

## A CASE STUDY TO ADDRESS THE TRAVEL NEEDS OF PHYSICALLY CHALLENGED PEOPLE BY MANUFACTURING A MULTI – PURPOSE TRANSPORT VEHICLE

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*An experimental device developed and tested on a sample of physically challenged people with limited limb movement to test the ease of use and travel comfort.*

**Abstract** - Travelling around the world is a fantasy for people with limited limb movement or no movement at all. Often, they have to depend on other people to support then in computing from one place to another. The study is a microscopic observation of the travel needs of the physically challenged and the design of the vehicle is chosen after conducting plenty of research into the contemporary works conducted by other researchers.

The basic inspiration for the design of the vehicle is drawn from a previous experiment Conducted by two scientists who developed a wheel chair which is electronically controlled by using robotics. The chair was designed to take physically challenged people with little arm and leg movements to places. The researcher had developed a vehicle which is basically a hybrid of electric and gas power vehicles, the engine is chosen in such a manner it works on solar power also. The vehicle has been designed in such a manner it can be driven with a single limb and contains facilities which helps the person to sleep, use toilet facility available and charge his mobile and laptop during the drive. The study is conducted by testing the vehicle on five patients suffering with osteoporosis, a common decease among even young people, which weakens the bones and reduce the movements of limbs to a large extent and five patients suffering with slip disk and disabling back ache. The sample respondents chosen were briefed about the utility of the vehicle, they were shown and trained on the use of the vehicle and observations are recorded in the ease with which PHP were able get into the vehicle, drive it for a certain period and move in traffic comfortably. The area chosen for the study is a busy road which connects Guntur to the highway. The experiment was a success as the study was conducted under the surveillance of Road Transport Officer and it was conducted in real time situations.

**Key words:** Motor Electrical, Battery, Tubeless tyres, Controllers, Welding operation, seating arrangement. Solar charging enables system.

### 1.INTRODUCTION

We cannot imagine a life without travelling from one place to another, day by the globe is getting smaller and diversified work force is the call of the day. In these times of travel, one needs a warm heart to imagine the perils faced by physically handicapped people face in traveling. It is very difficult for physically challenged people to drive because of their limited use of their hand movements and leg movements and coordination is a great problem. By offering hand controls which are within the reach of the driver will make life an easier one for them and their response time will be less. Persons with Both Limbs Disability can use an Automatic Transmission Vehicle fitted with a Hand operated Brake & Accelerator. The study's focus is to develop a commercially viable vehicle which can enable physically handicapped people to travel in comfort on their own. Many a times, physically handicapped people have to depend on others for helping in moving from one place to another. The specific objective is to reduce such needs to enable them to travel on their own with the help of the vehicle.

#### 1.1.NEED FOR THE STUDY:

The need for the study arises from the fact that there are no vehicles designed to enable a physically challenged person to travel like normal people and in comfort. All my reference studies shows that only wheel chairs were developed to allow them travel inside the house but not on road. Also, those vehicles cannot be called transport vehicles because they were not approved to carry passengers. The researcher's idea is to develop a vehicle which is approved to carry passengers (Physically challenged people) on board and in safety and comfort. The vehicle will be a one stop solution for their travel needs while keeping in mind about their physical limitations. The specific objectives of the study are developed as follows:

## 1.2. STUDY OBJECTIVES:

- To understand the various travels needs of the physically challenged people.
- To develop a suitable and viable design for the vehicle which can satisfy their travel needs and safe for them to travel?
- To test the vehicle in real time situations under the surveillance of authorities.

## 1.3. STUDY METHODOLOGY:

The Methodology used for the study is based and experiment and testing method which is the most suitable for exercising engineering projects. In order to conduct the study a, model of the vehicle was developed with the help of previous studies available and a suitable model was designed. Then all the components were built and assembled in the work shop and fixed together. The vehicle was sent to the testing laboratory where the vehicle had its simulator runs and was found to be fairly safe even at the initial stages. A sample of 10 respondents with physically challenging disabilities such as osteoporosis and slip disk problems were chosen and under the surveillance of the Road Transport and safety authorities. The sample respondents were trained for using the vehicle for three days and they were allowed to test the vehicle and drive it in real traffic for about 5 Kilo Meters. Their observations were recorded and the vehicle was tested to be successful.

## 2. LITERATURE REVIEW:

In order to get an idea about the task in hand I have tried to gather as much information as one can from the similar studies carried over previous across the globe. The details of which are as follows:

### THE DEVELOPMENT OF THE "WELLESLEY CHAIR MIT, 2006:

Wellesley is the name given to the chair used for experimental development by HollyYanco, first at Wellesley College and now at MIT. This chair has a SubsumptionArchitecture-like layered approach to its performance. By means of a graphical interface the user of the chair points to the direction in which the chair should head. The chair then goes in that direction while performing other tasks such as obstacle avoidance. The interface also allows the user to tell the chair when specific tasks. such as going up ramp are required and to have a record of particular environment and important features of that environment. The chair is designed in such a way that it can turn in place. It has 12 proximity sensors, 6ultrasonic range sensors, 2 shaft encoders and a front bumper with sensors. A 68332 computer is onboard and the interface runs on a Macintosh Power book. Work is underway to incorporate

information from the angle of the eyes of the user to control the computer as a replacement for the mouse.

## 3. DESIGN AND DEVELOPMENT PROCESS:

The vehicle is developed keeping in mind the necessities of the physically challenged people. It is aimed to provide them with utilities such as cooking facility on board, provision of drinking water, sleeping facility, charging for laptop or mobile phone, emergency toilet and a comfortable seat.

The various stages in the design and testing process are:

- Identifying a suitable motor for the vehicle. The vehicle is fitted with a 150 CC Motor (Electro - Crafted tape drive motor).
- Identifying the sensors for controlling several mechanical devices such as the steering and other controls.
- Installation of Driving system with brakes.
- Design of the chassis with a light but strong material.
- Body construction and design of a solar panel to store the power required for the vehicle

Diagrammatic representation of the vehicle: Representation of the various stages is shown in diagrams as given below:

### 3.1. MOTOR DETAILS:

The motor is an electro craft tape drive motor from a reel to reel computer tape drive. The model number of motor was rubbed off. This motor firstly used to design cyclic motor vehicle. The specification of this motor is 5/8 inches diameter shaft and 14 gauge wire for power. Dimensions are 4 inches in diameter and 6.75 inches long. The motor has a fairly high winding resistance measured 0.5ohms which was one of the criteria that made me go with a 60 volt system.



Figure 1: Electro Craft Tape Drive Motor

### 3.2.CONTROLLER:

The bike uses a 60 volt electrical system to take advantage of the characteristics of the motor and to lower battery losses due to high amperage. 60 volts is fairly nonstandard and there is a bite more difficulty finding compatible equipment than with the more typical 36v or 48v. Luckily there are cheap scooter controllers and chargers available that work with 60v system. A key switch is used in-line with the throttle and accessory power circuit for security.

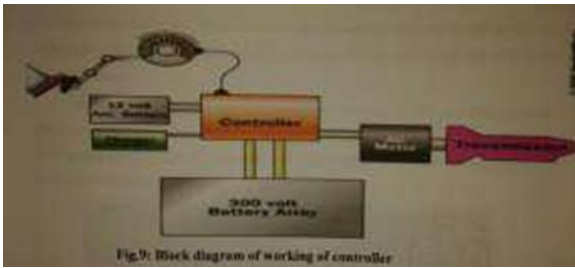


Figure 2: Electrical Controller

### 3.3.BATTERIES:

Lead acid batteries were the default choice at least for the initial build/proof of concept. Five (5) 7 amp-hour, 12 volt “bricks” in a series string were used to get a nominal 60 volts. The battery pack weight is 13.6kg. The typical rules of lead acid and avoiding discharges of over 50% this battery pack has capacity of 210 watt hours: $60v \cdot 7ah \cdot 0.5$ . The batteries are house hold in a fiberglass reinforced plastic case which is molded to fit into the triangle on the frame making this box was probably the single most labor intensive item in the project.

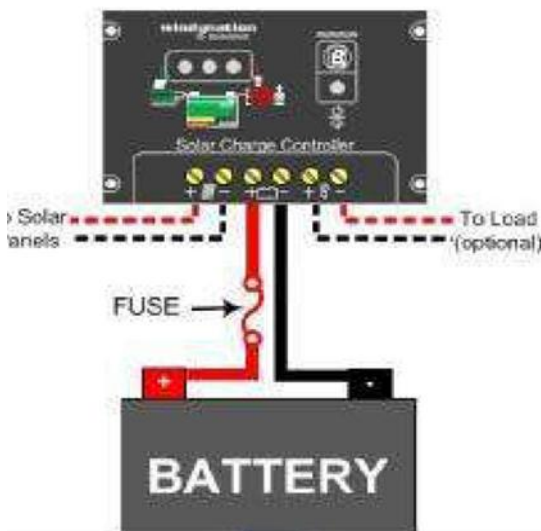


Figure 3: Battery

### 3.4.DYNAMIC BREAKING:

Given the heavy weight of the vehicle braking became more of a problem. The typical bicycle rim brakes worked but it was certain that wear of breaks pads and rims would be horribly quick if they were the only mode of braking. Since the motor generates electricity when coasting down long steep hills for more power than the batteries could ever absorb inn regenerative breaking a braking resistor was added. It’s nothing more than a coil of stainless steel wire that gives a resistance of about 4ohms. Using the debarked active a relay which switches the motor off of the controller and across this resistor.



Figure 4: Regenerative Breaking

### 3.5.DRIVE SYSTEM:

The drive system of this powered vehicle is open belt drive. The open belt drive is used with shafts arranged parallel in the same direction. In this the driver pulley pulls the belt from one side and delivers it to the other side. Thus the tension in the lower side belt will be more than that in the upper side belt. The lower side belt is known as tight side whereas the upper side belt is known as slack side the open belt drive is as shown in the figure

### 3.6.SEAT DESIGN SPECIAL FOR PHP'S :

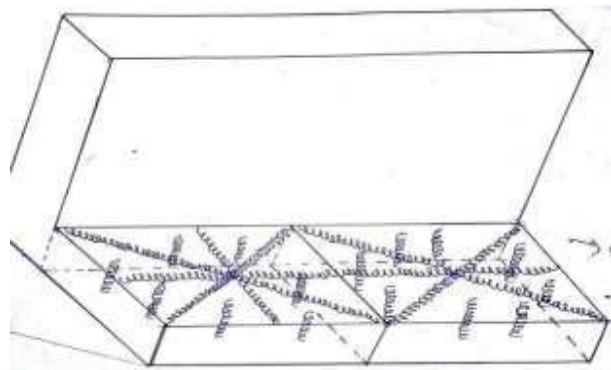


Figure 5: Seat

cross springs supports the total body weight pillar springs supports the vertical loads of muscles, bones and gives the uniform blood circulation of body pillar springs balances the vertical loads on the spines it reduces the sodalities pains.

#### 4.A PICTURE OF THE FINISHED VEHICLE LOOKS AS GIVEN BELOW:



Figure 6 : Finished Vehicle

#### 5. Testing process:

The vehicle is tested under the supervision of qualified automobile experts for injury and biomechanics testing and the results obtained were found to be good. Also, the vehicle is tested for road grip and stability to prove that it is safe for public transport and the results are positive.

#### 6. CONCLUSION:

The design and development of the project is meant to offer a solution for the needs of the physically challenged people and not entirely for commercial gains. However, economics in design and cost of the development are kept in mind in the creation of the vehicle. There is plenty of scope for further research and development in the project and it can be initiated in the future.

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