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SOLAR BASED GPS TRACKING TRICYCLE

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Abstract: The goals of this project The majority of handicapped bicycles used for commuting are found in India. Some run on batteries, while others require manual handling and handles. Vehicles that run on batteries have poor performance and a high failure rate. With this project, we want to build a solar-powered GPS tracking tricycle that can run both manually and with a motor, eliminating the shortcomings of each approach and maximizing its potential while optimizing its own constraints. A hub motor that powers the back wheel and a battery that powers the hub motor that powers the middle wheel are both included in the design. Relays are used by the system to manage the throttle, the battery and solar panel, and to switch the drive between the batteries in predetermined circumstances. Through a reduction in the efforts of disabled individuals, the system significantly lessens environmental pollution. The goal of this project is to create an electric tricycle with a solar-powered GPS tracking system that is specifically made to meet the mobility requirements of people with disabilities. A thorough study of the literature was done before this project started, using a wide range of sources such as books, journals, and articles. This review's main goal was to thoroughly examine recent advancements and research that are pertinent to the project's scope. The project's emphasis on providing assistance to people with disabilities emphasizes how crucial it is to provide creative solutions that will improve their mobility and accessibility. This project aims to provide disabled people with a sustainable and dependable mode of transportation by incorporating solar-powered GPS tracking technology. This will allow them to become more independent and integrated into their communities.

Keywords: *GPS Tracking Tri-cycle, Battery, Hub Motor, Accident Detector, Ultrasonic Sensor*

I. INTRODUCTION

Utilizing renewable energy sources, such as solar power, has become essential for sustainable growth in the modern world. The combination of GPS tracking devices with solar technology is one such creative application, especially in the context of disability tricycles. By merging these technologies, we can produce a system that improves accessibility and safety for people with mobility issues in addition to aiding with navigation. Let's investigate how this solar-powered GPS tracking device can completely transform the way that people use handicap tricycles for electric mobility. The creation of a GPS tracking tricycle that runs on electricity and solar power is a major advancement in logistics and sustainable transportation. This kind of tricycle combines cutting-edge technology with renewable energy sources to provide a cost-effective, eco-friendly, and adaptable solution for both residential and commercial use.

A review of the literature has been done for this project using a variety of sources, including books, journals, articles, and others. The major investigations completed by earlier research projects are all included in this chapter. Conducting a literature review prior to beginning a project is crucial since it allows us to put any relevant information into practice. The most crucial thing is to have a thorough understanding of the issue we want to work on before beginning the job. Therefore, by completing the literature study, we can ensure that we comprehend the project completely and are able to finish it. To find studies that were pertinent to the subject, the article was reviewed. The quest for information pertaining to the Categories for this topic include motor, electric tricycle, battery, solar panel, solar charger, and speed control.

1. Solar and Electric Power Integration

The tricycle can minimize carbon emissions and operating costs by reducing its reliance on fossil fuels through the combination of solar panels and rechargeable electric batteries. The car can continue to run even in isolated or off-grid locations since the solar panels use sunshine to charge the batteries during the day. The tricycle's range and dependability are increased by this dual power system, which makes it a practical choice for last-mile logistics, urban deliveries, and personal mobility.

2.Gps Monitoring Features

There Are Many Benefits To Incorporating Gps Tracking Technology Into The Tricycle. Fuel Consumption Is Decreased And Delivery Efficiency Is Increased With Real-Time Tracking. Gps Tracking Offers Safety Features To Individual Users, Including Geo-Fencing That Can Send Notifications If The Vehicle Leaves A Set Area, Route Monitoring, And Theft Recovery.

2.CONCEPT OF GPS TRACKING TRI-CYCLE:

The idea behind GPS tracking for triathlon bicycles is to include GPS technology into the frame of the bike so that riders may benefit from features like route planning, real-time location tracking, and different safety and performance-enhancing capabilities.

1. Real-time location tracking:

GPS tracking sensors are built into the tricycle's frame or attachments to track its exact location over time.
• Using a dashboard interface or accompanying mobile app, cyclists may view their current location in real time.

2. Route Mapping and History:

During training sessions or competitions, the cyclist's paths are tracked by the GPS monitoring device.
• The history of their routes, including the distance travelled , elevation variations, and average speed, is available to cyclists.
• Features for route mapping let bikers see visual records of previous journeys and to create new routes according to their performance.

3. Anti-Theft Protection:

The tricycle is shielded against theft and unwanted usage by anti-theft capabilities that are enabled by GPS monitoring technology.
• Certain systems have the ability to create virtual boundaries for users to define boundaries and receive alerts if the bike leaves the approved area.
• If the bike is moved without permission, the system can send alerts to the owner's smartphone and notify authorities of its current location.

4. Performance Monitoring:

• Cyclists can set performance goals, track their progress over time, and evaluate their performance during training sessions or races.
• The GPS tracking system gathers data on various performance metrics, such as speed, cadence, heart rate (if integrated with additional sensors), and calories burned.

5. Emergency Assistance:

• The GPS tracking system can aid in the event of an accident or emergency by transmitting distress signals to designated contacts or emergency personnel.
• The emergency aid feature may be activated automatically by built-in sensors that identify abrupt impacts or falls.

6. User Interface and Mobile App:

Bicyclists can access all GPS tracking capabilities and functionalities through an easy-to-use dashboard interface or mobile app.
• The app shows performance metrics, route histories, real-time location updates, and alerts from its emergency assistance functions.
• Bicyclists can customize their monitoring experience and establish alert and notification preferences with the customization tools.

7. Durability and Battery Life:

Tricycle GPS tracking devices are made to be strong, weatherproof, and able to withstand the rigors of outdoor cycling. Extended battery life. Overall, the concept of GPS tracking for tri-bicycles offers cyclists enhanced safety, performance monitoring, and peace of mind during training sessions and races. By integrating GPS technology with advanced features and functionalities, cyclists can optimize their riding experience and achieve their fitness and performance goals more effectively.

3. BLOCK DIAGRAM DESCRIPTION

A solar-powered GPS tracking tricycle system consists of several critical components. At its heart is a solar panel positioned atop the tricycle, which collects sunlight and turns it into electrical energy. This energy is handled by a charge controller, which ensures that the battery is charged efficiently without overcharging. This energy is stored in the battery and used to power the system, which contains a GPS module for location tracking, a microprocessor for data processing and management, and a GSM/GPRS module for connection with a central server or user device over cellular networks. Additional sensors could monitor characteristics like as speed and temperature. The system's user interface offers feedback to the user, and an antenna allows wireless communication with GPS satellites and cellular networks. All components are contained within a protective enclosure to withstand environmental conditions. Together, these components enable real-time tracking and monitoring of the tricycle's location and performance.

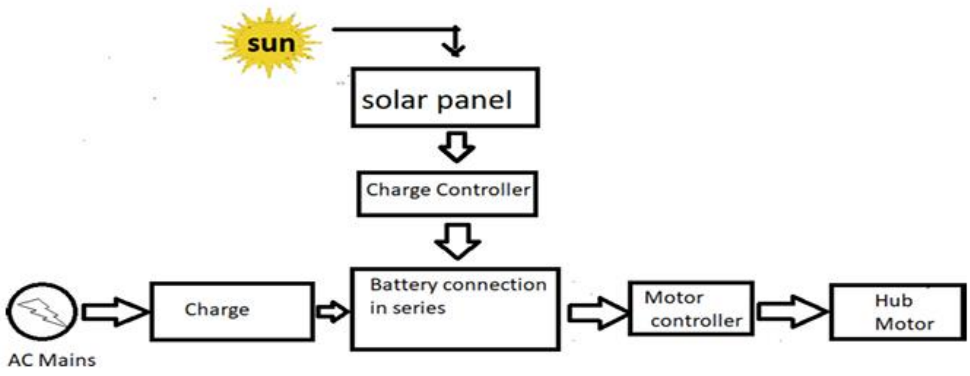


Figure 1: Block Diagram

All components are contained within a protective enclosure to withstand environmental conditions. Together, these components enable real-time tracking and monitoring of the tricycle's location and performance.

4. DESIGN OF PROPOSED VEHICLE

Figure 2: Layout of the proposed vehicle

The above figure shows the layout and basic positioning of the parts in the system. The vehicle at lower speed act as front wheel drive and at high speed gets switched to rear wheel drive. Components in the figure shows the attachment of tire with the hub motor since the torque produced is sufficient enough to drive the vehicle. The axle of the motor is connected to the suspension; suspension is connected to the handle which is connected to the main chassis. A microcontroller powered up from battery, performs the switching from electric to internal combustion or vice versa as per the requirements. This layout optimizes the functionality and aesthetics of the solar-based GPS tracking tricycle, ensuring reliable performance, user comfort, and ease of maintenances.

5. COMPONENT DESCRIPTION

The components used in this project are BLDC Hub Motor, DC Motor Controller, Batteries, Charging circuit, Ignition switch, Accelerator.

5.1 BLDC Motor

Brushless DC motor also known as electronically commutated motors are synchronous motors that are powered by a DC electric source via an integrated inverter which produces an alternating electric signal to drive the motor. In this manner, an alternating current, does not affect a sinusoidal waveform, but rather a bi-directional current with no effect on waveform. Additional sensors and electronics control the inverter output amplitude and waveform (and therefore percent of DC bus efficiency) and frequency (i.e. rotor speed). The rotor part of a brush less motor is often a permanent magnet synchronous motor, but can also be a switched reluctance motor, or induction motor. Brush-less motors may be explained as stepper motors; however, the term stepper motor tends to be used for motors that are formulated specifically to be operated in a mode where they are smoothly stopped with the rotor in a defined angular position.

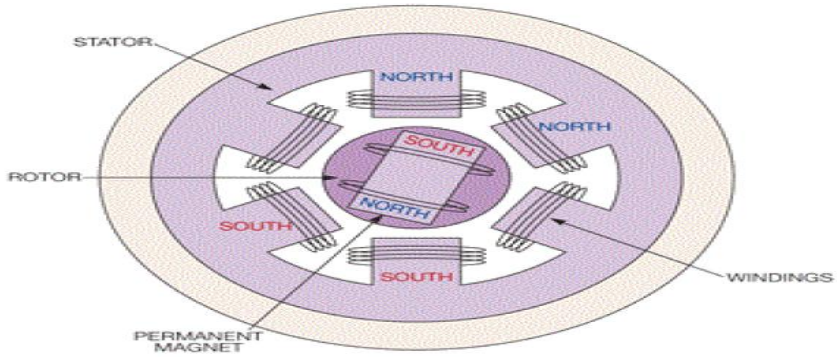


Figure 3: BLDC motors have a motor with a permanent magnet contain north and south poles

Two key performance parameters of brushless DC motors are the motor constants Kv and Km (which are numerically equal in SI units).The four poles on the stator of a two-phase brushless motor.

Table 1: Technical Specifications of hub motor:

Rated Voltage (V)	36V
Rated Power (W)	250W
No Load Current	3A
Full Load Current	14A approx.
Weight Carring Capacity	120kg
Rated RPM	300rpm

5.2 Motor Controller

The controller connects the power source to the motor. It controls speed, direction of rotation, and optimizes energy conversion. While batteries produce constant voltages which decrease as they are used up, some controllers require a DC to DC converter to step down this variable voltage to the motor's expected constant operating voltage, but other controllers incorporate a DC-to-DC converter and can accept a changeable voltage. Converter efficiencies are typically greater than 90%.

The motor controller is being interfaced with the motor speed regulation. The speed varying throttle is being connected through the motor controller circuit. The motor used here is 48V, 750W, Ampere made hub motor. The controller for the motor is also Ampere made suitable for regulating the specified motor. The throttle is an ampere made throttle for speed control of the specified motor. The input to the motor is supplied by four Exide made Electra lead-acid batteries each of 12V, 26Ah through controller for testing purpose. Two independent propelling sources are being employed for determining total propulsion of the vehicle.

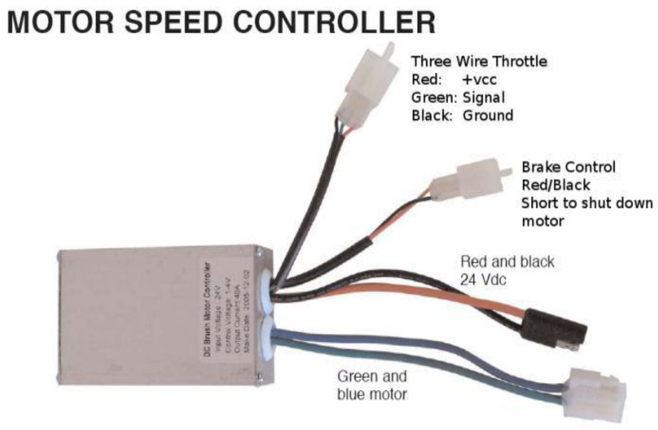


Figure 4: DC controller

Table 2: Specifications of motor controller

Rated Voltage	24V DC
Rated Power	250W
Rated Current	14A
Cost	1,600

5.3 Battery Storage

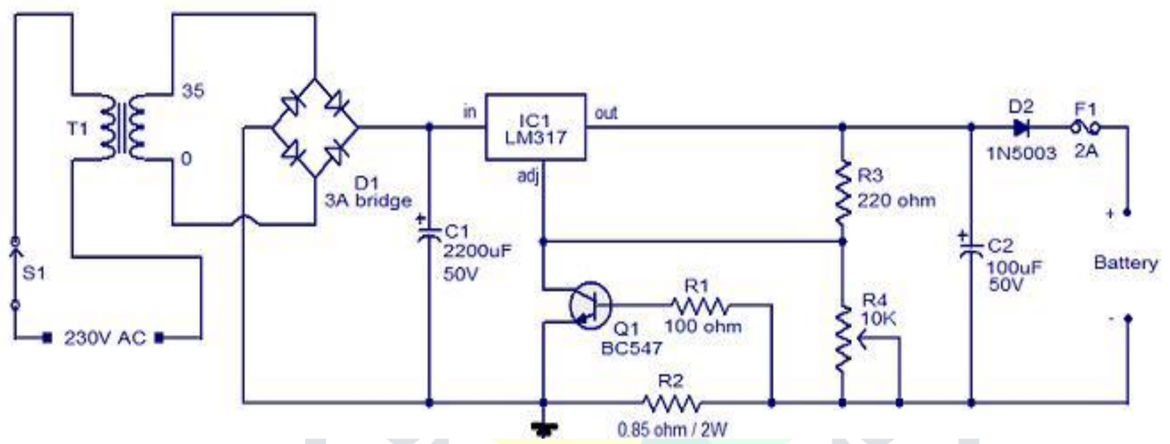
5.3.1 Lead Acid Battery: -The lead–acid battery was invented in 1859 by French physicist Gaston Plante and is the oldest type of rechargeable battery. Even though having a very low energy-to-weight ratio and a low energy-to-volume ratio, its ability to supply high surge currents implies that the cells have a relatively large power-to-weight ratio. These characteristics, with their low cost, make it reliable for use in motor to provide the high current required by automobile starter motors. As they are cheap compared to newer technologies, lead-acid batteries are widely used. even when surge current is not important and other designs could provide higher energy densities. Large-size lead-acid designs are commonly used for storage in backup power supplies in cell phone towers, high-availability settings like hospitals. For these roles, recent versions of the standard cell may be used to improve storage times and decrease maintenance requirements. Due to the freezing-point depression of the electrolyte, as the battery discharges and the concentration of sulfuric acid decreases, the electrolyte is more likely to freeze during winter weather when discharged. During discharge, H+ produced at the negative plates and from the electrolyte solution moves to the positive plates where it is consumed, while HSO_4^- is consumed at both plates. The reverse occurs during charge. This movement can be by diffusion through the medium or by flow of a liquid electrolyte medium. Since the density is greater when the sulfuric acid concentration is higher, the liquid will tend to flow by convection.

Figure 5: Lead acid battery

Table 3: Specifications of Lead acid battery

Rechargeable batteries specification	
No. of batteries	4
Current	33A
Voltage	12V

5.4 Charging Circuit These Chargers are designed to fulfill all kind of power requirements of Electric Bike .Battery charging which operates in AC input range (170 - 300VAC) and to withstand the adverse Indian power conditions. These are designed with high frequency switching technology that makes product highly reliable, cost effective, and compact in size and light in weight. When the charge level in the charge indicator shows less, then the Engine is switched on mechanically. The power developed from the engine generates electricity through the BLDC motor and charges the batteries through the Charging circuit.



Calculation

Motor = 250W

Other compounds = 100 W

Total load= 350 W

Energy per day consider 2 hrs./day

Now,

W*h= 250*2= 500W

W*h= 100*2= 200W

Total energy/day= 700Wh/day

= 0.7 kWh/day

Battery Calculation:

Lead acid battery =DOD= 50%

DOD= Its Depth of discharge

Now,

Battery storage =Total energy/DOD

=0.7/0.5

=1.4 kWh/day

Loss in battery 15%

Loss kWh= 0.7*0.15

=0.105 kWh

Total input to battery=0.7+0.105

=0.805 kWh/day

Loss in charge controller 4%

Loss kWh= 0.805*0.04

=0.0322 kWh

Total kWh= 0.805+0.0322

=0.8372 kWh

Solar calculation:

Now consider 25% loss

Hence, Loss kWh= 0.25*0.8372

=0.2093 kWh

Total energy = 0.8372+0.2093

= 1.0465 kWh

Now, hours of solar radiation

= 5500/1000 [This is standard calculation for India location]

=5.5 hrs.'/day

Now,

Power of solar panel =1.0465/5.5

= 0.1903 kW

= 190.3 W

Consider solar panel of 40 W

Now ,no of solar panel =190.3/40

= 4.75

= 4 Quantity

6. BRAKING SYSTEM

Brakes are used to decrease the speed of motors. We know that there are various types of motors available (DC motors, induction motors, single phase motors etc.) and the specialty and properties of these motors are different from each other, hence this braking methods also vary from each other. But we can divide braking in to three parts mainly, which are applicable for almost every type of motors During braking, the motor fields are linked across either the main traction generator (diesel-electric locomotive, hybrid electric vehicle) or the supply (electric vehicle) and the motor armatures are connected across braking grids (rheostat) or the supply (regenerative). The rolling wheels rotate the motor armatures and when the motor fields are excited, the motors act as generators.

6.1 Types of Braking

6.1.1 Dynamic braking

Dynamic braking is the use of the electric motors of a vehicle as generators when slowing. It is termed rheostat if the generated electrical power is transfer as heat in brake grid resistors, and regenerative if the power is back to the supply line. Dynamic braking lowers the wear of friction-based braking components, and additionally regeneration reduces energy consumption. During dynamic braking, the traction motors, which are now acting as generators, are connected to the braking grids of large resistors which put a large load on the electrical circuit. The generator circuit is loaded down with resistance; it causes the generators to resist rotation, thus de-accelerating the train. By changing the amount of excitation in the traction motor fields and the amount of resistance fed on the circuit by the resistor grids, the traction motors can slow the train to about 5 mph (8 km/h) (for a direct current "transmission" system; for an alternating current "transmission" system, the traction motors can slow the train to nearly 0 mph (0 km/h)).

Locomotives with a direct current "transmission" system always use series-wound traction motors as these motors produce their maximum tractive effort at "stall", or zero mph, thereby easily starting almost any train. This method, however, releases all the energy as heat in the motor itself, and so cannot be used in anything other than low-power intermittent applications due to cooling limitations. It is not suitable for traction applications.

6.1.2 Regenerative Braking

Regenerative braking takes place whenever the speed of the motor increases the synchronous speed. This method is called regenerative braking because here the motor works as generator and supply itself is given power from the load. The main principle for regenerative braking is that the rotor has to rotate at a speed greater than synchronous speed, only then the motor will act as a generator and the direction of current flow through the circuit and direction of the torque opposite and braking takes place. The only drawback of this type of braking is that the motor has to run at super synchronous speed which may damage the motor mechanically and electrically, but regenerative braking can be done at sub synchronous speed if the variable frequency source is present.

7. WORKING

This system uses a hub motor driven by the batteries in the front and an IC engine in the rear and an Arduino which gets its input from the speed sensor circuit which continuously feeds the instantaneous speed of the vehicle. The Arduino is connected to a relay switch which performs the essential switching on the command of the relay. There are two relays which perform the switching for various controls of the vehicle. The specifics are as below:-

Relay 1: The first relay is connected to the battery circuit and hence switches on and off the circuit when the need arises.

Relay 2: The second relay is connected to the ignition circuit which turns on and off the engine. There basically are two modes of operation which are selected by the toggle switch.

MODE 1: Battery mode

This mode is a battery only mode, i.e. the hub motor alone runs the vehicle at any speed, essentially, in this mode, and the vehicle can be considered an Electric vehicle. The battery mode is useful during low speed and beneficial in high traffic conditions. Also, the battery mode can be used when the fuel is low. During this mode the Arduino through the sends a high signal to the relay 1 due to which the battery circuit is on. The relays 1 and 3 are off.

MODE 2: Engine mode

Engine mode like the battery only mode, the entire motion of the vehicle is dependent on the IC engine alone. The self starter motor is connected to one of the terminals of a 3-way switch and when it is switched to the engine mode, the engine starts as a result of starting of self-starter motor. In this mode the Arduino send a high signal to the relays 2 and 3(for 750 ms). This essentially cuts off the power to the hub motor and turns on the engine through the starter motor.

8. RESULT

After assembly of all the components the tricycle was tested as a whole for all the modes of the vehicle and the following results were obtained and are tabulated as follows:

Energy efficiency: solar panels provide renewable energy, reducing reliance on conventional power sources.

Real-Time Tracking: GPS system enables precise location monitoring, enhancing security and theft prevention.

Cost Savings: Utilizing solar power cuts fuel and maintenance expenses, leading to overall cost reduction.

Environmental Impact: Decreased carbon emissions contribute to environmental sustainability.

Accessibility: Suitable for areas lacking electricity infrastructure, expanding service reach.

Data Utilization: Generates valuable insights for analytics, aiding operational improvements.

Customer Satisfaction: Offers real-time delivery updates, enhancing customer experience and trust.

Scalability: Adaptable to various applications and industries, with potential for expansion.

Innovation: Represents a technological advancement in sustainable transportation solutions.

Efficiency Boost: Improves fleet management, route optimization, and driver behavior monitoring.

9. CONCLUSION

While concluding this part, We Feel quite contented in having completing the project assignment the project assignment well on time. We had enormous practical experience on the manufacturing schedules of the working project model We are therefore happy to state that the inculcation of the mechanical aptitude proved to be very useful purpose. Undoubtedly the joint venture had all the merits of interest and zeal shown by all of us the credit goes to the healthy co-ordination of our batch colleagues in bringing out a resourceful fulfillment of our assignment of our assignment described by the university although the design criterion imposed challenging problem which however welcome by us to availability of good reference books The selection of choice of row materials helped us in machining of the various components to very close tolerances and thereby minimizing the level of wear and tear We believe that we have system that will be effective in providing mobility for persons who have disabilities one of the major lesson we have learned is that designing an appropriate technology is a huge challenge appropriate is more than just availability for replication it considers reliability and efficiency.

II. ACKNOWLEDGMENT

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