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A Review on Automatic Staircase Climbing Platform

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Abstract - *In today's life, technology related with robots plays a key role in many fields because they are used to operate in dangerous and urban environments, for different operations. Some of the E robots are designed to operate only on natural terrains, but it can also use for rough terrains and artificial environments including stairways. This paper represents the mechanism of how will robot climb the stairs carrying load. Its mechanical design is suitable with front wheel and back wheel driven by DC motor for climbing stairs. Although many robots had been introduced earlier have some problems like need of special device or software to control the robot etc. This paper suggests an advance method for robotics control using the mechanical links. Until recent years, the stair climbing robots are designed with huge hardware and robots are furnished with chain roller to climb stairs or to move on a flat surface. The mechanical design of the this robot contains the fixed and flexible links of wheel legs instead of chain roller moves relative to each other to generate high friction with stairs.*

Key Words: **ATMEGA 32, Platform, Sensor, Stair, Motor**

1. INTRODUCTION

The old constructions in the heavily crowded areas of cities do not have lifts. The task of climbing stairs is a major challenge for physically handicapped people or for elderly people because of the age-dependent impaired mobility.

Also transferring a material from the ground floor to the upper floors is another challenge even for a normal person living in old and high buildings which do not have lifts. Hence, a platform for climbing steps of the stairs is a major requirement at least in underdeveloped regions.

The platform serves the purpose of a chassis. Different versions, such as staircase-climbing wheelchair or staircase-climbing trolley for material transferring, staircase climbing stretcher can be derived depending on the object built on the platform.

These platforms can also be useful in the buildings with lifts, particularly when power backup is unavailable. Several rehabilitation devices are currently available or in development.

This platform is controlled by using microcontroller ATMEGA 32. The body of the model is being prepared mechanically and electronic components are being selected to be suitable for the task.

The movement of this model is controlled by controlling the directions by DC motor. (Forward, reverse, right and left).

2. LITERATURE SURVEY

2.1 Basilio Dobras Castillo, Yen-Fu Kuo, Jui-Jen Chou, "Novel Design of a Wheelchair with Stair Climbing Capabilities", IEEE ICIIBMS, Track2: Artificial Intelligence, Robotics, and Human-Computer Interaction, Okinawa, Japan 2015

Author has discussed about stair climbing wheelchair with four "X" shaped wheel that uses its legs to climb and descend stairs. [1] The author surveyed of Taiwan and found out a conclusion of having persons of ages 60-100 is about 18.12%.[1] As Taiwan is taken as a survey point so according to Taiwan they considered the height and base of stairs as height≤18cm and its base≥23cm so giving Φ=36.83° which is required.[1]

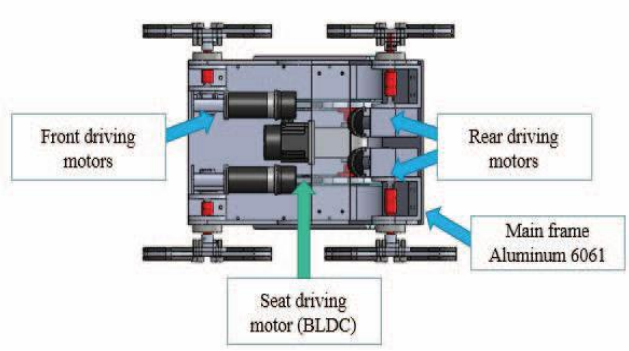

Fig -1: Overview of stair climbing wheelchair structure

Advantage of the design is to use IMU (Inertial Measurement Unit) a sensor was used to detect the angle of seat in relation to ground (Basilio Dobras Castillo, Yen-Fu Kuo, Jui-Jen Chou) and two IMU's with 3-axis gyroscope, a 3-axis accelerometer, and a 3-axis magnetometer are used which did stair detection by author (Ren C. Luo, Ming Hsiao and Tsung-Wei Lin).[1,2]

2.2 Ren C. Luo, Ming Hsiao, Tsung-Wei Lin, "Erect Wheel-Legged Stair Climbing Robot for Indoor Service Applications", IEEE/RSJ International Conference onIntelligent Robots and Systems (IROS), 3-7 November, 2013

Author has discussed about triangular wheel legged structure. [2]

Locomotion techniques where robot can rotate a pair of triangular module to climb up stairs and keep balance at the same time. The active wheels on the vertices of the slope line. [2]

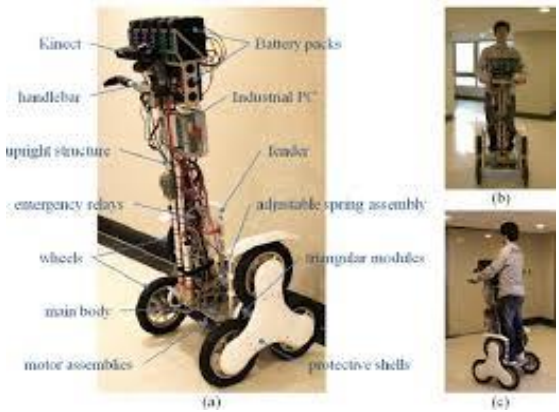

Fig -2: The general structure of the erect stair-climbing robot and the robot with a human rider standing on it

Advantage is to use the Simulation techniques with various realistic parameter setting using MATLAB. [2]

And Kinect a sensor is a popular sensor for robotics. Because of its robustness and real-time ability, it is used as our main sensor to recognize and measure stairs. [2] Procedure discussed was to first measure basic specifications of robot and testing the basic motions on flat ground with moving forward, backward and turning with zero radius which made a complete design overview. [2] There was no drawback in the system designed by the Ren C. Luo.

2.3 Weijun Tao1,*, Yi Ou1 and Hutian Feng1, "Research on Dynamics an Stability in the Stairs-climbing of a Tracked Mobile Robot", International Journal of Advanced Robotic Systems, 2 May, 2012

Author has discussed about the stairs-climbing ability of another tracked reconfigurable mobile robot with a modular structure by analyzing the robot's kinematics and dynamics in the stairs-climbing process.[3]

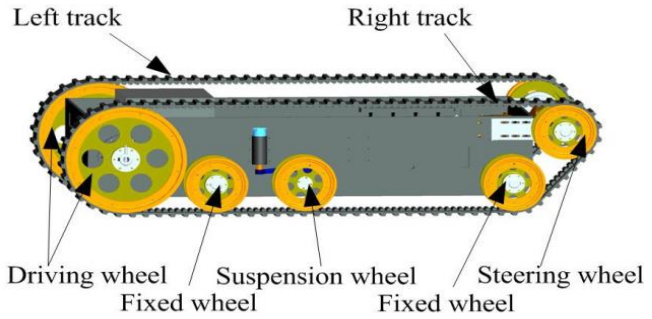

Fig -3: Structure of the tracked mobile robot

Advantage of the design was having a total mass baring capacity of 62kg which can be taken as a normal weight of the object.[3]

The drawback is deciding the stair height and base. Because if we decide these values, the design would be useful for that particular stairs which is considered.[3]

2.4 Basil Hamed, "Design and Implementation of Stair-Climbing Robot for Rescue Applications", International Journal of Computer and Electrical Engineering, 3 June, 2011

Author has discussed about design and implementation of feedback control system for RF remote controlled stair climbing robot.[4]

Fig -4: Top View of the Robot

Advantage of the design is to use micro C and visual basics 6.0 program to carry out the controlling operations via PIC controller and proteus software for PCB designs which we found is a simplest technique. [4] And RF module used to control Robot wirelessly 433.92MHz where USART was used for serial communication via RS-232 cable.[4]

The drawback of the design is having a design dimension of (60×40×13) cm. Which is found to be compact.[4]

Thus, we conclude that above survey gave us a line of sight to design a project model where above mentioned drawbacks would be overcome.

3. DESIGN

Designconsist of mathematical calculations, technical information, and creativity for development of certain different mechanism with maximum economy and efficiency. Hence careful design approach has to be acquired. The full design work has been split into two parts.

3.1 System Design

3.2 Mechanical Design

3.1 System Design:

The system design is a process where the physical and logical architecture is defined. We are mainly focusing on the concept of compact design which will require less space.

The block diagram shown in Figure (1) shows the main design of the stair climbing platform which consists of:

Power supply, DC motors, LCD. The main part of the robot is ATMEGA32APU1018. The various system components are explained below:

- ATMEGA 32: It is the heart of the system. It is a 32bit programmable controller used for controlling the operations of the system.
- Sensors: IR sensors are used to sense the motion of robotic platform.
- Motor Driver: L293D motor driver is used to drive the DC motors.
- DC Motor: The DC motor of low RPM and high torque is used.

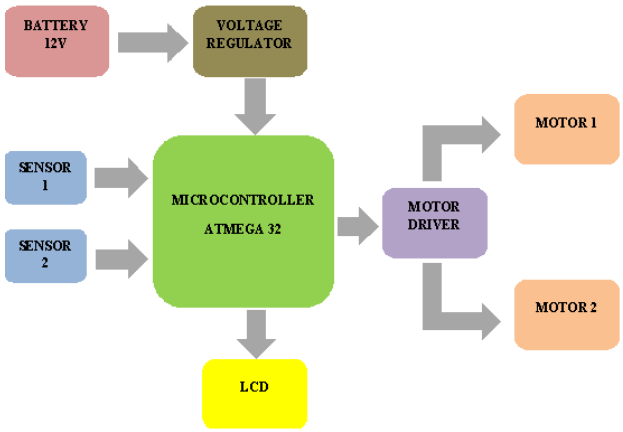

Fig -1: Block Diagram of Automatic Staircase Climbing Platform

3.2 Mechanical Design:

Mechanical design is very important from the view of designer as whole success of project depends on the correct design analysis of the problem. Designer should have an adequate knowledge about physical properties of material, load stresses and failure.

Selection of factors of safety to find working or design stress is another important step in design of working dimensions of machine elements. The correction in the theoretical stress values are to be made according in the kind of loads, shape of parts & service requirements Selection of material should be made according to the condition of loading shapes of products environment conditions & desirable properties of material.

4. SOFTWARE TOOLS

4.1 Embedded C program:

Embedded C is nothing but a subset of C which is compatible with ATMEGA 32 very efficiently. [5]

It is very easiest for the programmer to develop applications of embedded systems using this.

4.2 Proteus Software:

Proteus combines ease of use with powerful features to help us design, test and layout professional PCBs.

Proteus PCB design seamlessly combines Schematic capture and PCB layout to provide a powerful, integrated and easy to use suit of tools for professional design.

So, it is used to design circuit diagram and PCB layout

4.3 AVR studio:

AVR Studio is a software development environment developed by Atmel with an editor, simulator, programmer, etc. It comes with its own integrated C compiler the AVR GNU C Compiler (GCC). As such you do not need a third party C compiler. It provides a single environment to develop programs for both the 8-bits, 32-bits microcontrollers. So, we are using it to simulate programs.

5. FUTURE SCOPE

- In villages there is need of elevators but they are not available in most cases, so there is an demanding need for some sort of solution for this problem.
- This project may be the complete solution, so it will definitely improve the conditions up to a certain extent.
- The main objective of the present project is to provide a module which can also solve the problem of disable people to climb them up and down.
- The advantage which achieved from our Idea is Disabled people can climb stairs without manual help if chair is fixed on platform, lifting patients from upper floor to ground floor in case lift is not available or electricity supply is cut off because of which lift can't be worked. This study is dedicated to schools, colleges, offices, and tall buildings.

6. REFERENCES

[1] Basilio Dobras Castillo, Yen-Fu Kuo, Jui-Jen Chou, "Novel Design of a Wheelchair with Stair Climbing Capabilities", IEEE ICIIBMS, Track2: Artificial Intelligence, Robotics, and Human-Computer Interaction, Okinawa, Japan 2015

[2] Ren C. Luo, Ming Hsiao, Tsung-Wei Lin, "Erect Wheel-Legged Stair Climbing Robot for Indoor Service Applications", IEEE/RSJ International Conference onIntelligent Robots and Systems (IROS), 3-7 November, 2013

[3] Weijun Tao1, Yi Ou1 and Hutian Feng1, "Research on Dynamics an Stability in the Stairs-climbing of a Tracked Mobile Robot", International Journal of Advanced Robotic Systems, 2 May, 2012

[4] Basil Hamed, "Design and Implementation of Stair-Climbing Robot for Rescue Applications", International Journal of Computer and Electrical Engineering, 3June, 2011

[5] Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, "AVR MICROCONTROLLER AND EMBEDDED SYSTEMS": Using Assembly And C for ATMEGA 32 Prentice Hall, 2009.