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Article

A Review Paper on Walking Wheel Chair

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A B S T R A C T

Physical disability is the better common trouble, generally found in veterans and they are choosing wheel chairs for their mobility but many times using of this wheel chair put them in trouble. Now ever days electric wheel chairs are also available in the market. Electric wheel chairs are not so user friendly, the disable feel difficult to operate and these are expensive compare to normal wheel chairs more over these wheel chairs cannot move on uneven surface. If we can design a wheel chair which can climb the stairs we can solve most of the problems of disable.

Keywords Veterans Wheel Chair, Walking Wheel Chair

Introduction

Physical disability is the most common trouble, generally found in veterans and they are choosing wheel chairs for their mobility but many times using of this wheel chair put them in trouble. Now ever days electric wheel chairs are also use in the market. Electric wheel chairs are not so user friendly, the disable feel difficult to operate and these are expensive compare to normal wheel chairs more over these wheel chairs cannot move on uneven surface. If we can design a wheel chair which can climb the stairs we can solve most of the problems of disable.

In recent years, research in electrical wheel chairs has been stressing on how to implement the sensing and judgment capabilities commonly seen on robots, so that the wheel chairs can perform autonomous behaviors to a certain extent to improve its usability. Miller and Slack (1995) first used the term robotic wheel chair in their research. They applied various sensing and navigation technologies often used in robotics and built two prototypes of robotic wheel chairs, which were able to assist users to pass through narrow paths while avoiding obstacles.

Automatic navigation is one of the most important research problems in robotic wheelchair since mobility help is the fundamental function of a wheelchair. (Katsura and Ohnishi 2004 Galindo et al., 2006a). Galindo et al. (2006b) developed a robotic wheel chair.

SENA to encourage portability of the handicap individuals and clients. They considered totally self ruling climate is absurd yet, because of various reasons including climate vulnerability, sensor programming power, restricted mechanical capacities, so forth execution of a versatile robot inside non-controlled elements.

The Design & Concept

Since the main objective of the present research program is to investigate how legged locomotion can be optimized by using sensory information, flexibility rather than dynamic performances has been followed in the design of each component of the system. For example, the mechanical design of the leg has not been intended for supporting real locomotion, but rather for providing a degree of dexterity comparable, with that of a manipulator. Furthermore, the system has been designed to incorporate as many sensors as possible, both proprioceptive (at each joint) and exteroceptive (at the foot). The control architecture, although not fully implemented yet, is being developed in order to obey with the intended role of the leg as a terrain exploratory tool. The concept we are following reflects the one we have pursued in the study of artificial tactile perception 1161. The situations we wish to investigate are particularly challenging for example, the case of a vehicle walking inside a building in which a terrible event has occurred so that the original map has been altered, the floor is obstructed with rubble and other unpredictable obstacles, perhaps the electric energy has been disconnected, so that no illumination is available. In these extreme conditions, in which legged locomotion is essentially more convenient than wheeled locomotion, the robot should behave almost like a blind person who probes with a stick and with foot the terrain immediately in front. Then, based on the different information extracted by the sensors (for the mechanical properties of the terrain the presence of small and large obstacles or holes etc.), the vehicle should decide if, where and how the foot should he placed in order to provide stability, traction and support. It is clear from the above description that the control architecture of the system should be capable of commanding leg motions after having processed at different levels the data provided by the sensors.

The control design is as far as anyone knows entirely equivalent to the one we earlier arranged and applied in a one finger situation created for researching counterfeit material discernment. The principle objective in the two cases is the chance of executing successions of tangible engine activities as exploratory subroutines, each pointed toward extricating some particular data on the outside climate. On its IBMPC which controls the engines of the leg through programmable servo movement regulator sheets (Galil DMC/600). The signal from joint position sensors is used as feedback signal by the servo motion controller. But, also processed at a high control level, along with the signal Fluxgate compass detected by the ankle sensor, to derive exteroceptive information on the terrain. Examples of this procedure will be given in the section dealing with experimental results.

Mechanical Design

The leg has spatial pantograph geometry. Additional exactly it is a Cartesian three dimensional pantograph with skew angle of 180. A program of the leg geometry with reference axes is depicted in Figure 1.

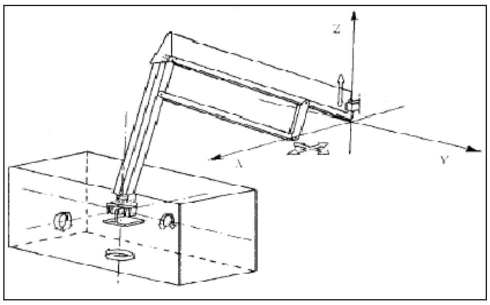

Figure 1.Schematic of the Leg

This configuration has advantages over other possible geometries. For example, a pantograph allows vertical and horizontal foot motions to be fully decoupled. This fact reflects favorably on the energy efficiency of locomotion. Moreover it makes control algorithms some what simpler as catch actuator simply moves the foot along one coordinate direction. A workspace on this type is called a Cartesian type three dimensional workspace. The use of a spatial mechanism allows the leg to simulate walking in both mammal and insect type with greater flexibility in gait selection. To avoid singularities, the two principal plane (vertical) axes (12) can never become collinear (otherwise the whole mechanism would rotate freely around the principal plane axis). The prototype leg (shown in Figure 2), was intended for laboratory experiments. Accordingly, it was not built full scale. The magnifying ratios are R=4 in the vertical motion and R=I+R=5 in the vertical motion.[12] At present, the reachable workspace is basically a parallelepiped 160mm wide (X-axis), 420 mm long (Y-axis) and 250 mm high (Z-axis) with sonic small parts truncated (two lower comers and part of an ellipsoid near the hip). DC motors, all of same type, have been used to actuate (through low friction ball screws) all trick doff. of the leg. Maximum spaced components of the ankle along the three axes arc I Omni/s, I Omm/s and 64nim/S, respectively. Maximum force components allowed at the foot along the three axes are 12N, 12Nand 15N, respectively. The intensity of the contact force between the foot and the terrain is expected to be larger along the vertical direction. Linear potentiometers are used to measure the ankle foot displacements along the coordinate axes.

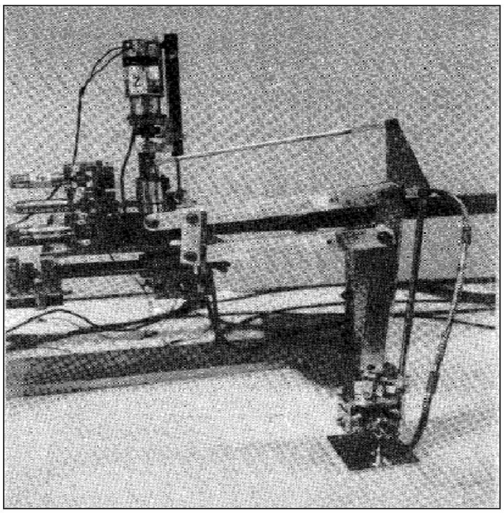

Figure 2.The Prototype Leg

Being the pantograph of Cartesian kind, one of the controlling focuses has a two fold layer slide component, which presents some short coming in the foundational layout. Then again, the pantograph calculation allows motors and potentiometers to be easily placed in the main body, thus reducing undesirable inertia during the leg motion, most of the other existing legs have passive systems to maintain foot parallel to the body. This choice was probably dictated by the need of limiting the number of D.0.F. Be that as it may, since our model leg was basically proposed as a tried for researching sensor based legged movement and the foot landscape component contact when all is said in done, it was chosen to give the foot three extra D.0.F. to accomplish a serious level of foot aptitude. The lower leg foot Joint was impelled to pivot around three symmetrical tomahawks (+90) around the vertical hub and 30 around the other two flat tomahawks) consequently permitting the foot a circular movement concerning the shank interface. The chance of changing foot stance ought to permit the compel applied on the ground to be made more uniform even on lopsided landscape. Furthermore, an actuated ankle makes the leg foot system more similar to a manipulator and therefore, more suitable to be sufficiently sensitized. The spherical joint between the shank and the foot uses a bevel gear differential mechanism of the type employed in some actuated wrists. In the first version of the leg, the three rotational D.0.F. were actuated by tendons allow the corresponding DC motors and rotary potentiometers to be placed on the main body. However, friction was not end and another solution with motors directly mounted.

System Design of Tin Man

Tin Man is built on top of a commercial wheel chair (see Figure 1), from Vector Wheel chair Corporation. Tin Man has no electrical interface between the chair's control and the robot's computer. Instead, there is a mechanical interface. The control computer controls two servo motors that are mechanically linked to the standard joystick that comes with the chair (see Figure 3). The user enters their commands through an input device (usually another joy-stick). The commands and sensory data are processed by a commercial micro controller based around the Motorola 68HC 11 processor (see Figure 4). The micro controller then commands the servo motors which move the main joystick on the chair. The joystick position is read by a standard wheel chair controller which sends control signals to the two drive motors.

Tin Man has five types of sensors

- Drive motor encoders
- Contact sensors
- IR proximity sensors
- Sonar range finders
- Fluxgate compass

The drive motor encoders after gearing, deliver are solution of 6.725 tics per inch. With the encoder resolution and the robot's wheel separation, the oretically the robot's orientation can be known to a resolution better than 0.01 radians. Unfortunately, because of the width of the drive wheels, slippage, wheel distortion, etc. it appears that the robot is only able to turn within t-10% of the commanded amount. As a result, dead reckoning errors can grow quickly.

Figure 3.Tin Man

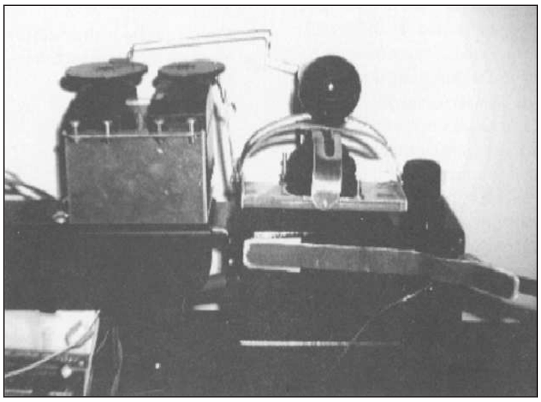

Figure 4.Mechanical Interfaces to Joystick

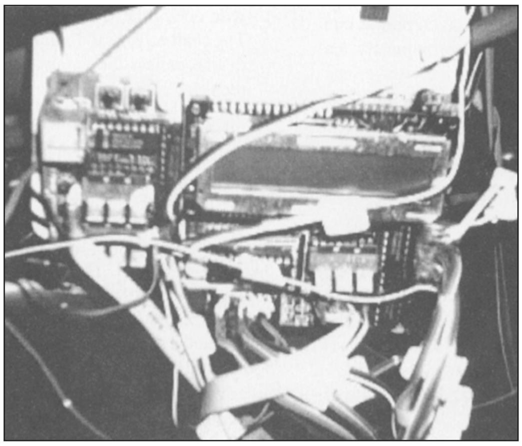

Figure 5.The Tin Man Micro controllers

There are eight contact sensors on the robot which are used as whiskers. Each sensor is made from a resistive strip approximately ten centimeters in length. As the strip is bent, its resistance changes, the degree of the bend can be calculated from the current flow through the strip. Two of the strips are mounted on each side of the robot, one in front of the wheel and the other in front of the arm rest. The remaining four sensors are mounted on the front. These sensors are encased by a sheet of froth elastic. The froth fills the holes between the sensors. On the off chance that the froth contacts an impediment, its shape is mutilated causing the detecting strips to twist. There are four IR nearness sensors circulated equally along the front and sides of the robot. These sensors radiate a coded light emission light. On the off chance that an item is close by, the light is reflected back to the sensor, showing the presence of an obstruction. Unfortunately, these sensors are very albedo sensitive, making detection of dark objects more difficult than light objects. To compensate for the albedo sensitivity of the IR sensors, there are six sonar range finders on Tin Man. Each sonar has a resolution of one centimeter, a minimum range of thirty five centimeters, a maximum range of five meters. It takes each sensor approximately two hundred milliseconds from the time it is activated until it settles on a reading. Due to port limitations on the 6811 processor, all of the sonars are time shared into the same timing port using a simple round robin scheme. Each sonar can be activated or deactivated in software, only the active sonars are polled. Because of these limitations, if all the sonars are active, it can take over one second between readings from specific sonar. The fluxgate compass is a standard compass meant to be used in an automobile. The coils that control the display are directly wired to two of the analog to digital ports on the micro- controller. The computer can distinguish changes in heading of approximately ten degrees. While not satisfactory for precisely crossing long, open distances, this is adequate goal for exploring along roads and in building passages where the climate can help keep the robot on course.

Software Design of Tin Man

The product for Tin Man is written in IC an intuitive, performing multiple tasks vernacular of the C language. Every sensor type has its own non concurrent cycle which screens those sensors. Except for the sonars, each sensor is surveyed in any event 5 Hz. The greatest safe speed of the seat is represented by this sensor invigorate rate joined with the deceleration pace of the chair. All of the sonars are multiplexed through a solitary port and into a solitary planning register. It takes a few ultrasonic heartbeats to guarantee a solid distance perusing from the sonar and from the time the main heartbeat begins, till the last reverberation restores, a solitary sonar controls the circumstance register. Single sonar can be perused at 3-5 Hz. Most methods of the robot use in any event three dynamic sonars prompting an update pace of around 1 Hz. In the manual operation mode, the operator gives their input through a joystick. The micro-controller reads the joystick and issues servo motor commands to cause the chair's joystick to copy the movements of the operator's joystick. There are three semi automatic modes that Tin Man can run. They are-

- Human guided with obstacle overrule
- Push ahead along a heading

In all three modes, the same importance scheme holds True

- If a contact sensor reads true, the chair moves away from the point of contact
- If a proximity sensor reads true (and contact sensors do not) then the chair turns away from the direction of the sensor reading true (if both front sensors read true then the chair will back up, if both side sensors read true then the chair will go straight, slowly)
- If sonar senses an obstacle less than 60 cm away in front or behind then the chair will not move forward or backward. If sonar senses an obstacle less than 1 m away, then the chair will turn away from the direction of the obstacle
- The robot follows the designated heading or towards the designated way point, unless this differences with one of the sensor rules listed above
- The chair follows the commands from the user input device, unless the commands conflict with one of the rules above

While working in the hindrance supersede mode, the seat adheres to the client's directions aside from when a close by obstruction is identified. At the point when an impediment is distinguished, the seat will adjust its heading, following a protected heading that is as close as conceivable to the heading being contribution by the client. On the off chance that the client places in a stop, the seat will stop. This is probably the most common mode to run the chair. It is especially useful when training someone to use a power chair. It is also helpful when manipulation in tight spaces or through narrow doorways. For an operator with slow reflexes or limited awareness, this mode allows the chair to be operated at a speed much faster than would otherwise be safe. In all cases, it greatly reduces the risk of impact with an obstacle, and the severity of an impact should one occur. The move forward along a heading mode is most useful for someone who has a very limited amount of bandwidth for input to the chair. The chair can be spun until the desired heading is reached. When at the desired heading, the chair moves forward, avoiding or maneuvering about obstacles as needed. If the chair is pointed in the general direction of a door, it will autonomously plan through the entrance. If pointed down a hallway, the chair will continue down the hallway until blocked. The only control needed by the user.

Conclusion

Therefore, after referring the several technical papers on this domain, they gave me an ideology & methodology to implement an autonomous walking wheel chair that can climb the stairs and walk through the tough terrains. By considering the cost factor, the design can be made simple and secure by effective usage of A. I based algorithms. Thus, we can make a wheel chair to walk within our economy and without clinical issues.

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