ELECTRIC TRICYCLE

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Abstract : At present many exciting developments in electric vehicle technology are taking place. Some of these have advanced sufficiently to be commercially available, whilst others remain for the future. The first demonstration electric vehicles were made in 1830's and commercial vehicles were available by the end of the 19th century. Today's concerns about the environment particularly noise and exhaust emissions, coupled to new developments in batteries, fuel cells, motors and controllers may swing the balance of electric vehicles.

There are many types of electric vehicles such as railway trains, ships, aircrafts, cars, bikes, bicycles, wheel chair and many more. But in this project is focused on electrical powered tricycle which is categorized under Low Speed Vehicles (LVSs) are an environmentally friendly mode of transport for short trips.

I. INTRODUCTION

At present many exciting developments in electric vehicle technology are taking place. Some of these have advanced sufficiently to be commercially available, whilst others remain for the future. The first demonstration electric vehicles were made in 1830's and commercial vehicles were available by the end of the 19th century. Today's concerns about the environment particularly noise and exhaust emissions, coupled to new developments in batteries, fuel cells, motors and controllers may swing the balance of electric vehicles.

There are many types of electric vehicles such as railway trains, ships, aircrafts, cars, bikes, bicycles, wheel chair and many more. But in this project is focused on electrical powered tricycle which is categorized under Low Speed Vehicles (LVSs) are an environmentally friendly mode of transport for short trips.

The objective of the project is to design and develop a concept battery powered tricycle for multipurpose use and to choose the best concept to reduce them ass and expensive batteries required. Besides that, to design a tricycle with high efficiency and greater flexibility to place components in tricycle to optimize weight positioning and minimize aerodynamic drag.

B Problem Definition

PROBLEM 1:Battery powered tricycles are normally expensive and require a lot ofmoney.
PROBLEM 2:The mass of an electrical vehicle has critical effects on theperformance, range, and cost of an electrical tricycle.

PROBLEM 1 SOLUTION:

Nowadays, the electric tricycles mainly make use of a brushless D.C. motor whose cost is very high. In our project, we will make use of PMDC motor which costs less and thus the cost of the electric tricycle is in turn reduced.

PROBLEM 2 SOLUTION:

Usually, the electric tricycles are very bulky. We are doing our maximum in order to reduce the weight of the tricycle.

C. Project Objectives

The main purpose of this project is to develop a battery powered electric motor tricycle which can be used as a simple transportation and for economic reasons.

The objectives are:

- To carry out literature review on electric Tricycles to understand the latest trends, present practices and collect relevant data.
- To design and develop a battery powered electric motor tricycle speed of 10-15km/h.
- To design a tricycle which is far more Table in braking turns.
- To design a battery powered tricycle particularly suitable for short distance use (10km).
- To build a prototype of the final concept and take user feedback.

D.Block Diagram and Description

The design of the electric tricycle is adaptable to the current hand-powered Tricycles with little modification. The design consists of an electric motor, a drivesystem, battery, accelerator, battery charger and a power supply.

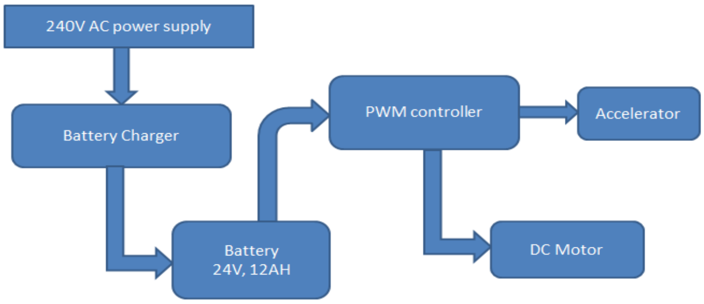


Fig1.1: Block Diagram of Tricycle Motor Circuit

A PMDC motor was chosen because high fuel costs prohibited the use of a combustion engine. An intelligent battery charger was used in order to charge the battery. 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 the front wheel of the tricycle. Secondly, a method of motor control was decided on. The controls for motor speed and braking were incorporated into a simple electrical accelerator. Thirdly, power is supplied to the motor by a battery pack.

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

II. LITERATURE SURVEY

A.General Introduction

The main purpose of this literature review is to get information about the project from the reference books, magazines, journals, technical papers and websites. We have made use of three papers which helped us generate our tricycle design. In this chapter, we will discuss all the information that we found from many sources.

B. Electric Tricycle with Amphibious Characteristics

[1] An amphibian or amphibious vehicle is defined as a transport vehicle that can travel both on land and on water. This study revolves around the mechanical design of a three-wheeled electric vehicle, or a tricycle, with amphibious characteristics. In this study, dynamic simulation and stress analysis were performed using the finite element method (FEM) approach. This study will serve as a design platform of a multi-purpose vehicle for public utility and transportation, recreation and for emergency and rescue operation situations. Furthermore, focusing on the public transport sector by developing such innovative yet low cost transport vehicle that can carry multiple passengers would hopefully reduce current traffic in the country.

III. HARDWARE DEVELOPMENT

A. Calculations of Tricycle Component Selection

We needed to decide how much power would be required for our electric motor to achieve our objectives. Some testing and calculation helped us to determine this.

We selected a front wheel which is of a diameter of 18 inch. Therefore,

D = 18inch = 0.4572m ……... Eq.3.1

According to our objective we require a speed of

10 km/h = 2.77m/s ……...Eq.3.2

Mass of tricycle along with the batteries, motor and drive circuit was found to be 20kg.

And we took the maximum load weight to be 80kg. Therefore,

(Dead weight) Total weight = 20+80= 100kg Eq.3.3

A spring balance test was carried out which involved moving a tricycle by using a spring balance as shown in Fig 3.2.

Therefore, the reading obtained in moving the tricycle,

M = 6 kg.……......................... .... Eq.3.4

1) Motor Force Determination

We already know that,

$F = M \times a$………………………. Eq.3.5

Where,

F = force which the electric tricycle exerts w.r.t the ground in kgm/s^2 or N

M = spring balance reading in kg

a = acceleration due to gravitation in m/s^2 = 9.81 m/s^2

now, substituting 3.1 and a in 3.5 we get,

$$F = 6 \times 9.81$$
$$= 58.86\ kgm/s^2$$
$$= 58.86\ N \qquad \text{...................... Eq.3.6}$$

B. Components Used

This section gives us the details and ratings about the electrical components and the different mechanical parts used to build up the electric tricycle.

Electrical components:

The Table 3.1 indicates the electrical components used in our Electric Tricycle.

SL. No.	Components	Purpose
1	PMDC motor	The main component used to move the front wheel of the Tricycle.
2	Motor drive circuit	Used to control the speed of the motor.
3	Sealed lead acid Batteries	To supply energy to the motor.
4	Electrical accelerator	To increase or decrease the Speed of the motor.
5	Battery charger	To charge the battery when low.
6	RF based wireless remote control	To turn on and off the tricycle from a distance.

Table 3.1: Electrical Components used

C. Electrical Components:

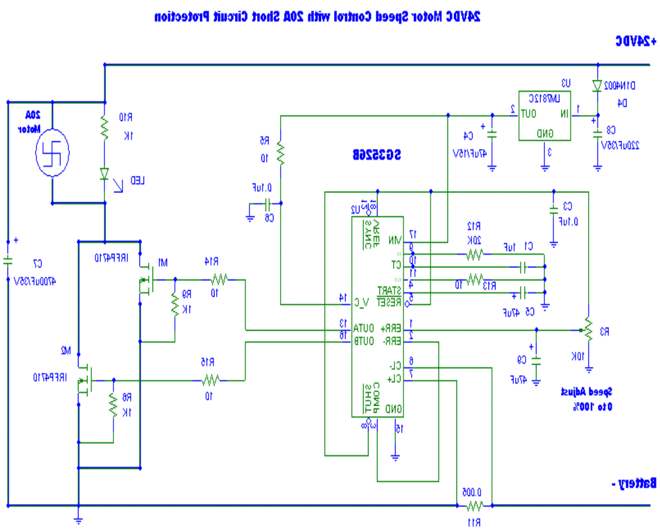
1) D.C. MOTOR:

For our tricycle, we are using a PMDC (brushed D.C. motor), 350W, 24V and 300 rpm brush motor.

The brushed DC electric motor generates torque directly from DC power supplied to the motor by using internal commutation, stationary magnets(permanent or electromagnets), and rotating electrical magnets.

Fig 3.4: PMDC Brush Motor

i. *Circuit diagram:*



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The Fig 3.6 shows the motor drive circuit with 20A short circuit protection. The 24V DC voltage is applied to the voltage regulator IC LM7812C which reduces the voltage from 24V to 12V. This voltage is now applied to the input of the SG3526. The SG3526 is a high performance pulse width modulator integrated circuit intended for fixed frequency switching regulators and other power control applications. The 10KΩ potentiometer is used to vary the width of the PWM in order to control the speed of the motor. The output of the high performance pulse width modulator integrated circuit SG3526 is given to the driver circuit which consists of 2 MOSFETs which is used to drive the motor.

3) Sealed Lead Acid Batteries:

We are using 2 12V, 12AH batteries as shown in the Fig.3.7.

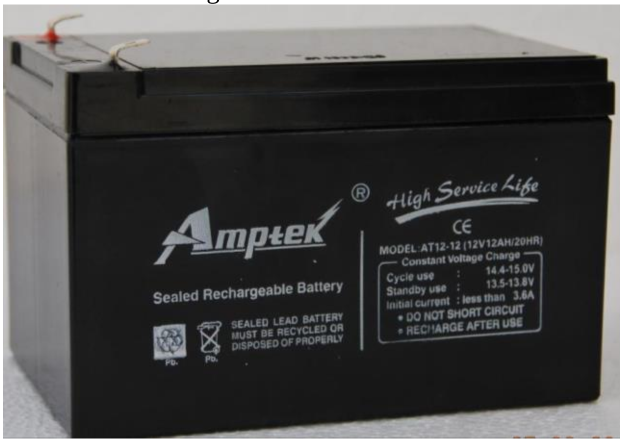

Fig.3.7: Sealed lead acid batteries.

4) Electrical Accelerator:

The accelerator used is nothing but a potentiometer which is used to vary the speed of the motor.

In a nutshell, the PWM controller takes input when we twist the accelerator and that tells it how many watts of electricity to send to the motor. So the PWM controller has to also convert the direct current (DC) from the battery to the alternating current (AC) for the motor. So basically the twisting position determines how much electricity to shove into the motor. More electricity, more torque and speed. Twist the accelerator, PWM controller sends power from the battery to the motor, motor turns the wheels.

Fig 3.8: Electrical Accelerator

5) Battery Charger:

A smart battery is generally defined as one containing some sort of electronic device or "chip" that can communicate with a smart charger about battery characteristics and condition. A smart battery generally requires a smart charger it can communicate with. A smart charger is defined as a charger that can respond to the condition of a battery, and modify its charging actions accordingly.

Circuit diagram for a battery charger is as shown in Fig 3.9.

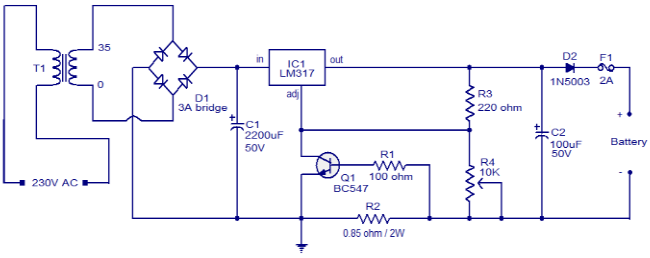

Fig 3.9: Battery Charger Circuit

6) RF Based Wireless Remote Control:

We are providing a RF based wireless remote controller for switching on and off the tricycle for security purposes. It is often required to switch electrical appliances from a distance without being a direct line of sight between the transmitter and receiver. An RF based wireless remote control system (RF Transmitter & RF Receiver) can be used to control an output load from a remote place. RF transmitter, as the name suggests, uses radio frequency to send the signals at a particular frequency and a baud rate.

i. RF transmitter:

Fig 3.10: RF transmitter

This simple RF transmitter, consisting of a 27 MHz license-exempt Transmitter module and an encoder IC, was designed to remotely switch simple appliances on and off. The RF part consists of a standard 27 MHz transmitter module, which works at a frequency of 27 MHz and has a range of about 400m. The transmitter module has four pins. Apart from “Data” and the “VCC” pin, there is a common ground (GND) for data and supply. Last is the RF output (ANT) pin. The Table 3.6 shows the pin assignment of the 27 MHz transmitter module.

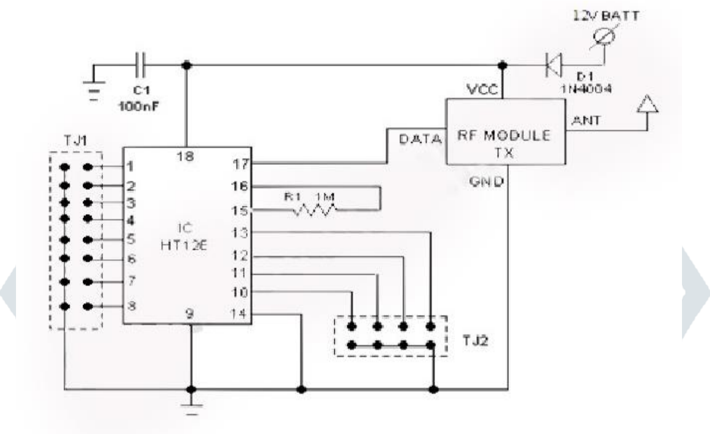

Fig 3.11: RF Transmitter Circuit Diagram

ii. RF Receiver

This circuit complements the RF transmitter built around the small 27 MHz transmitter module. The receiver picks up the transmitted signals using the 27 MHz receiver module. This integrated RF receiver module has been tuned to a frequency of 27 MHz, exactly same as for the RF transmitter.

The miniature 27 MHz RF receiver module receives On-Off Keyed (OOK) modulation signal and demodulates it to digital signal for the next decoder stage.

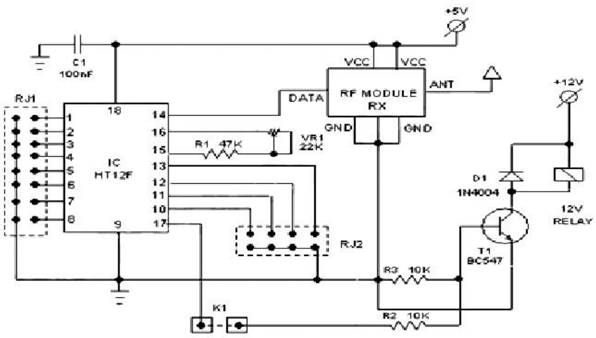

Fig 3.13: RF Receiver Circuit Diagram

IV. CIRCUIT DIAGRAM AND OPERATION

A) Circuit Diagram:

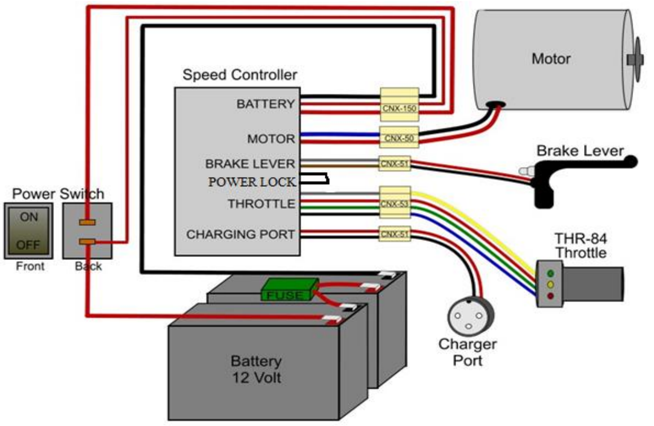

Fig 4.1: Electrical Connections.

B) Circuit Operation:

The simple electrical connections are as shown in the Fig 4.1 All the connections are taken from the PWM speed controller circuit. Connect the motor terminal to the motor. Reversing this connection will reverse the direction of motor. Connect the brake terminal to the tricycle handle where the brakes are placed. The two terminals of the power lock must be shorted in order to start the motor. The battery terminals must be connected to the battery terminals of the motor drive circuit. Care must be taken that the positive terminal of the battery is connected to the positive terminal of the motor drive circuit and vice versa or else this would permanently damage the drive circuit. The throttle terminal of the drive circuit is connected to the throttle (electrical accelerator). When the battery needs to be charged, the charging port terminal of the drive circuit will be connected to the battery charger.

V. RESULTS AND DISCUSSION

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Design :

Fig 5.9: Back view of final design

VI. APPLICATIONS ADVANTAGES AND DISADVANTAGES

A) Applications:

- It useful in aero drum.
- It is useful in Railway station to carry luggage.
- It is useful for Students.
- It is very useful in visiting places like zoo, palace, Lake Visitors, etc.

B) Advantages and Disadvantages:

1) ADVANTAGES:Electric vehicles do, however, offer other strong benefits that are ignored by the marketplace.

- Speed: Electric tricycles generally have a higher top speed than a normal tricycle with the same rider.
- Environment friendly: One is the dramatic reduction in oil consumption and gasoline imports that their widespread use would bring about.The use of electric hence does not create any pollution and is eco-friendly and they have the potential to dramatically reduce global warming, smog forming and toxic pollution from cars and trucks.
- The greenhouse gas emissions are relatively lower.
- System efficiency: The overall system efficiency taking into account the production of electric power, transmission and distribution, local storage in batteries and conversion of electric power to mechanical motion is estimated to be approximately 50%, while combustion engine vehicles are only 15% to 25% efficient.
- About 10% of the energy used in combustion engine vehicles is during idling; electric tricycles consume no energy during idling.
- High torque: In these vehicles, the electric motor can deliver very high torque over short periods of time, providing good acceleration on the highway.

2) Disadvantages:

- Maintenance cost: When any components fail to operate, it becomes very costly to replace them and the maintenance cost is very high.
- If the batteries fail to operate, it is very necessary to dispose these batteries safely else it will cause environment degradation.
- The initial cost of the tricycle is high.

VII. PROJECT CONCLUSION AND FUTURE SCOPE OF IMPROVEMENT

A) Suggestions for Improvement:

As a whole, the group felt that they achieved the objectives that they set forth for themselves at the beginning of this design process. After completing the designed prototype, the group suggests the following improvements. The Table 7.1 shows the description and its suggested solution

B) Conclusion:

The electric tricycle has been successfully designed and developed. This type of electric tricycle can be very helpful in reducing pollution.

Our current oil dependence leads to myriad problems – environmental, security and economic. Reliance on oil leaves us vulnerable to fluctuations in oil prices and gas price shock and creates significant challenges for our foreign policy. Oil and other petroleum products are also the great source of global warming pollution – just edging out coal.

Transportation is almost exclusively dependent on oil and represents over two-thirds of U.S. petroleum demand. It is also a single source of many air pollutants. It causes more than half of the carbon monoxide, more than a third of the nitrogen oxides, and almost a quarter of the hydrocarbons in our atmosphere.

Motor vehicles also emit pollutants, such as carbon dioxide, that contribute to global climate change. The transportation sector is responsible for about 30% of all U.S. greenhouse gas emissions.

So, by using electric vehicles, we reduce this pollution to a large extent and thus they allow an ecofriendly mode of transportation.

VIII References

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