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DESIGN OF AN INNOVATIVE AND EFFICIENT PERSONAL TRANSPORTER

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Abstract: ***Nowadays, every individual has a two wheeler and they are using this even for reaching short distances. By these conventional resources like petrol, diesel etc, are consumed more and more. Not only the depletion of natural resources, it produces more environmental pollution hazards. To overcome this, comparatively unconventional energy resources should be used. Even major industries and factories that span overlarge areas restrict the use of this type of transport by their employees within their premises to avoid the risk of contamination due to emissions. For this our efforts are directed towards developing an electric operated Personal Transporter. The main Objective of the project work is to design and implement an electrical vehicle with an acceleration and breaking functions with the feasible design which aims at lowering the cost of the electrical vehicle when estimated commercially in the product market. Practically tested it gives a speed of about 35kmph. It powers the prominence of 'Energy Efficiency 'by using the hub motor of 350W for its operation. Cut-off circuit is designed to automatically cut off charging for a 12V, 20Ah lead acid battery, which protects it from over charging. This project explains in detail the choice of motor, Controller, the chassis design and the need for an electrical vehicle and its advantages.***

I. INTRODUCTION:

It is a three wheeled electric vehicle in which one wheel is at front and two supporting wheels are at the back. In the Existing system there are two motors fixed at back wheels which leads to complex design and cannot bear huge weight. So, it is proposed to fix a single motor at front wheel through which the effect of weight on motor speed can be avoided.

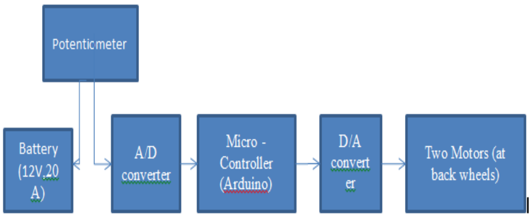


Fig 1:Block Diagram of Existing System

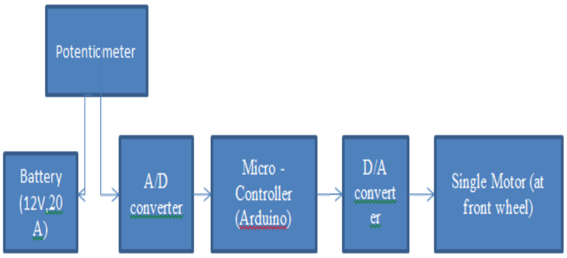


Fig 2:Block Diagram of Proposed System

The main components of personal transporter are
1. Motors
2. Controller
3. Battery

II. BLDC MOTORS:

BLDC motors, included as a separate section, are an interesting development which could offer benefits for electric vehicles. These motors have stators fixed at the axle, with the permanent magnet rotor embedded in the wheel. By directly driving the wheel, they eliminate the inefficiency transmission and chain connecting the motor to the axle. Other advantages include higher efficiencies, less space, and often easier servicing. The more traditional "exterior rotor" design has the rotor in a hollow cylinder shape and spinning around a stator axle. The rotor consists of permanent magnets, and this is a "radial gap" motor because the air gap between the stator and rotor extends in the radial direction.

CONTROLLER:

The key electrical characteristics of e-bike controller include

- **Battery Under-voltage Protection**

When the voltage of 48V battery drops to 41.5V, motor should be disconnected from the power supply in order to increase the battery life. After that, the motor will stop until the power supply voltage is charged above 44V for +48V battery. Note that the recovery voltage level is higher than that of under-voltage protection.

- **System Over-current Protection:**

When the feedback current going through the Power MOSFETs exceeds 15A, the motor should be shut down immediately. Restart happens when the current recovers to its norm.

- **Auto-cruising**

When the handle bar is held at a certain position for more than 8 seconds, the microcontroller will enter into auto-cruising mode. In this mode, e-bike will keep running at its current speed even if you let go of the handle bar. The Auto-cruising mode can be released if you turn the handle bar again or when the brake is applied.

III. REFERENCE DESIGN :

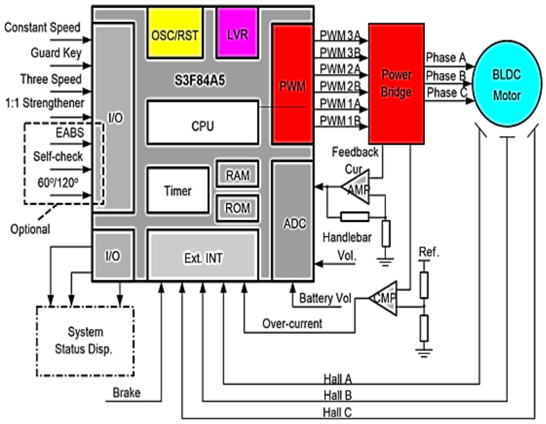


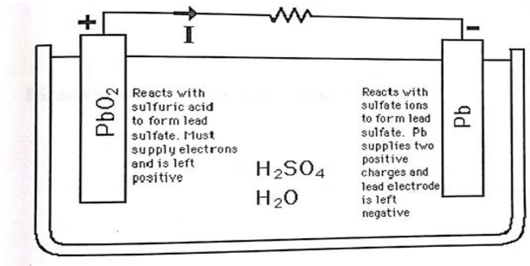
Fig:3 E-Bike Controller System Design

The Personal transporter controller system includes three stages.

Three external interrupts are used for getting position information from Hall sensors while one is used for brake mechanism. One timer is used for counting the Hall interrupts in a fixed time to get speed information. Three ADC channels are used for detecting battery voltage, handlebar voltage, and system feedback current. PWM output directly controls the power bridge. Different duty cycle results in different vehicle speeds. Remaining I/O can be used as advanced function input pins or system status indicating pins.

THE LEAD ACID BATTERY:

The oldest type of rechargeable battery in use is lead acid battery. Despite having and a very low energy-to-weight ratio and a low volume ratio, its ability to supply high surge currents means that the cells have a relatively large power to weight ratio.



These features, along with their low cost, make it attractive for use in motor as they are inexpensive compared to newer technologies, lead-acid batteries are widely used even when surge current is not important and other designs could provide higher energy acid designs are widely used for storage -availability settings like hospitals, and stand-alone power densities. Large-format lead in backup power Supplies in cell phone towers, high leg, modified versions of the standard cell may be used to improve Systems.

APPLICATIONS:

- Industrial use.
- It is convenient for Commuting, at crowded events for Security or for Recreational purposes.
- Used in Warehouse floor transport or anywhere you need to save time and steps.
- For physically challenged.

IV. OUTPUT RESULTS:

Specifications:

Battery:

Four 12V, 18 Ah Battery packs

Maximum current =4.5 Amps

Battery could continuously supply a current of **4.5 Amps** to a load for **4 hours**

Since (18/4.5) = 4 hours

Practical tested results:

LOAD(Kg)	SPEED(Km/hr)
60	30
120	23
170	20

An average for **1 hour** it will give **25 km.**
For four hours it will give 100 km.
Conversion from Km to miles:
1 mile =1.6 Km
So 100Km = 100/1.6Km = 62.5miles.

CONVERTED TO ENERGY:

Battery charge energy=12*18*4
=0.864KWh.

Mileage=0.864KWh/62.5 miles
=0.0138KWh/mile.

Motor Specifications:

Motor has 350W, 48v capacity.

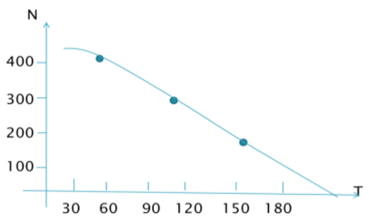
TORQUE CALCULATIONS:

T=F*r
$T=9.81*(S_1-S_2)*r$
Where;
T=Torque.
S=weight of the load.
F=Force.
r=Radius of the motor.
$T=9.81*S*10*10^{-2}$

For Different loads:

LOAD(Kg)	Rpm	TORQUE(N-m)
60	400	58.6
120	310	117.872
170	260	166.77

Relation between Torque &Rpm



V. **CONCLUSION**

The vehicle which we have developed is very much energy efficient & light in weight and last but not the least its costs is very less than an conventional stand up transporter namely Segway. It is environment friendly and easily movable in congested places.

ACKNOWLEDGEMENTS:

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REFERENCES

[1] http://www.segway.com/about-segway/segway-technology.php
[2] http://www.trikkeindia.com/about-trikke
[3] Budynas-Nisbett , Shigley's Mechanical Engineering Design (McGraw Hill Publishers, 2006)
[4] http://www.nissan-zeroemission.com/EN/HISTORY/LANDGLIDER.html
[5] http://designworksusa.com/design/lifeleisure/BMWStreetcarver/
[6] http://www.flexboardz.com/riders- area/atelier/technicz
[7] R. E. Sorace, V. S. Reinhardt, and S. A. Vaughn, "High-speed digital-to-RF converter," U.S. Patent 5 668 842, Sept. 16, 1997.
[8] (2002) The IEEE website. [Online]. Available: http://www.ieee.org/
[9] M. Shell. (2002) IEEEtran homepage on CTAN. [Online]. Available: http://www.ctan.org/tex-