

ARDUINO CONTROLLED SPECIAL STAIR CLIMBING WHEEL CHAIR BOT

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Abstract

In this paper a special stair climbing robot is proposed. In today's world, robots are used for almost all purposes. Now a days many day to day problems are solved due to the implementation of robots. Many robots like balancing robot, Stair climbing robot .etc. brought revolution in the field of transporting weights. But when it comes to senior citizens or physically disabled persons it is a tough task to climb the steps. This paper presents the structure, construction and application of an Arduino controlled special stair climbing robot attached with a wheel chair with which the person sitting in the chair directly climbs the steps. There is a special triangular assembly of three wheels attached to the geared heavy duty DC motors and this whole architecture is controlled with Arduino uno microcontroller board. The proposed stair climbing wheel chair bot can be controlled by a smart phone. The proposed system is very smooth and

more comfortable for the person using it. The person sits on it can easily control the system with his mobile phone. This system avoids another human assistance .i.e. the one who sits on it can control it without any others help. This system is a cost effective one.

Key Words:wheel chair, Arduino uno, heavy load dc motors, Bluetooth controlled bot, wall climbing bots.

1 INTRODUCTION

From thousands of years many inventions are done in order to ease the human life by solving day to day problems. Wheel chair was one among those wonderful inventions which made many lives easier than usual. It was developed in early 18th century in order to help the people who cant able to walk. From many centuries many evolutions had happened in many fields. Even in the case of wheel chairs many evolutions took place from comfortable wheel chair to electronic wheel chair. Now days many wheel chairs are available in market like racing chairs used by sports men, automatic wheel chairs [1],[2] which can be controlled by joystick and many more. There are many innovations in robotics which can be employed in many fields in order to get better results. We have many types of robots like stair climbing bot [3], mobile controlled bot [6], and obstacle detection bot which can be employed in many fields like medical, sports and many more

2 RELATED WORK

Now a days we have many models of wheel chairs which are automatic and can also climb stairs [7,8,9]. But the main problem with them is either they need another human assistance or they are slow. Sometimes there may be a chance of falling. Another important aspect we need to consider is the cost, all the existing wheel chairs are very costly such that a common human cannot afford them. There are many disadvantages in the existing systems like their speed, cost, safety, assistance, mainly the comfort of the person sitting on it.



Fig.1. (Topchair-S escalator model stair climber)

The existing stair climbing wheel chairs need another human assistance or very slow. There may be a chance of falling down and the person feels difficulty in operating the chair. One of the most considerable thing is the cost, as the available ones cost more than lakhs a common person cannot afford them. These disadvantages can be overcome by the implementation of the proposed system.

3 PROPOSED SYSTEM

This proposed system represents stair climbing wheel chair bot which can be controlled by android application with Bluetooth interface. This project is mainly proposed to make the life of senior citizens and physically challenged persons easy. This project includes a wheel chair with a triangular wheel alignment connected to heavy load dc motors which are controlled with android application. With this project we can make a wheel chair to climb the staircase easily. Here we use mainly Arduino UNO (ATMEGA 328P), Bluetooth module (HC-05), heavy load dc motor, triangular architecture. The Bluetooth module can be interfaced with the system so that we can easily control the system by smart phone application. This project is more necessary especially in the case of senior citizens and physically challenged persons. The project aims in designing a stair climbing wheel chair that can be operated

using Android mobile phone. The controlling of this is done wirelessly through Android smart phone using the Bluetooth feature present in it. Here in the system the Android smart phone is used as a remote control for operating. The controlling device of the whole system is a Microcontroller. Bluetooth module, DC motors which are interfaced to the Microcontroller. The data received by the Bluetooth module from Android smart phone is fed as input to the controller. The controller acts accordingly get control on the DC motors which helps in climbing the steps. In achieving the task the controller is loaded with a program written using Embedded C language.

In this proposed system we are going to design a wheel chair which can be controlled by a smart phone and can also climb the steps. This can be performed with the help of the special triangular architecture arranged in a special way such that, this system overcomes all the disadvantages of the existing system. Here heavy load DC motors can be used to make the system climb the steps and stepper motor is used to make the system make its turnings. The final model of the base of the system looks like

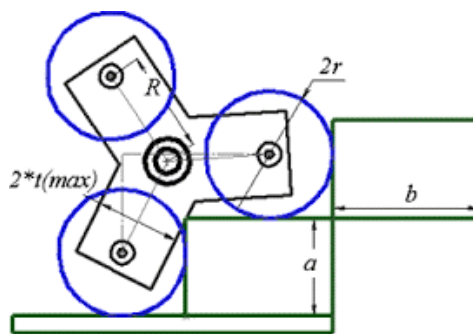


Fig.2. triangular assembly

The architecture was designed such that it forms an equilateral triangle if all the wheels centers were joined. this brings the system the capability to switch to the top wheel when there is an obstacle objecting the front wheels way. This makes the whole arrangement to climb the next step and the process repeats until all the steps are climbed or completed

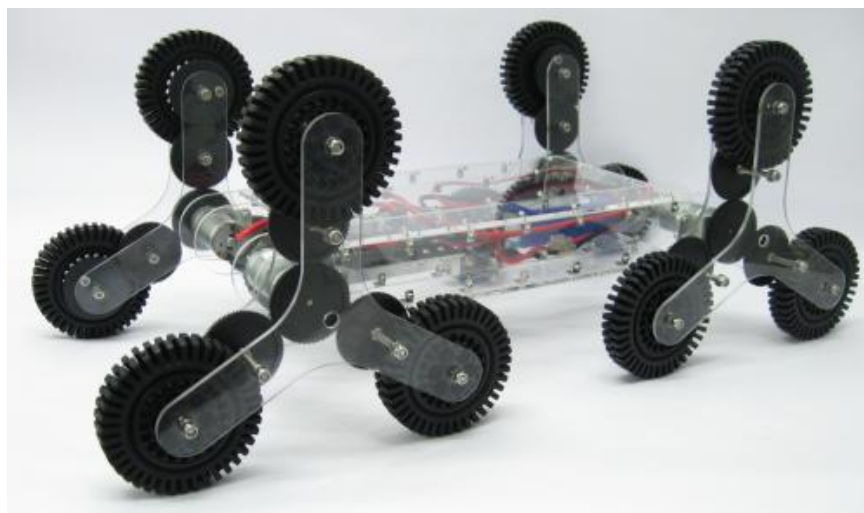


Fig.3. wheel alignment

4 IMPLEMENTATION

This project mainly consists of Arduino Uno microcontroller board (ATMEGA328P), Bluetooth module (HC-05), Bluetooth enabled Smart phone, Wheel chair unit with Triangular arrangement, DC motors

A- ARDUINO UNO

Microcontroller will act as the brain of the robot. The robot movement will be decided by the microcontroller. In this system we will be using microcontroller named Arduino UNO which contains ATMEGA 328P microcontroller chip. The microcontroller is programmed with the help of the Embedded C programming. Arduino has its own programming burnt in its Read Only Memory (ROM). C program is very easy to implement for programming the Arduino UNO.

B- BLUETOOTH MODULE (HC-05)

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. This is a highly qualified module with Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz

radio transceiver and baseband. It uses CSR Blue core 04External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). This module inter connected to smart phone, by receiving instructions from smart phone transfers them to microcontroller and there by the functioning starts.

BLOCK DIAGRAM

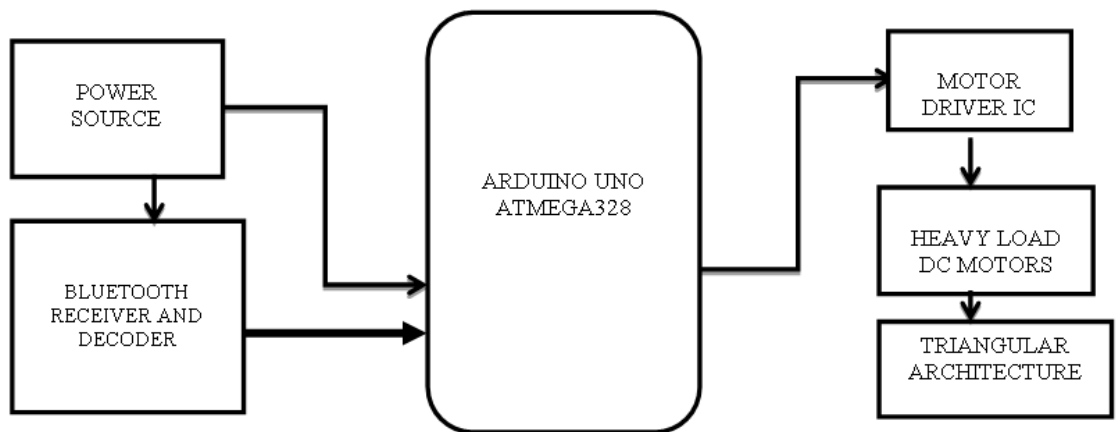


Fig.4. block diagram

C- SMART PHONE

The bluetooth enabled smart phone is used here. The smart phone acts as the remote of this circuit. It sends the instructions to microcontroller through Bluetooth module. It is used to send the instructions of forward, backward, left, right to the microcontroller. Actually, the smart phone is used as a remote of this system. Here we the Bluetooth RC Controller application as the operating remote of this system. The main advantage of this project is that the application software designed for android phones is kept simple but attractive with all required built-in functions. The novelty lies in the simplicity of the design and functioning.

D- WHEEL CHAIR UNIT

The primary wheel chair was invented in the late 18th century, from many years many evolutions took place in those wheel chairs

like powered wheel chair, electric wheel chair and now a days many types were available in the market.

The wheel chair used here is an electrical or powered wheel chair. As the name indicates the wheelchair is powered by a power source other than the human power which is initially used. Power motors are used in these wheel chairs in order to move without human power. In the further developed wheel chairs buttons and joysticks are used to make the movement more user friendly.

To this wheel chair unit, the proposed architecture which is incorporated with three wheel mechanism associated with a gear which controls three wheels. This whole architecture is connected to a heavy load dc motor which is controlled by a microcontroller.

The three wheel arrangement should replace the wheels in the wheel chair. Until any obstacle or step objects the motion the chair moves as a normal chair but when anything objects the front wheel automatically the chair climbs the steps. The clear explanation of its work is explained in working principle.

E- Dc motors

DC motor is designed to run on DC power. The two models of pure DC designs are the ball bearing motor, which is (so far) a novelty and Michael Faraday's homopolar motor (which is uncommon),. By far the most common DC motor types are the brushless and brushed types, which use internal and external commutation respectively to create an oscillating AC current from the DC source

Motor Driver (L293D) Motor driver IC is used to control the dc motors. It is also interfaced with the microcontroller and the circuit

F- POWER

The power can be provided to Arduino uno with the external power sources by adapters and USB connection. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Terminal wires from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

5 WORKING PRINCIPLE

In this design, DC motor is connected to the triangular architecture which consists of three wheels. The dc motor is controlled by smart phone. There are three controls to move forward, backward and remain neutral. While neutral there is no power connection to DC motor. When in forward position battery power is connected to motor, hence it moves forward. When it is to move in backward motion, the terminals are reversed make the motor to rotate reverse direction. When it is moved forward three wheels moves but when it gets obstructed the wheel on top goes forward and by then the system climbs the step.

Hardware of this project consists of Arduino UNO, Bluetooth module, heavy load DC motors, triangular architecture and a motor driver IC. The Bluetooth module is connected with the Arduino UNO board for the connection with the user. The Bluetooth module is used for controlling and monitoring the particular motor and reaches the board and process accordingly and the output of the Arduino goes to the motor driver IC and it controls the particular motor. Our proposed project consists of the following three sections: a) Input section b) Microcontroller section c) Output section In our android application base Bluetooth controlled robotic car, the user interacts with the system with a smart phone. In this method user must be present within in range (≈ 15 meters) to control the system. In future we would try to extend the range using Internet of Things (IoT). Based on users input data to the Arduino board then the corresponding pin of Arduino goes to high state and switches the motor driver ic in the on mode. The corresponding motor works as per the input data. Here in this project the user (android application) is the input section. This device is connected with the Arduino board (microcontroller section) by the means wirelessly i.e. Bluetooth module. The system can now be connected with the motors (output section) to be controlled via wireless connectivity.

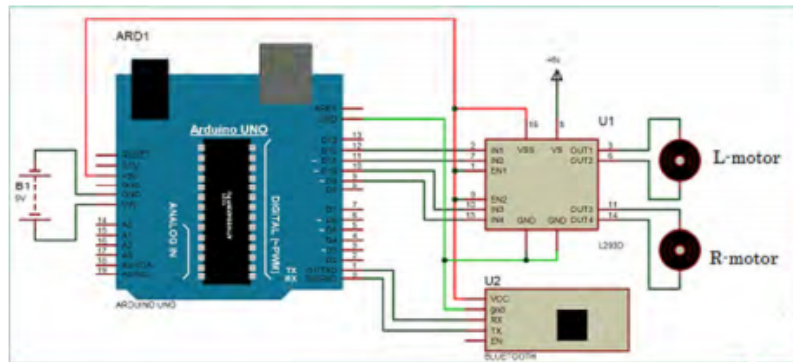


Figure 7. Circuit diagram of the project.
 Fig.5. (Circuit diagram of arduino Interface with DC motors)

To the above diagram the proposed triangular architecture was attached to the DC motors. The proposed architecture was designed such that it forms an equilateral triangle if all the wheels centers were joined. This brings the system the capability to switch to the top wheel when there is an obstacle objecting the front wheels way. This makes the whole arrangement to climb the next step and the process repeats until all the steps are climbed or completed

Integrated development environment

Arduino is open source physical processing which is base on a microcontroller board and an incorporated development environment for the board to be programmed. Arduino by taking a few inputs like switches or sensors, controls a few multiple outputs like lights and engine and others. Arduino program can run on Windows, Macintosh and Linux operating systems (OS) opposite to most microcontrollers frameworks which run only on Windows. Arduino programming is easy to learn and apply to beginners and amateurs. Arduino is an instrument used to build a better version of a computer which can control, interact and sense more than a normal desktop computer. Arduino is an open-source physical processing stage focused around a direct microcontroller board, and an environment for composing programs for the board. Arduino can be utilized to create interactive items, taking inputs from a diverse collection of switches or sensors, and controlling an assortment of lights, engines, and other physical outputs. Arduino activities can be remaining solitary, or they can be associated with programs

running on your machine (e.g. Flash, Processing and Maxmsp.) The board can be amassed by hand or bought preassembled; the open-source IDE can be downloaded free of charge. Focused around the Processing media programming environment, the Arduino programming language is an execution of Wiring, a comparative physical computing platform. The turnings can be achieved in the system by incorporating stepper motor to the front wheels.

6 THE MAIN ADVANTAGES OF THIS SYSTEM ARE

- It doesnt need other human assistance.
- The one who sits on it can control it with his smart phone.
- Safety will be high in this case as the sitting persons position will not be changed in this case
- The person sitting on it feels highly comfortable as the triangular arrangement helps in avoiding the jumps.
- The cost will be low compared to the existing system.

7 CONCLUSION

The system which is proposed can ascend and descend the stairs. It can be moved on the floor as a general wheelchair. Its payload can match the average weight of a person. Than looking this as an electronic project, it is actually an evolutionary thing which makes the lives of many persons easy and helps many physically challenged persons especially to make them climb steps. The incorporated feature (to control this with mobile) increases its feasibility. Even the one who sits on it can control it very easily at the same time the others can control it very easily. . We can also add wireless camera to it in order to monitor the patients situation and present condition in hospitals.

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