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COST EFFECTIVE E-RICKSHAW USING BATTERY & PADDLE

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Abstract - Most of the cities in developing countries are highly polluted. The main reasons are the air and noise pollution caused by transport vehicles especially petrol-powered two and three wheelers mostly called auto rickshaws. An electric cycle rickshaw can provide a non-polluting and a very silent transport system for urban and rural areas of India. We can develop three types of rickshaws:
Improved pedal cycle rickshaw, Motor assisted pedal rickshaw; and A completely battery driven rickshaw called E-Rickshaw. The details of these rickshaws are presented in this synopsis.
It is shown that these rickshaws can provide a very environmentally friendly, energy efficient and cost effective transport system and can replace the existing auto rickshaws. Economic analysis of these rickshaws is presented and policy issues are identified. Besides reducing pollution these rickshaws can provide large scale employment in urban and rural areas of India.
As this project is sponsored by **S.G. Hightech, Aurangabad** motto of this project is to transportation in remote areas where fuel vehicles cannot travel.

Keywords - Chopper, Battery, DC motor, Bearings, Wheels, Gear.

I. INTRODUCTION

Most of the cities in developing countries are highly polluted. The main reasons are the air and noise pollution caused by transport vehicles, especially petrol-powered two and three wheelers. For example, in India there are close to 18 million petrol powered two wheelers and about 1.5 million petrol and diesel powered three wheelers and their population is growing at a healthy rate of about 15% per annum. Besides being a major hazard to people's health, these machines are guzzling huge amounts of petrol and diesel for which the country has to pay dearly in foreign exchange outflow. In fact it is a common sight in developing countries that during traffic jams in congested areas of cities these vehicles produce tremendous pollution.

An electric cycle rickshaw can provide a non-polluting and a very silent transport system for urban and rural areas of India. Besides it is a very energy efficient and cost effective vehicle. Work done at our Institute has shown that improved cycle rickshaws powered by electric motor and batteries have a potential to provide an attractive alternative to petrol and diesel powered three wheelers. Besides they can also provide large scale employment and extra income to the rickshaw puller.

II. RELATED WORK

A. A Study of Motor Assist E-rickshaw

In first paper, A E-Rickshaw was developed and controlled through the Fixed gear, Two chain System, Retro direct, Derailleur, Electric assist resulting that the setup should give an estimate of the most feasible and cost-effective solution to the current problems surrounding single-speed rickshaws, in India or elsewhere.

B. Solar Battery Charging Station with Automatic System

In second paper, Eight 12V, 20 Ah lead acid batteries connecting in series combination to make Two 48V, 20Ah batteries, PV controllers, Wire connections so that this project is implemented in a larger scale, this will prove to be a huge contributor of the savings of electricity in major cities and as a result, will improve the load-shedding conditions more.

C. Design & Fabrication if Tri-rickshaw

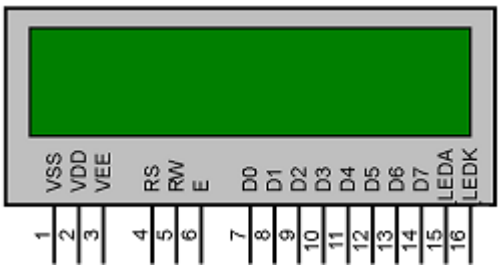
In the same way in 3rd paper E-Rickshaw can be controlled by Electric motor installed beneath the frame of the vehicle, Batteries accommodated beneath the seat, Controller so that Electric Power Rickshaw means of transport for passengers as it gives them extra comfort for seat and space and would reach their destinations faster compared to the existing Manually more or less same fare.

III. COMPONENTS

The fundamental segments utilized really taking shape of this model are as per the following:

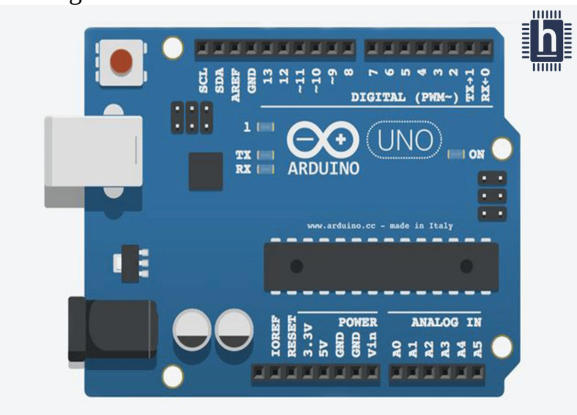
1) LCD Display:

16x2 LCD display is used to display the percentage value of the battery.



2) Arduino Uno:

It is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. It also contains in built ADC which converts analog readings into digital.



3) BLDC Motor:

An Electric DC motor is a machine which converts electric energy into mechanical energy. The working of DC motor is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a mechanical force. The motor is the main component of an EV. It is very important to select proper type of motor with suitable rating.

4) Motor Controller:

Motor controller is a device that improves the performance of an electric motor in a prearranged manner. Motor controllers can include an automatic or manual means for starting/stopping the motor, choosing forward/reverse rotation, selecting and controlling the speed, modifying or limiting the torque, and shielding against faults and overloads. The major constituents of electric vehicle systems are the motor, power supply, controller, drive train and a charger. An EVM controller or electric vehicle motor controller is a machine that is employed to regulate the torque generated by the motors of electric vehicles by means of modifying the energy flow from the power sources to the motor.

5) Battery:

Sealed Maintenance Free (SMF) cells may be made of flat plates like a conventional flooded lead–acid battery, or may be made in a spiral roll form to make cylindrical cells.

Sealed Maintenance Free (SMF) batteries have a pressure relief valve which will start when the battery starts building pressure of hydrogen gas, normally a result of being recharged. Some gases allowed by valve activation or electrolyte to escape, thus decreasing the overall capacity of the battery. Rectangular cells may have valves set to operate as low as 1 or 2 psi; round spiral cells, with metal external containers, can have valves set as high as 40 psi.

The cell covers typically have gas diffusers built into them that allow safe dispersal of any excess hydrogen that may be formed during overcharge. They aren't permanently sealed, but It designated to be "maintenance free". They can be oriented in any manner, unlike normal lead–acid batteries, which must be kept upright to avoid acid spills and to keep the plates' orientation vertical. To improve cycle life cells may be operated with the horizontal plates

At high overcharge currents, electrolysis of water occurs, expelling hydrogen and oxygen gas through the battery's valves. Care must be taken to prevent short circuits and rapid charging. Constant-voltage charging is the usual, most efficient and fastest charging method for Sealed Maintenance Free (SMF) batteries, although other methods can be used. Sealed Maintenance Free (SMF) batteries may be continually "float" charged at around 2.35 volts per cell at 25 °C. Some designs can be fast charged (1 hour) at high

rates. Sustained charging at 2.7 V per cell will damage the cells. Constant-current overcharging at high rates (rates faster than restoring the rated capacity in three hours) will exceed the capacity of the cell to recombine hydrogen and oxygen.

6) Charger:

A battery charger or recharger is a device used to put energy into a secondary cell or rechargeable battery by forcing an electric current through it. The charging protocol (how much voltage or current for how long, and what to do when charging is complete, for instance) depends on the size and type of the battery being charged. Some battery types have high tolerance for overcharging (i.e., continued charging after the battery has been fully charged) and can be recharged by connection to a constant voltage source or a constant current source, depending on battery type. Simple chargers of this type must be manually disconnected at the end of the charge cycle, and some battery types absolutely require, or may use a timer, to cut off charging current at some fixed time, approximately when charging is complete.

IV. WORKING

These rickshaws have a Mild Steel tubular Chassis; consist of 3 wheels with a differential mechanism at rear wheels. The motor is brushless DC motor manufactured mostly in India. The electrical system used in Indian version is 48V and 60V. The body design from most popular Chinese version is of very thin iron or aluminum sheets. Vehicles made in fiber are also popular because of their strength and durability, resulting in low maintenance, especially in India. Body design is varied from load carriers; passenger vehicles with no roof, to full body with windshield for drivers comfort It consist of a controller unit. They are sold on the basis of voltage supplied and current output, also the number of MOSFET (metal oxide field effect transistor) used. The battery used is mostly lead acid battery with life of 6–12 months. Deep discharge batteries designed for electric vehicles are rarely used. Weight of the electric car has also been a recurring design difficulty in them.

V. DESIGN AND CALCULATION

As a transport for the physically disabled people the overall safety, stability, reliability, control, comforts etc. are a very much important and taken in to consideration while designing it.
Here we considered a total weight of 350kg including driver.

5.1. Notations

d = tricycle wheel rim diameter,
r = tricycle wheel rim radius,
ω = Angular velocity of tricycle shaft,
N = Speed of tricycle wheel,
v = Speed of tricycle in kmph
N1=Normal reaction of the road on each wheel of the tricycle
μ=Coefficient of friction = 0.3.
F= Frictional force between wheel and road
T=Torque developed on the shaft due to frictional force
P= Power required to ride the tricycle
t = time needed to fully charge the battery with A

5.2. Technical Details

5.2.1. Cycle Dimensions

Cycle Rim Diameter d = 56 cm = 0.56 m
Required Cycle Speed v = 15 kmph
Tricycle weight = 75 kg, Rider weight = 60 kg
Total weight W =135 kg.

5.2.2. Power Calculations

Normal Reaction N_1 on each tyre = W/3
Normal Reaction N_1 = 45 kg = 441.13N
Friction force on each tyre = μN_1 = 0.3*441.13= 132.33N

5.2.3. Power Requirement

T = F x r = 132.33×0.28=37.05 Nm

5.2.4. Speed Calculations

ω = v ÷ r = (15*1000÷3600) ÷0.28=14.88 rad/sec

N = (60 x ω) ÷ (2π) = (60 x 14.88) ÷ (2π) = 142.17 rpm

VI. CONCLUSION

This system is designed for Rural development & smart city, it is energy efficient & cost effective transportation where fuel consumable vehicles are not allowed & it gives non polluting & silent transport.

The following are the result found during experiment:

Sr. No	Technical Details	Output
1	Back wheel Diameter	56 Cm
2	Cycle Weight	135 Kg
3	Friction Force on Each Tyre	132.33 N
4	Without Load current	0.064 A-3.69A
5	With load current	0.064 A-11.53A
6	Using paddle only	0.070 A- 2.36 A
7	Using paddle and battery	0.070 A- 5.17 A

As load increases current drawn by motor also increases.

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