WALKMATE-AUTOMATED WHEELED PLATES

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ABSTRACT

Elderly people need care and comfort to lead a healthy life without worries and anxiety. They often need help of another person to move from one place to another. This is not always possible as in most of the situations; they are left in home alone. Even though prosthetic legs are available in the market for amputees, a difficulty in adjusting with the prosthetic leg exists. Hence, we introduce WALKMATE a unique, stable and user friendly automatic wheeled plates. It consists of a metal base with four wheels attached to it.

KEYWORDS: ATmega328P, Relay, Motor

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INTRODUCTION

As there are many inventions like prosthetic leg for physically challenged people, it is still difficult for them to walk with ease without any helping hands. Due to this they get exhausted and it gets painful. Level of difficulty in walking is an important measure of mobility disability among older adults. Those who report difficulty in walking two or three neighbourhoods will provide a standard measure of mobility disability. Disability is typically defined as physical or cognitive difficulty in performing social roles or other every day activity. It represents a dynamic state in which functional capacities, such as balance and lower body strength, are insufficient to meet current and changing social expectations and environmental challenges. Functional limitations, in turn, refer to either self-reported or directly measured reduced generic capacities, such as lifting, balance, walking speed, and lower body strength. Hence we introduce a unique, stable and user friendly device WALKMATE which is an automatic wheeled device setup for physically challenged people. It is a wheeled device which consists of supporting handles on both sides. A remote control is implemented on the supporting handle which can be used by the user for controlling motion. The device is focusing on those who have difficulty to walk on prosthetic legs or with individuals having a plastered leg is able to utilize it. This can also be used by aged people who face difficulty while walking, Walk mate helps physically challenged people to move independently.

POETIC CONTENTS

There are many similar products like Walk mate. One such product is motorized roller skates, where wheels are attached directly to the shoes. The best balance scenario involves riding with one foot out in front of the other, giving you a wider base for balance [2]. When they're not on your feet, the skates look a bit like tiny wheelchairs. When they're strapped on the belts fit securely around your ankles, and the adjustable footplates are made to

accommodate different foot sizes they feel like open-toe ski boots [3]. Each skate weighs around 7 pounds, and the fact that you can always stop yourself or climb stairs with them on by shifting your weight onto your tiptoes is a good safety mechanism. Acton co- founder and CTO Peter Treadway say the motorized roller skates were inspired by a combination of science fiction, 1950s futurism, and the harsh reality of driving in southern California, that modest 12 mph maximum speed is a strategy to help keep the Rocket Skates sidewalk- friendly in the future [3]. With two larger, heavier wheels on the sides of each skate that are powered by 50W electric motors, there's a third wheel on the heel to provide stability when you are balanced on them [4]. There's also a mechanical brake on the back that makes contact with that smaller wheel when you push down with your heel [3]. Walk mate is made with new advancement for an easy and stabilized walk. Since it is targeted for aged people and for those who have difficulty in walking, stability of the machine is mainly focused in the design. We have handles attached on both sides of the base plate. A remote control is attached on the handle, which controls the motion of the walk mate. While the needs of individuals with disabilities can be satisfied with traditional manual or powered wheelchairs, a segment of the disabled community finds it difficult or impossible to use wheelchairs independently [2].

DESIGN AND DEVELOPMENT

Figure 1: Block Diagram

The block diagram of the prototype is shown in fig.1, and the following components are: ATmega328P microcontroller, IR sensor, electromechanical relay, power supply and direct current motor.

The high-performance Microchip is an 8-bit AVR RISC-based microcontroller that involve 32 KB ISP flash memory with read and write capabilities, 1024B EEPROM, 2 KB SRAM. It has 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer or counters with compare modes, internal and external interrupts. A serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6- channel 10- bit A/D converter, programmable watchdog timer with internal oscillator, and five software selectable power saving modes. Generally CMOS based microcontrollers ask for only about 5mA for itself. But complete project has other elements like resistors, capacitors and MOSFETs. Since most of microcontrollers are CMOS devices they need very small average operating current. But for reliable CMOS based microcontroller operation, we need to feed it with power supply which can supply 10 times or even 100 times more current peaks than normal average case. The power will typically come from AC power supply or lead acid batteries. The power supply can be mainly divided into two parts as power source and regulator. If regulator is properly designed and constructed, the power source is not that critical. Simplest power source is likely to be AC or DC power-pack connected to AC outlet in house. If you supply regulator with this type of power pack, it should supply at least 5V above

regulated output. Data sheets for a typical regulator like 7805 says about 3V above output voltage is sufficient as input but that doesn't allow for the extra ripple and the odd voltage dips that can occur with load and supply changes. For a 5V regulator you should feed it with a measured 10V DC or more. At this supply voltage if you draw few hundred milliamps current from regulator, you will most likely need a heat sink on your regulator. A typical 12V DC unregulated power-pack will have no load output of 14V to 18V. Current demand of about 50mA or more will pull this no load output down by few volts. For the device to operate properly there is a need for a power system to supply electrical power to the microcontroller, relay, motors and other electrical devices. The power supplies used in our system are either the standard utility power sources or batteries. Battery operated section requires a power that includes on-board batteries, Battery recharging system, Power distribution and control system. There are two possible configurations when using batteries. The first configuration is to use a single battery to supply the complete system, and the second configuration is to use two or more batteries. The two types of batteries suitable are lead-acid and gel-cell batteries. Nickel cadmium and carbon zinc batteries can also be used to supply electronic circuits. Infrared technology addresses a variety of wireless applications. The main areas are sensing and remote controls. In the electromagnetic spectrum, infrared portion is divided into three regions: near infrared region, mid infrared region and far infrared region. The wavelength of these regions and their applications are shown below. In near infrared region — 700 nm to 1400 nm— IR sensors, fiber optic, Middle infrared region— 1400 nm to 3000 nm — Heat sensing far infrared region — 3000 nm to 1 mm —for thermal imaging. The frequency range of infrared is higher than microwave and lower than visible light. An infrared sensor emits and detects infrared radiation to sense its surroundings. The concept of an Infrared Sensor which is used as an Obstacle detector is to transmit an infrared signal, this infrared signal bounces from the surface of an object and the signal is received at the infrared receiver. An infrared detection system includes an infrared source, transmission medium, an optical component, infrared and signal processing functionality. Infrared lasers and Infrared LED's of specific wavelength are used as infrared sources. The three main types of media used for infrared transmission include vacuum, atmosphere and optical fibers. In this prototype, atmosphere is used as the medium. Infrared transmitter is a light emitting diode or LED which emits infrared radiations. Hence, it is known by the name IR LED. Even though an IR LED looks like a normal LED, the radiation emitted is invisible to the human eye. Certain applications require infrared heat and the best infrared source is an infrared transmitter. Infrared receivers are known as infrared sensors because they detect the radiation from an IR transmitter. IR receivers are available in the form of photodiodes and phototransistors. An infrared photodiode is different from normal photodiode as they detect only infrared radiation. It consists of an IR phototransistor, a diode, a MOSFET, a potentiometer and an LED. When the phototransistor receives an infrared radiation, the current flows through it and MOSFET turns on. This in turn lights up LED which acts as a load. The potentiometer is used in controlling the sensitivity of the phototransistor. When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to IR receiver. Based on the intensity of the reception in the IR receiver, the output is being defined.

A relay works as an electromagnetic switch. The main operation of relay is to make or break a contact with the help of a signal without any human involvement. It is mainly intended to control a high powered circuit using a low power signal. A relay consists of the following components including an electromagnet, movable armature, switch point contacts and a spring. The two types of relays are electromechanical and solid state relays. An electromechanical relay is used in designing of this prototype. The basic parts and functions of an electromechanical relay includes i. Frame : Heavy duty frame that contains and supports the relay components, ii. Coil: A metallic wire wound around a metal core. The coil of wire produces an electromagnetic field.iii. Armature: A moving part of the relay. The armature opens and closes the

contacts. An attached spring brings the armature to its original position, Contacts: The conducting part of the switch that makes or breaks a circuit. Relays involves two circuits: the energizing circuit and the contact circuit. The coil is on energizing side, and the relays contacts are on the contact side. When a relay coil is energized, current flows through the coil and creates a magnetic field. The magnetic coil attracts a ferrous plate, which is a part of the armature. One end of the armature is attached to metal frame, which is formed so that the armature can pivot, while the other end opens and closes the contacts. Contact come in a number of different configurations, depending on the number of Breaks, poles and Throws that make up the relay. For instance, relay might be described as Single Pole, Single Throw (SPST), or Double Pole, Single Throw (DPST). An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between motor's magnetic field and electric current in a wire winding to generate force in the form of torque applied to motor shaft. Electric motors can be powered by direct current sources, such as batteries, motor vehicles or rectifiers, or by alternating current sources, such as inverters or electrical generators. In this prototype, it is DC powered by means of a 12V battery. There are different types of motors, but in the perspective of the project been done, a window motor is been chosen. Power window is a semi-automatic window that can be raised and lowered by pressing a button switch, as opposed to using hand-turned crank handle. A PMDC motor is used in a power window. In a DC motor an armature rotates inside magnetic field. The basic working principle of DC motor is that whenever a current carrying conductor is placed inside a magnetic field, a mechanical force is experienced by the conductor. Hence for constructing a DC motor, it is essential establish a magnetic field. The magnetic field is established by using a magnet. In a permanent magnet DC motor, the armature is placed inside magnetic field of permanent magnet; the armature rotates in the direction of the generated force. Here each conductor of the armature experiences the mechanical force $F = B \cdot I \cdot L$ Newton where, B is the magnetic field strength in Tesla, I is the current in Ampere flowing through that conductor and L is length of the conductor in meter which comes under the magnetic field. Each part of the armature experiences a force and the compilation of the forces produce a torque, which tends to rotate the armature. ATmega328P is the basic control unit.

Figure 2: Circuit Diagram

used in the circuit. The basic circuit in microcontroller consists of power supply unit, external crystal oscillator, and a reset button. The capacitors are used with the microcontrollers as decoupling capacitors for decreasing the noise.

CONCLUSIONS

The proposed device was successful in achieving its outcome as an automatic wheeled device. The future scope with more advanced technology is still under consideration. In future we can add a system to go upstairs and downstairs and it can also be made to use as vehicles on roads. It can travel long distance with comfort. Throughout the process of the testing, the prototype demonstrated consistent and repeatable functionality from the mechanical subsystem. It is identified that a better battery system could provide more advantage to its design consideration such as weight and size. At the time of project review we were questioned about the feasibility of the product, size constraints and stability of the device. The fact we mainly considered was a common usable device with enough safety measurements. On considering the size of it as a prototype, it can be made more ergonomic in design. The project was taken up in the light of rising disabilities faced by the aged people, prosthetic leg users, individuals with a plastered leg, who always need the help of a second person to reach to a place in need. Through this work, we were able to understand the design, working and become a part in designing an automated wheeled device for the benefit of people belonging to a larger community.

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