DESIGN AND FEBRICATION OF STAIR CLIMBING ROBOT

SRI SABARINATHAN.R[1], AAKASH RAJ.R,[2],AJITH KUMAR.S,[3]DEVABALAN.R,[4],

1 Assistant Professor, Department of Mechanical Engineering, Gnanamani College of Technology
2,3,4,5 III year, BE, Department of Mechanical Engineering, Gnanamani College of Technology

ABSTRACT

Since the invention of the wheel, Man has sought to reduce effort to get things done easily. Ultimately, it has resulted in the invention of the Robot, an Engineering Marvel. Up until now, the biggest factor that hampers wide proliferation of robots is locomotion and maneuverability. They are not dynamic enough to conform even to the most commonplace terrain such as stairs. To overcome this, we are proposing a stair climbing robot that looks a lot like the human leg and can adjust itself according to the height of the step. But, we are currently developing a unit to carry payload of about 4 Kg. The automatic adjustment in the robot according to the height of the stair is done by connecting an Android device that has an application programmed in OpenCV with an Arduino in Host mode. The Android Device uses it camera to calculate the height of the stair and sends it to the Arduino for further calculation

KEYWORDS: *Adjustable frame,wheel,motor,chain.*

1.INTRODUCTION:

The sight of a robot climbing stairs is one to behold. There has been extensive research and development with a drive to improve these kinds of robots with respect to factors like cost, climbing ability, reasonability and practicality of its mechanical complexity. Further it aims to lower body weight, reduce the power consumption while also increasing the payload carrying capacity. Robots employ different types of mechanisms for their locomotion. The synthesis of mechanisms is the very first step in any robot design depending upon its application. Each type of mechanism has its own strengths on which it can capitalize. Some of them use wheels, some use legs and so on. With the passing of time and advanced research, technology has gone mobile. The robotic is the area of automation which integrate the technology in variegated field like mechanisms, sensor,remote manual operating systems .the synthesis of mechanisms is the very first step in any robot design depending upon its application

Adjustable stair climbing robot is one of the most attractive performances of robot in legged and wheeled. Developments have been made on various kinds of stair climbers, considering how to make its climbing ability higher and its mechanical complexity reasonable and practical. The research includes realizing a large step negotiating. Reducing body weight and energy consumption is also the important matter of developing. We introduce some solutions to realize stair climbing machines that we developed. Each of them has good performance as in a category of their kind, e.g. various numbers of wheeled shapes. Then, we discuss a development of adjustable high-grip mover, which we think one of the best solutions as the stair climber .A mechanism is a combination of rigid or restraining bodies so shaped and connected that they move upon each other with definite relative motion. A machine is a collection of mechanisms which transmits force from the source of power to the load to be overcome, and thus perform useful mechanical work. Robotics is the area of automation which integrates the technology in variegated fields like mechanisms, sensors & electronic control systems, artificial intelligence and embedded systems. The synthesis of mechanisms is the very first step in any robot design depending upon its application.

2.RELATED WORK:

Stair climbing has been carried out with robots using different types of mechanism. one wheel legged and tracked robots. developments have been made on various kinds of stairs climbers.

2.1 WHEELED ROBOTS:

Wheeled robots usually have to resort to mechanic extensions to overcome stairs. One application of such a technique is inpatient rehabilitation, where stair climbing could greatly enhance mobility, and thus quality of life, of people confined to wheelchairs. Lawn and Shiatsu [1] present a stair-climbing wheelchair using two (forward and

rear) articulated wheel clusters attached to movable appendages. The robot is equipped with step-contact sensors, but relies on user steering and is thus only semi-autonomous. Where front and rear segment can slide linearly up and down in order to negotiate a large height difference of front and rear landing point on the stairs .

2.2 LEGGED ROBOTS:

Authors have been also been developed quadruped with another strategy according to the design concept in which total number of actuators can be used as small as possible hypersion.as waling robot with minimum actuated dof for walking motion. Figliolini and Ceccarelli[2] present the architecture of the bipedal robot EP-WAR2, that uses electro pneumatic actuators and suction cups for locomotion. In order to climb stairs, the robot relies on an open-loop control algorithm implemented as a finite-state machine. The main limitation of the approach that operating in a different staircase necessitates manual recalibration

General purpose steel bars for machining, suitable for lightly stressed components including studs, bolts, gears and shafts. Often specified where weld ability is a requirement. can be case-hardened to improve wear resistance. Available in bright rounds, squares and flats, and hot rolled rounds. Can be supplied in sawn blanks, and bespoke size blocks

2.3 TRACKED ROBOTS:

Tracked vehicles include construction vechiles.military armored vehicles and unmanned ground vechicles.the principle design of tracked over wheeled vechicle aTracked robots have a larger ground contact surface than wheeled vehicles and are more stable than bipeds due to their low center of gravity. Liu et al.[3] derived the fundamental dynamics of the stair-climbing process for a tracked robotic element, analyzing the different phases of

riser climbing, nose crossing, nose line climbing and the effects of grouser bars or cleats. The analysis is limited to 2D, and slippage, shocks, and intermittent loss of track-surface contact, phenomena that are commonly encountered during stair climbing, are neglectedre they are in contact with a large surface area than would generly be the case.the prominent tread of the metal plates are both hard-wearing and damage resistant,espically in comparison to rubber tires.the aggressive tread of the tracks provide good tractionin soft surfaces.

3.MECHANISM OF A ROBOT:

The mechanism of usually have been utilized in the indoor environment due to their advantage on the application .to extant the application area to the outer environment . The adjustable stair climbing robot consists of a adjustable wooden frame, D.C induction motors, Wheels, On-Off Switch, Connecting wires, circuit board and a platform.

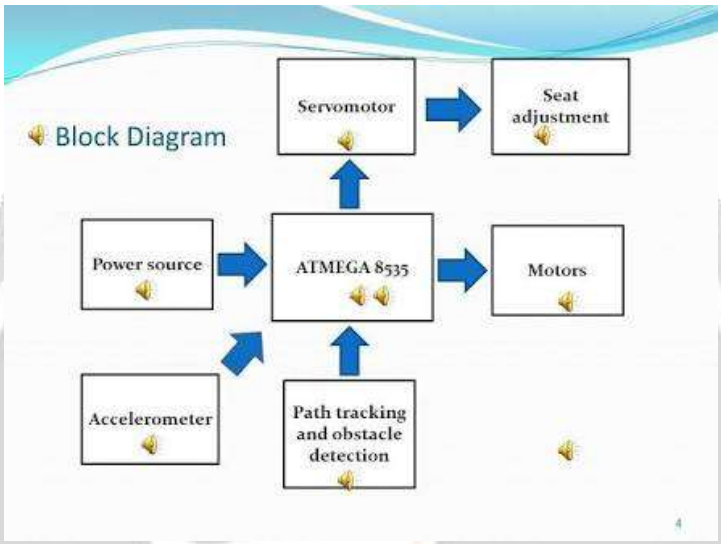
robot body is modeled as a rectangle, and its center of mass is assumed to be lied at the center of the rectangle. robot body is assumed to be moved in the quasi-static constant-velocity with forward motion without any pitch, and dynamics of the swing leg are ignored due to its low inertia compared to that of the body. Every time customer has to pull the trolley from rack to rack for collecting items and at the same time customer has to do calculation of those items and need to compare it with his budget in pocket. After this procedure, customer has to wait in queue for billing. So, to avoid headache like pulling trolley, waiting in billing queue, thinking about budget, New conce the robot forword and backward with the help circuit bord is designed for moving robot.

3.1.2 PLATFORM:

This platform is used to carry the materials up and down .it is made by steel board attached to the frame the developed stair climbing crawler with powder filled belts comparison experiments between a crawler with powder filled belts

3.1.3 CIRCIT DIAGRAM:

he robot forward and backward with the help of remote control. The circuit board is designed for moving the robot which can climbs the stairs up and down. It is a wireless circuit which produces 12v when moving up and 6v when moving down. Slitting is carried out with a pair of circular blades. the rotary cutters slit the sheet along straight line or along straight line or along a closed contour. The blades or either rotated by power or kept idling through which the sheet is pulled.



3.**2 PARTS SPECIFICATIONS**:

S.NO	PARTS	SPECIFICATION	QUANTITY
1	motor	12v dc gear motor 60RPM	5
2	Upper wheel	7cmx2cm	1
3	Lower wheel	10.5cmx4,2cm	4
4	battery	12v,1500mah	1
5	Circuit board	12v-moving up and ,6v-moving down	1
6	Adjustable frame	Length can be adjust able	1
7	platform	420mmx102mm	1

4.STEPS FOR MAKING THE ROBOT:

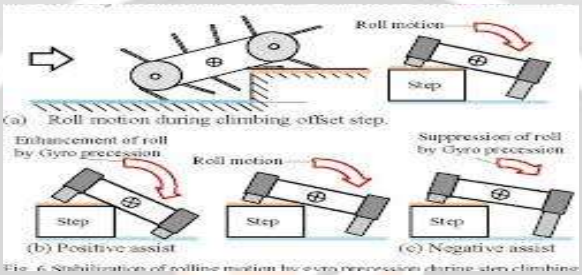
- First design the wooden frame as per m.the dimensions with adjustable mechanis
- The structure of the robot should be rigid
- The five D.C motors are attached to the end of the frame.
- Four 12v batteries are connected in series for constant movement of wheels.

- The positive connection is upto12v, and negative connection is up to 6v.
- Positive connection is for forward motion and negative connection is for backward motion.
- These connections are linked to circuit board for the robot motion.
- The robot can be controlled by remote which is connected to circuit.
- The remote has a switch which is helpful for the backward and forward motion of robot.

5.WORKING OF THE ROBOT:

Working of the robot takes place stepwise. The robot comes to rest momentarily after each step. The four steps for climbing the stairs are

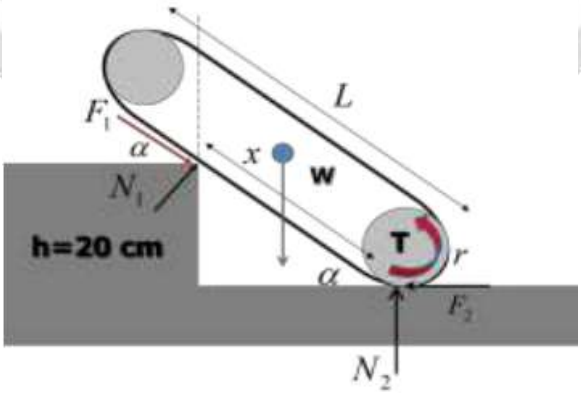
1. Robot wheel touches the step
2. Lifting the front part.
3. Lifting the back part of the robot.
4. Following the above steps the robot proceeds.
5. It can also be used for descending of steps.



The product should be ergonomic and easy to use. The weight of product should be comparable that of conventional models. Future work on this product should involve design and construction of other prototypes which use different stair-climbing strategies. Also, the possibility of a design that does not rely on an electrical power source should be investigated thoroughly

6.ROBOT WHEEL TOUCHES THE STEP:

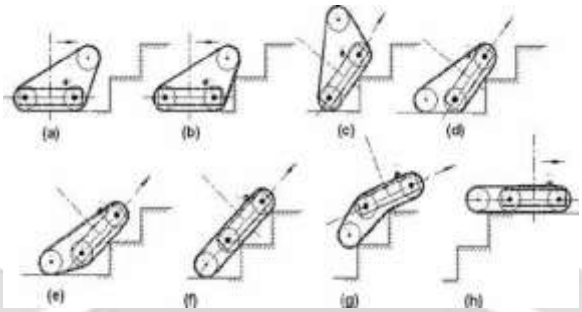
Initially the robot is in horizontal position and when the robot touches the first step, the upper wheel is ready to move upward to lift the front part of the robot. Although the crawler with grouser –attached tracks could not ascent the stairs because the traction from the edge.



7. EXPERIMENTAL RESULTS:

We are succeeded to run the stair climbed robot to climb the stairs up and down which has shown .
in figures displayed below.we describe the pratical stair climbing crawler and the mechanisms required to obtain sufficient grip force on the stairs.developed powder filled belts which consists of severalstair edge. The stair

climbing is used for material handling. This mechanism can be used as stair climbing mechanism for material handling. It can be used in transportation of luggage from one floor to another on stairs in hotels, malls, hospital etc. It can be used in building construction. After lifting the front part of the robot, the rear wheel touches the step and moves forward. After climbing all the steps, it will reaches to its initial position. By switching on, the motor starts rotating the upper wheel which lifts the front part of the robot to a certain height. The front wheels will move forward .



CONCLUSION AND FUTURE SCOPE:

In this paper we have developed Adjustable stair climbing robot for providing the service to replace the human in many fields like office, military tasks, hospital operations, industrial automation, security systems and dangerous environment. The developed model has completed the task successfully.

This mechanism can be further modified and used in various other applications. It can be useful in carrying heavy baggage or load and thus reducing human effort. Another commonsituation that employs the use of this mechanism is in the case of urban disasters or hostage situations wherein these robots are designed to rescue workers. The benefits of rescue robots to these operations include personnel requirements, reduced fatigue as well as access to unreachable areas. These robots have the ability to move over irregular terrain of collapsed or destroyed buildings. On the robot, a camera can be placed to take a video of the affected areas which can further help in rescuing operations.

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