



Design and Development of a Solar Powered Vehicle for Physically Challenged People with Voice Recognition

Udhayakumar S¹ , Kathirvel K¹, Prakash R¹

¹Assistant Professor, Department of Automobile Engineering, Hindusthan Institute of Technology, Coimbatore, Tamilnadu, India

Emails: svsudhaya@gmail.com, katir.star@gmail.com, prakash.meauto@gmail.com

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Abstract

The current scenario, transportation has become one of the most important requirements for the humans. There is no correct platform for physically challenged folks to commute severally the physically challenged people's travelling is very difficult and challengeable. They have to depend on others to complete their travelling needs. Now days utilization of vehicles was increased a lot so the ingestion of fossil fuels like petrol and diesel are keep on increasing. Due to this, the accessibility of fossil fuel is also increased. The high consumption and demand of this fuel causes the enormous price. These types of fuels also affect the environment in more. Hence, we decided to solve the both glitches in a single conception. We have design and developed a vehicle which helps persons who physically challenged to commute easily without other's help. The vehicle is powered only by solar and we introduced a new technique to start and stop the vehicle by voice recognition.

1. Introduction

Generally, physically challenged people faces lot of challenges for mobility using automobiles. They are in need of external support for long travels using their vehicles (Rani et al.). About 1.85% of the total world population of 7.1 billion people, 130 million people need wheelchairs or tricycles for people with disabilities. Of these 130 million, nearly 120 million live in developing countries (Devan et al.).

In current days the physically challenged people have very limited options are available to travelling from one to another place. There are no special vehicles is designed for them. The currently used vehicles are only modified vehicle. There is lot of challenges are occurred during riding a vehicle. The price of the vehicle used by physically challenged people is also very high.

Another dispute of the 20th century is that, all

combustible fuels like petrol, diesel and coal are not sufficient for future use due to its less availability (Katoch). Due to this scenario, the fuel prices also will shoot up sky high. In addition, the IC engines generate greenhouse gases which results in global warming and ozone layer depletion. The fuel economy and maintenance of IC engine vehicles are high compared to solar powered or electrical vehicle.

2. Objective

The main objective of this article is to support the physically challenged people by designing a low-cost special vehicle which enables them to travel independently. This vehicle is specially designed who were unable to use their legs and arms for driving a vehicle (Pita). The cost of customized vehicles for the handicapped people is too high which is

not affordable comparing to their economic status of life. Also, we include the ergonomic and safe design of the vehicle with keeping the end user in mind.

The vehicle design has the following features. It operates on electric and solar power which is the future of automobiles in our country. Cost of vehicle for fabrication is comparatively less so that everyone can use to a larger extent voice recognition helps to ease of start and stop a vehicle and also it prevents from vehicle thefts. Moreover, it gives confidence to the user to travel independently (Prajapati, Gundaliya, and Sheth). Frequent charging of electric vehicles is ensured by installed solar panels fitted as roof of the vehicle.

3. Solar Energy Vehicle

Solar power is that the foremost abundant, renewable energy source within the planet. solar power systems confer with technologies that convert the sun light into electricity for the desired use. In the Solar Photovoltaic (or PV) technology, sunlight is converted into electricity by using semiconductors. The Figure 1 explains the way of electric current generation by solar energy

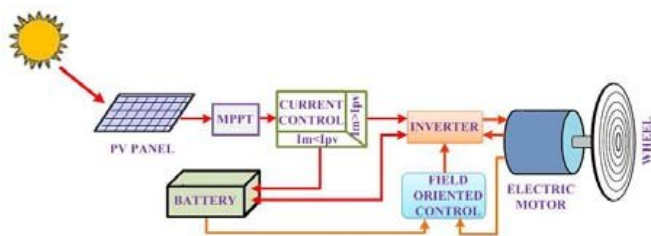


FIGURE 1. Solar Energy Generation

Solar is a renewable resource and doesn't emit any greenhouse gases within the energy generation process (Deepak Shah et al. Rani et al.). A solar vehicle is an all-electric vehicle powered by direct solar energy. Typically, photovoltaic (PV) cells in solar panels convert solar energy directly into electrical energy. The term "solar vehicle" generally implies that solar energy is used to power all or part of the propulsion of a vehicle.

4. Main Components used for this vehicle

Main Components used in this vehicle are shown in Figure 2.

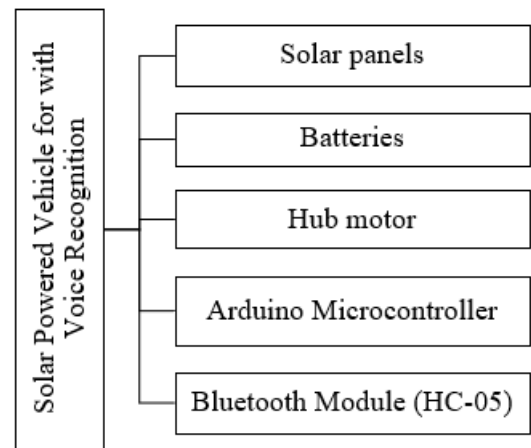


FIGURE 2. Main Components used in this vehicle



FIGURE 3. Solar Panel

4.1. Solar Panel

Photovoltaic is the field of technology and research concerned with devices that directly convert sunlight into electricity (Upare). Photovoltaic cells are the building blocks of photovoltaic technology. The figure 3 shows the real solar panels. Solar cells are made from semiconductor materials, such as silicon.

Several solar cells are electrically connected to each other and mounted on a single structure or support called a photovoltaic module. The modules are designed to supply power at a specific voltage, like a standard 12-volt system.

Specification of Solar Panel

- Solar panel= 100 watt
- Quantity =2
- Voltage = 12v

Solar panels are used to produce the power needed to drive the Hub motor. We use two quantities of 70X 65X 3.2mm monocrystalline silicon solar cells

shown in figure 3. The arrangement of the solar panels is located on the roof of the vehicles (Sachdev et al.). The solar panels provide shade for the driver. The solar panel generates 300 watts per hour.

4.2. Batteries

We used four 12V batteries are shown in figure 4. Store the electric energy of batteries produced by the solar panels. All the batteries are fixed at the bottom of rider’s seat. We need a time to charging 4 hours to fill a battery. The fill battery is to run around 30 - 40kms.



FIGURE 4. Batteries

4.3. Hub Motor

The two most common types of hub motors used in e-scooters and e-bikes are brushed and brushless. Direct-drive (in BLDC) and geared motor units (in BDC) are both used (Veeramani). Brushless motors have permanent magnets that rotate around the stationary armature, eliminating the problems associated with currents connected to the moving armature.



FIGURE 5. BLDC Hub Motor

A motor we used here is to run the vehicle which gets power from the 12V rechargeable battery. The

‘AMPERE’ 350 watts BLDC Hub motor shown in Figure 5 generates total speed of 35km/hr, which is sufficient to run our tricycle.

4.4. Arduino Microcontroller

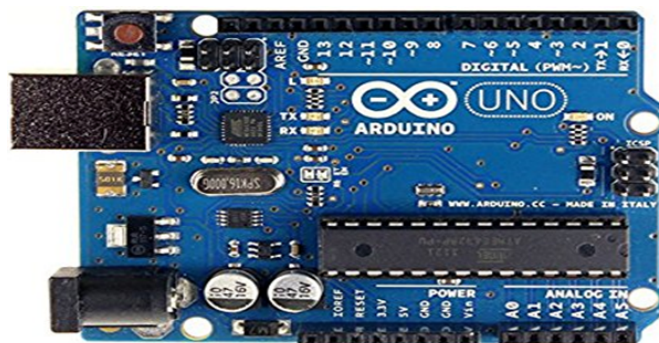


FIGURE 6. Arduino Microcontroller

Arduino UNO is an open-source microcontroller board and it is the core of this unit (Desai). The board is upgraded by sets of advanced and simple info/yield (I/O) sticks that will be interfaced with different electrical circuits. Figure 6 shows the Arduino Microcontroller board and it has 14 computerized pins, 6 simple pins and can be modified with the Arduino IDE (Integrated Development Environment) by means of a USB link. It tends to be accused of a USB link or with a nine-volt outside battery, despite the fact that it acknowledges voltages somewhere in the range of nine and twenty volts. Specifications of Arduino Board has given below in Table 1

TABLE 1. Arduino Board Specifications

| | |
|-----------------------------|---------|
| Functional Voltage | 5V |
| Input Voltage (recommended) | 7-12V |
| Input Voltage (limits) | 6-20V |
| Digital Input, Output pins | 14 |
| Analog Input pins | 6 |
| Clock Speed | 16MHz |
| Length | 68.6 mm |

4.5. Bluetooth Module (HC-05)

HC-05 module is an easy-to-use Bluetooth serial port protocol module, designed for translucent wireless serial connection setup. Serial port Bluetooth module is engaged with Bluetooth V2.0+ Enhanced Data Rate (EDR) 3Mbps Modulation with complete 2.4 GHz radio transceiver and baseband is shown in Figure 7.

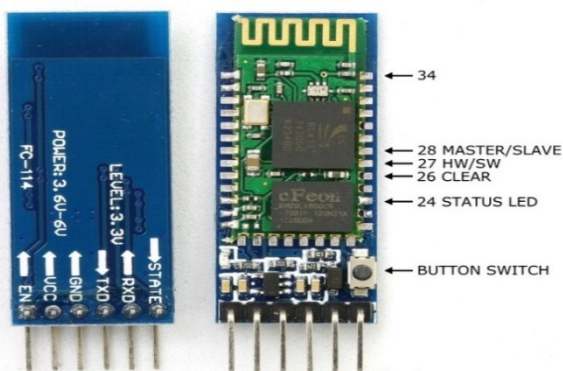


FIGURE 7. Bluetooth Module (HC-05)

The blue tooth is uses CSR Bluecore4.0 External single chip Bluetooth system with CMOS (Complementary metal–oxide–semiconductor) technology and with AFH (Adaptive Frequency Hopping Feature). It has a dimension of 12 mm x 27mm.

5. Fabrication of the vehicle

In this work we use 25mm hollow pipe for entire vehicle body structure (Esakkiraj Hassan). We provide a space for batteries at bottom of rider’s chair. Solar panels are assembled as top roof of rider cabin. Hub motor was fitted with front wheel of vehicle. Rear wheels are regular (Kandasamy). All kind of ECU components are fixed near batteries. Figure 8 shows the Flow chart of assembly of vehicle.

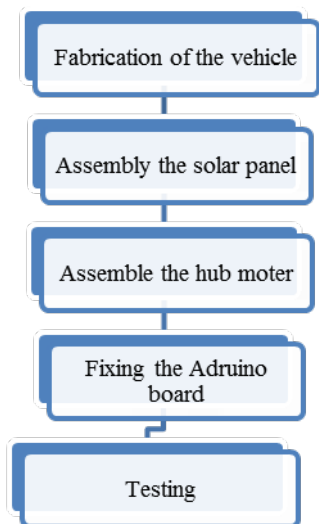


FIGURE 8. Flow chart for Vehicle Assembly

6. Voice recognition

The whole system comprises of Arduino UNO, Bluetooth Module and a Smartphone application. (Hua and Ng). The developed Smartphone

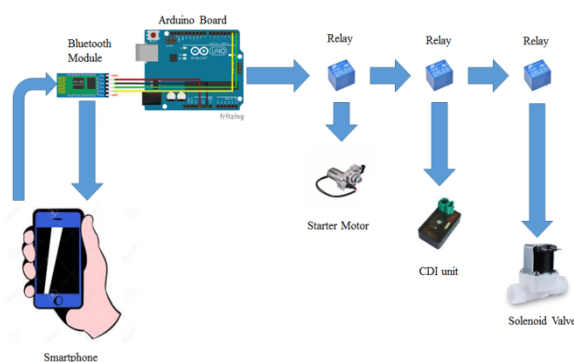


FIGURE 9. SchematicDiagram for Working

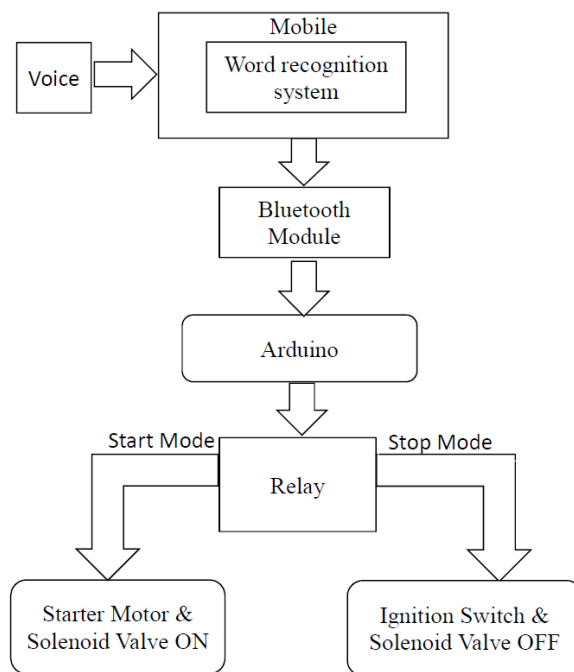


FIGURE 10. System Design Layout

application acts as a key for a vehicle, with App Locker, Biometric Fingerprint recognition, Face recognition etc. can be used for extra protection . If the voice command is “START” the Arduino will close the power circuit and allow the current flow to the motor. If the voice command is “STOP” the Arduino will turn OFF the vehicle

The Hardware components used are:

- Arduino Board
- Bluetooth Module
- Solenoid Valve
- Relay
- Printed Circuit Board
- Wires

The Software used are:

- Arduino Software
- MIT app inventor

7. System Design Layout

Figure 9 and Figure 10 shows the Schematic Diagram for Working and System Design Layout respectively. The smartphone is wirelessly connected with the Bluetooth Module; the connection is established by selecting the correct Bluetooth device from the smartphone app.

8. Conclusion

The designed solar tricycle with voice recognition will be a great remedy for the physically challenged to travel independently which is joyful and providing confidence to the user. The dependency of the physically challenged user to travel is highly reduced. The solar energy is a best replacement of fossil fuel. The goal of any education, technology and engineering gets its importance and scope only when it is useful to the society. This project is aimed towards that goal for the successful completion of the project.

ORCID iDs

Udhayakumar S  <https://orcid.org/0000-0002-4722-0161>

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