applied to it. If the tractive effort increases the total resistance affecting the movement of the vehicle, the excess tractive effort will accelerate the vehicle .If the tractive effort is less than the total resistances, the excess of the resistances will lower down the speed of the vehicle.

Vehicle acceleration = Tractive effort – Total resistance affecting the movement of vehicle.

V. MICROCONTROLLER

The AT89C51 is a low-power, high performance CMOS 8-bit microcomputer with 4K bytes of flash programmable and erasable read only memory.

Fig.3. Microcontroller

The AT89C51 provides the following standard features: 4K bytes of flash, 128 bytes of RAM, 32 I/O lines 216 bit timer/ counters, a 5 vector 2 level interrupt architecture, a full duplex serial port, and on-chip oscillator and clock circuitry. In addition, the AT89C51 is designed with static logic for operation down to zero frequency and supports 2 software selectable power saving modes.

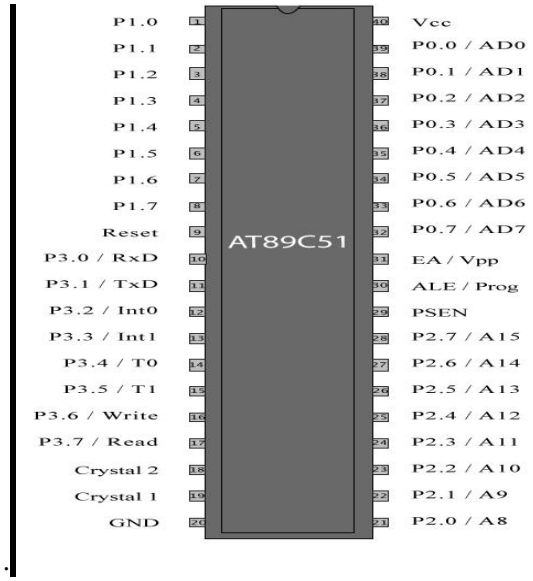

Fig.4. Pin diagram of Microcontroller

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VI. TIP122

Fig.5. Diagram of TIP122

It shows exceptional high gain performance coupled with very low saturation voltage

VII. VOLTAGE REGULATOR 7805 (5V)

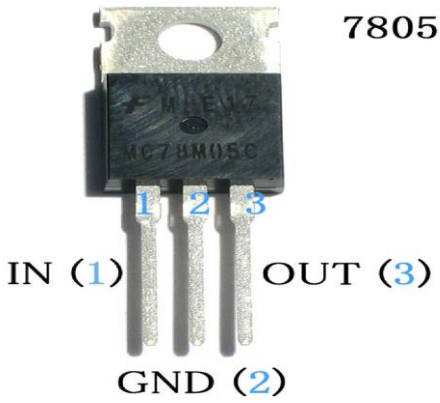

Fig.6. Voltage Regulator 7805

It employs built in current limiting, thermal shutdown and save operating area protection which make them virtually immune to damage from output overloads. 7805 is a 3 terminal positive voltage regulator. It can excess of 0.5 ampere output current. 8501 series have built in protection against a circuit drawing too much power and it also protect against overheating and short circuits, making them quite robust in most applications.

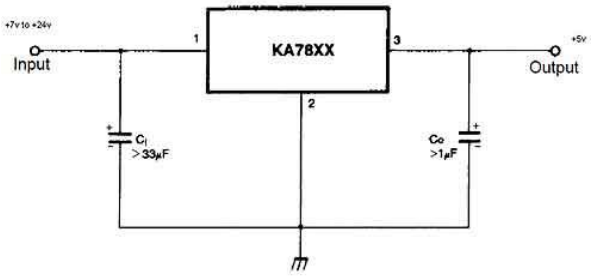

Fig.7. Circuit diagram of Voltage Regulator 7805

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VIII. HARDWARE MODULE OF CONTROLLER

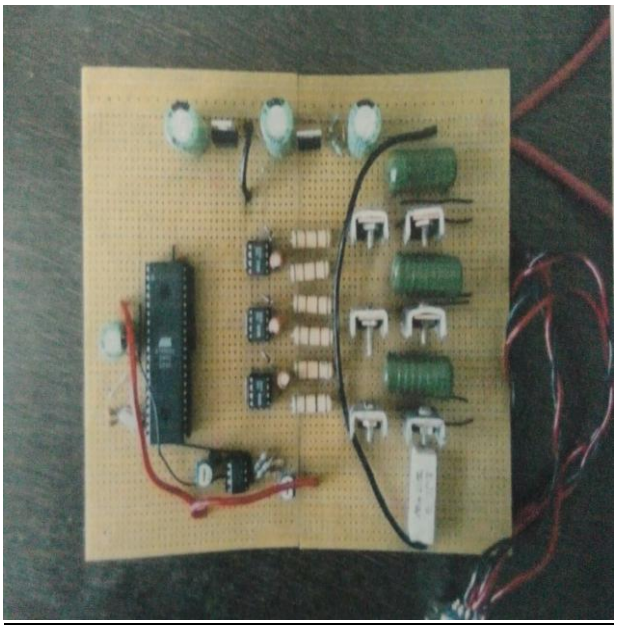

Fig.8. Hardware Module of Controller

IX. WORKING MODEL

Fig.9. Working model of Solar Based E-Rickshaw

X. CONCLUSION

To run this technology successfully, the solar energy is utilized in the maximum way with the help of calculations and as that the panel had been selected. From the panel used and the motor has powered, the backup source for the motor power is calculated. Finally, battery and controller are used. The vehicle would be running with help of solar-electric power one to two hours per day. As a result of that the air and noise pollution would be reduced up to 30% in urban areas. The fuel could be used very effectively and the city`s speed limit would be maintained to a great extent. The accidents could be avoided.

XI. ACKNOWLEDGMENT

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