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Modeling and Manufacturing of Powered vehicle for physically challenged people

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Abstract: *This vehicle is suitable for physically challenged or disabled people. I proposed complete customized solutions for physically challenged drivers and patents also. This proposed vehicle successfully dealing with electric and Hybrid vehicle Conversions. In the market they are so many vehicles are designed for physically challenged peoples but my proposed system is a luxurious vehicle. Luxurious means vehicle which is automotive electrical vehicle and provide good hospitality to PCP's. Vehicle conversion products which enable the person to drive a vehicle with the help of his/her hands or using only one limb. With a disability, it can be very difficult to drive. Hand controls can make this much easier with more control and faster response times. Vehicle hand controls are suitable for almost any make and model car on the road today.*

Key words: *Motor electrical, Battery, Tubeless Tires, Controllers, velding, Operations.*

Different operating options available are:

- Hand Operated Brake.
- Hand Operated Accelerator.
- Automatic Clutch
- Fitting Universal Handel for any Point of Disabilities

The Hand Controls are customized & specially made for each user.

Various disability measures and their solutions:

- Persons with Right Limb Disability can use a Manual Transmission Vehicle fitted with a Hand Operated Brake & Accelerator

Persons with Both Limbs Disability can use an Automatic Transmission Vehicle fitted with a Hand operated Brake & Accelerator.

I. Introduction

Power wheelchair for use by people with various types and degrees of handicap. The intelligent wheelchair project intends to establish a methodology to design, implement, and test an effective add-on autonomy management system for use in conjunction with most common commercially available power wheelchairs.

Proposed vehicle is different than any other vehicle from the previous.

Some of the vehicles are look like my vehicle but that vehicles are did not provide much hospitality and facilitates. This vehicle truly designed based on my thoughts and urges of pcp's. and I had took some references regarding structure. And also proposed vehicle is electric(powered) vehicle.

This is a different structure and it gives a peaceful life to pcp's. in future it makes a rapid evaluation on pcp vehicles .

The proposed vehicle manufacturing cost is low compare to other powered vehicles . its available price is less than are equal to Rs.35000/. It gives a rich look,fashion and luxurious facilities.

And also it carries more than 150kg weight. And the main advantage of my proposed vehicle is easy to drive with single limb.

The luxurious facilities are provided in the vehicle is as follows:

Cooking
Drinking water
Sleeping

Laptop
Charging fan
Note: if people required any sensors and applications for their urges we provide much room for that.

The thought of design p.v for p.c.p's for a common man(pcp's) also live with a luxurious life with a minimal cost. It is designed based on Indian economical statics in physically challenged peoples(p.c.p's).
In market so many p.v are there but it cost is very high so a common man(pcp's) did not capture. that's why I designed this vehicle and it may be solve some of p.c peoples problems.

Literature survey on physically challenged vehicles:

The intelligent wheelchair project, now called the TAO Project, intends to establish a methodology to design, implement, and test an effective add-on autonomy management system for use in conjunction with most common commercially available power wheelchairs. In order to demonstrate the principle, the project will build, during its life, an autonomy management system for several well-established electric wheelchair models currently available on the market throughout North America and Japan.
In late 1995, a sister R&D company was established in Japan exclusively for the development of intelligent robotic technologies for the disabled and the aged. With the initiative of this new R&D group, the development of TAO-2 autonomous wheelchair using a commercially available Japanese wheelchair began in the spring of 1996.

Based on our experience, methods used and some issues related to the application of the behavior-based approach to realize an intelligent wheelchair and possibly other assistive technologies are discussed. A brief survey is also presented of other groups who are working in this area.

Brief survey of the field

Below is a description of research on intelligent wheelchairs that has been conducted and still ongoing at some institutions. The survey is not intended to be complete but to provide an idea of the different approaches used.

IBM T.J. Watson Research Center

Some of the earliest work in the development of intelligent wheelchairs was a system implemented by Connell and Viola, [Connell & Viola, 90] in which a chair is mounted on top of a robot to make it mobile. Mr. Ed, as the chair was called, could be controlled by the user using a joystick mounted on the arm of the chair and connected to the robot. The user could also delegate control to the system itself to perform certain functions such as avoid obstacles or follow other moving objects. In addition to the joystick, input to the robot comes from bumper switches at the front and rear of the robot, eight infrared proximity sensors for local navigation and two sonar sensors at the front of the robot for following objects. Control is passed from the user to the robot through a series of toggle switches.

A set of layered behaviors were used to control the chair's movement. These were broken into competencies with each small set of rules becoming a toolbox to achieve a particular goal. These groups could be enabled or disabled by means of switches controlled by the operator. It worked as a partnership in which the machine took care of the routine work and the user decided what needed to be done.

KISS Institute for Practical Robotics

The KISS Institute for Practical Robotics (KIPR), located in Virginia is a non-profit educational corporation performing R&D on the integration of robotics in assistive technology, space robotics and autonomous underwater vehicles as well as education in robotics and related fields.
David Miller and Marc Slack at KISS Institute have developed a supplementary wheelchair controller is installed between the joystick and the standard wheelchair motor controller. Along with sensors installed on the chair, the chair avoids obstacles and goes through openings with minimum input from the user. It has been tested with two power wheelchairs, Dynamics and Penny & Giles.

CALL Centre, University of Edinburgh

CALL Centre at the University of Edinburgh has developed the CALL Centre Smart Wheelchair. It was originally developed as a motivating educational and therapeutic resource for severely disabled children. The chairs were designed to assist in the assessment and development of physical, cognitive, social and communicative skills. Thirteen chairs have been built and evaluated in three local school, one in a residential hospital and three others in pre-vocational establishments.

The chairs are adapted, computer-controlled power wheelchairs which can be driven by a number of methods such as switches, joysticks, laptop computers, and voice-output. The mechanical, electronic and software design are modular to simplify the addition of new functions, reduce the cost of individualized systems and create a modeless system. Since there are no modes and behaviors are combined transparent to the user, an explicit subsystem called the *Observer* was set up to report to the user what the system is doing. The *Observer* responds and reports its perceptions to the user via a speech synthesizer or input device.

The software runs on multiple 80C552 processors communicating via an I2C serial link monitoring the sensors and user commands. Objects or groups of objects form modules which encapsulate specific functional tasks. It is multitasking with each object defined as a separate task.

The architecture of behaviors each performing a specific functional task is similar to Brooks' Subsumption Architecture.

2.4 University of Michigan

Simon Levine, Director of Physical Rehabilitation at the University of Michigan Hospital began development of NavChair in 1991 with a grant for a three year project from the Veteran's Administration [Bell et al, 94]. The Vector Field Histogram (VFH) method was previously developed for avoiding obstacles in autonomous robots and was ported to the wheelchair. However, this method was designed for fully autonomous robots and it was soon determined that there were sufficient differences in the power base between robots and wheelchairs and in the requirements of human-machine systems that significant modifications were required. This resulted in a new method, called Minimum VFH (MVFH) which gives greater and more variable control to the user in manipulating the power wheelchair.

The Nav Chair has a control system designed to avoid obstacles, follow walls, and travel safely in cluttered environments. It is equipped with twelve ultrasonic sensors and an on-board computer. This team uses a shared-control system in which the user plans the route, does some navigation and indicates direction and speed of travel. The system does automatic wall following and overrides unsafe maneuvers with autonomous obstacle avoidance. Since it is desirable that the system change the user's commands as little as possible, the system and user must cooperat ively adapt to environmental or function conditions. A new method called "Stimulus Response Modelling" has been developed in which the system qualitatively monitors changes in the user's behavior and adapts in realtime. It is designed so that the adaptation is smooth and the change in modes intuitive to the user. By adjusting the degree of autonomy of obstacle avoidance the control modes of NavChair can be changed giving the user more or less control depending on the situation.

Nagasaki University and Ube Technical College Existing ceiling lights in an indoor environment are used as landmarks for self-localization of a motorized wheelchair by [Wang et al, 97]. The chair is therefore restricted to use within one the layout of which is known in advance. An azimuth sensor is used to give the angle between a fixed point and a particular object and a vision sensor detects the ceiling lights. The ceiling lights are used as the landmarks but if the lights are missed then the azimuth sensor and the rotating angle of both wheels provide the information necessary to continue the navigation.

A laser range finder is used to detect obstacles in the chair's path. Two CCD cameras are used, one is used to detect the ceiling light landmarks and the other is used in conjunction with the laser range finder to detect objects. A slit-ray is emitted from the laser emitter and this is detected by the CCD camera. The image signal is processed by a logic circuit constructed with an FPGA which informs the controller if passage is clear or where obstacles exist. In twenty test runs in a room with ten ceiling lights the maximum position error was 0.35 meters and the maximum orientation error was 17 degrees.

TIDE Programme

Technology initiative for disabled and elderly people (TIDE) programme of the European Union began in 1991 as a pilot action with 21 development projects and a budget of ECU18 million. The SENARIO project (SENsor Aided intelligent wheelchair navigatIOn), one of the initial projects within TIDE, includes 6 member companies from Greece, Germany, the UK, and France to introduce intelligence to the navigation system of powered wheelchairs. The system consists of five subsystems: risk avoidance, sensoring, positioning, control panel, and power control. The risk avoidance subsystem includes the central intelligence and inputs information from the sensoring and positioning subsystems. The sensoring subsystem includes ultrasonic, odometer, and inclinometer sensors. The positioning subsystem identifies the initial position of the chair by means of a laser range finder and allows the chair to be used in known environments. The control panel subsystem accepts user's instructions and the power control subsystem converts the system's instructions into vehicle movements.

The system has two modes of operation, the Teach mode and Run mode. In the Teach mode the user selects the desired paths from a topological diagram. In the Run mode (on a predefined path) the user selects a path and the system will follow it based on stored information obtained during the Teach mode. On a free route, the system takes instructions from the user and navigates semiautonomously while monitoring safety and taking action or warning the user of the level of risk.

Wellesley College, MIT

Wheelesley is the name given to the chair used for experimental development by Holly Yanco, first at Wellesley College and now at MIT [Yanco et al, 95]. This chair has Subsumption Architecture-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 a ramp are required and to have a record of a 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, 6 ultrasonic range sensors, 2 shaft encoders and a front bumper with sensors. A 68332 computer is onboard and the interface runs on a Macintosh Powerbook. 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.

Northeastern University

The long-term goal of Crisman and Cleary [Crisman & Cleary,96] is to develop a robot which can go to a destination, retrieve an object and return it to the operator. A teleoperated and autonomous approach each has its strength and weaknesses. Therefore, a shared control approach is suggested to divide the task between the user and the robot, taking advantage of the strengths of each. The user performs high-level functions such as object recognition and route planning while the robot performs safety and motion controls. Since the user points the objects out explicitly in a video image, the robot has been named "Deictic". The robot, after receiving instructions how to move relative to the object, performs the local motion and waits for further instruction. This means there is continuous interaction between the user and the robot with the user giving instructions to the robot every minute or so. Commands are given to the robot by means of a button interface in which a verb description describes the desired motion of the robot and a noun describes the object relative to which the motion should be performed. The robot is able to navigate in almost any situation using its vision system to identify corners, edges, and polygonal patches. The initial work was done in simulation followed by an implementation on an Invacare Arrow wheelchair. Motion controller cards, optical encoders, and a vision system were added to the wheelchair New directional ultrasonic transducers were developed to detect obstacles at a wide angle in one direction and at a narrow angle in the opposite direction. This gave the robot the ability to detect objects not at standard height. A bumper with piezo-electric film embedded was installed to detect when the chair didbump an obstacle. A Puma 200 was used for the reaching experiments.

Powered vehicle Design Requirement:

I had studied so many litterateur survey regarding powered wheel chairs nothing will great on its working. its very expensive and operation and driving is critical compare to my proposed vehicle. its not a wheel chair it is a vehicle. My total vision is to help the PCPeoples, towards their required needs.

Required blocks to manufacture Proposed Vehicle:

1. Motor(Electro-Craft tape drive motor)
2. Controller
3. Batteries
4. Driven system
5. Tiers `
6. Dynamic braking
7. Bearings
8. Bolts and nuts
9. Belt
10. Body construction (Blue print)
11. Chassis formation

Above all are the requirements for the construction of powered vehicle for physically challenged peoples. And the following operations are performed to construct the vehicle

Design Operations:

- Marking operation
- Bending operation
- Drilling operation
- Threads cutting
- Step turning
- Groove cutting
- Cutting operation

- Welding operation
- Grinding operation

Motor:

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.

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 cheep 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.

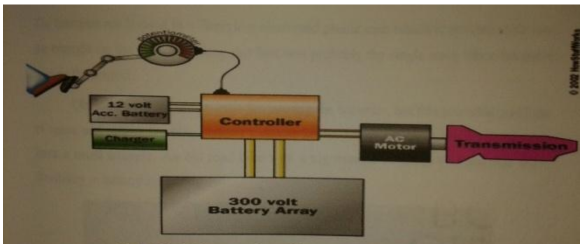


Fig.9: Block diagram of working of controller

Batteries:

Lead acid batteres 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*7ah*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.

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 pully 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 where as the upper side belt is known as slack side the open belt drive is as shown in the figure.

Tires:

A venire stretcher pavement tires was installed. They were inexpensive and had good ratings

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.

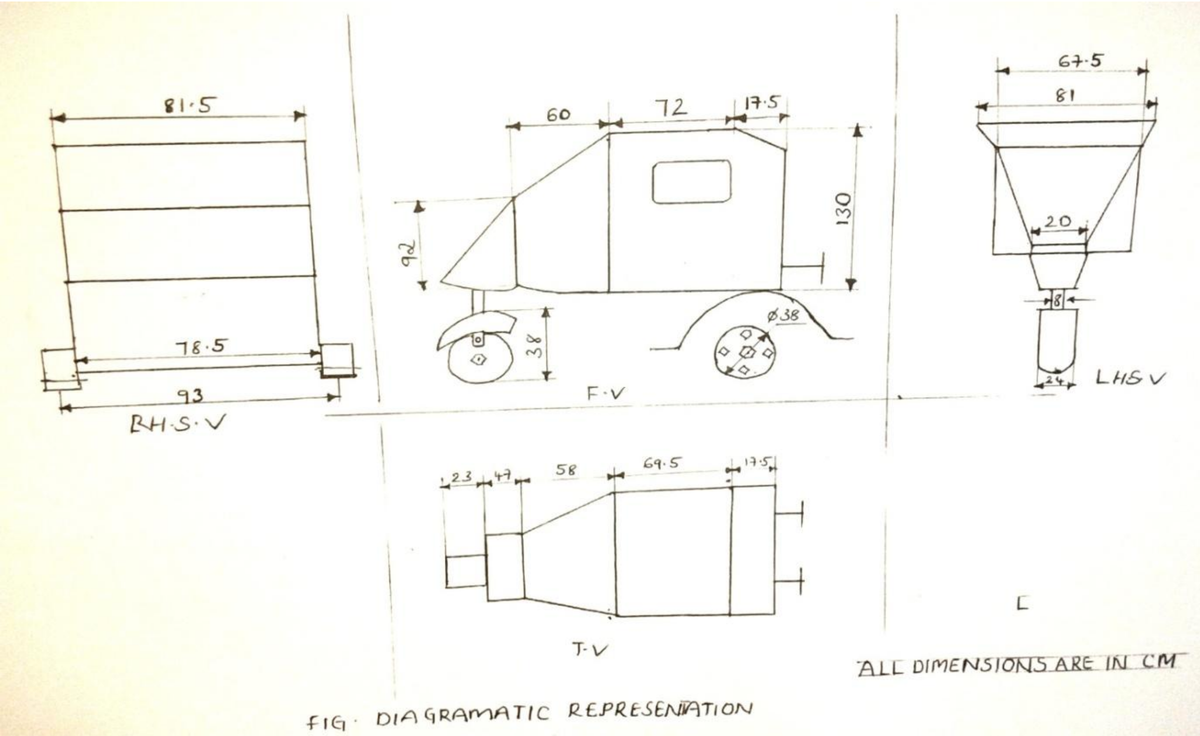
Since the motor generates electricity when coasting down long steep hills for more power than the batteries could ever asorb inn regenerative braking a braking resistor was added. Its nothing more than a coil of stainless steel wire that gives a resistance of about 4ohms. Using the d_brake active a relay which switches the motor off of the controller and across this resistor.


Above all are the main requirements of my powered vehicle. And my pv structure is as following it will shown in engineering drawing . it is look like a auto structure because the handle of the auto controls all the momentum of vehicle so I also proposed auto structure and I placed an application i.e it will be drive suitable single limb peoples that's y I had selected this structure.
Above requirements are to design inner means the engine structure and the body.

Body Structure:

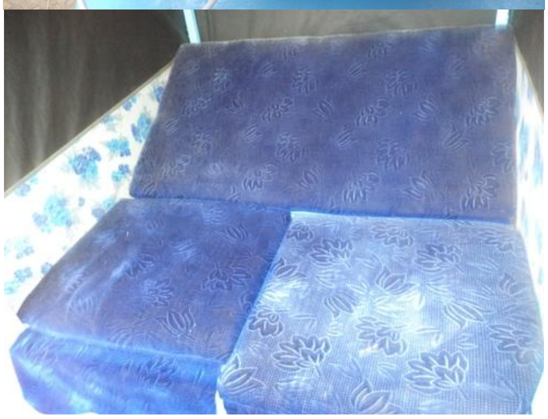



Body Frame represented in the form of Engineering drawing :



Facilities and Advantages:

- Cooking.
- Dust bin.
- Sleeping.
- Laptop.



ADVANTAGES:
1. More Facilities
2. Pollution Free
3. Noise free
4. Emergency Toilet
5. Less Cost
6. Less Vibrations
7. No fuel requirement
8. Easy maintenance

TECHNICAL DETAILS

6.1 TECHNICAL SPECIFICATIONS:

Vehicle type	: 3 Wheeler
Vehicle capacity	: Single person
Dimensions:	
Powered vehicle length	: 218cm
Powered vehicle width	: 82cm
Powered vehicle height	: 152cm
Motor:	
Motor weight	: 10kg
No of motors used	: 1
Motor type	: BLDC motor
Rated power	: 250W
Total vehicle weight	: 75kg
Battery:	
Type	: Sealed lead acid
Voltage	: 48V
Capacity	: 12Ah
No of batteries used	: 4
Charger:	
Rating	: 48V2A
Charging time	: 8-10 hrs
Range per charging	: 50 Kmpc
Power required	: 1 unit per full charging

No of controllers used	: 1
Estimate speed	: 25km per hour
No of wheels	: 3
Wheel diameter	: 38cm
No of bearings used	: 2
No of shafts used	: 1
Total shaft length	: 100cm
No of pulleys used	: 1
Pulley type	: Flat
No of belts used	: 1
Belt type	: Flat

6.2 MATERIAL SPECIFICATIONS

Material type	: MS Square pipes, circular pipe, flats and play wood
Square pipes thickness	: 2.5mm
Circular pipes thickness	: 3mm
Play wood thickness	: 3mm
Belt material	: Cotton
Pulley material	: cast iron (built)
Shaft material	: cast iron

II. Conclusion

This powered vehicle is not implemented .Our main criterian of this powered vehicle is economy of manufacturing.Despite of economy can any one can adopt automatic technologies for automatic opening and closing and openings of provided facilities so far cost factor we adopt simple technique in manufacturing of this multifaciltated vehicle.

The number of facilities provided in this power vehicle is helpful not only physically challenged people but also common .In personal intrest any one can adopt this vehicle.

These vehicles for challenged persons meet the expextations as the advanced technologies the person adopt this vehicle will satisfy more than expect. This vehicle provides almost all facilities without considerable moving of the person. Future Extension of my powered vehicle is automatic charging system by solar arrangement on the top of the vehicle, automatic seasonal dome opening, and advanced suspension system for avoiding quick fatigue of driver.

The vehicle specifications at glance
Voltage: 48v
Millage: 50K.m per Charge
Load: 150 K.g
Weight: 75Kg

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