SMART WHEEL CHAIR USING TOUCH SCREEN WITH OBSTACLE DETECTION

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Abstract - *In the technologically developing world patients with some cognitive disabilities and impairment must be provided with smart wheelchair systems for their easy navigation and safety. This device helps the disables to have automatic advancement to their destination through predefined paths in the indoor system. Use of touch-screen enables less muscle movement and less muscular pressure than the self-propelled wheelchairs which are being used from ages. Obstacle avoidance facility enables to drive safely in unknown as well as dynamic environments. GSM stands for Global System for Mobile Communication. It is a digital cellular technology used for transmitting mobile voice and data services. GSM provides basic to advanced voice and data services including roaming service. Roaming is the ability to use your GSM phone number in another GSM network. GSM digitizes and compresses data, then sends it down through a channel with two other streams of user data, each in its own timeslot. A wheelchair is a chair fitted with wheels. The device comes in variations allowing either manual propulsion by the seated occupant turning the rear wheels by hand, or electric propulsion by motors.*

Key Words: Smart Wheel Chair, GSM, Touch Screen, Digital Cellular Technology, Motors

1. INTRODUCTION

The main objective of this project is to design and develop a system that allows the user to interact with the smart wheelchair with touch screen at different levels of control for obstacle detection and collision avoidance providing efficient risk management. This project introduces a new design model of wheelchair for physically disabled which can be used for moving from one place to another. The project provides a helping tool to the disabled and helps them move around. The wheelchair provides safety by adopting features such as obstacle detection for collision avoidance and hollow detection to avoid danger which they might encounter in their day to day life such wheelchair designed reduces dependency on caretakers and family members and promotes the feeling of self-reliance. The smart wheelchair avoids or stops in front of obstacles. Speed is often decreased to avoid minimum obstacle clearance, speed is reduced to allow wheelchair to approach closer obstacles/objects.

1.1 Proposed System

In our system, developing a wheelchair which is operated by touch screen to which inputs given by the person. Wheel chair is smart enough to detect any obstacle coming in front and can avoid it. To detect any obstacle, we are using a ultrasonic sensor. Whenever any obstacle is detected by the sensor, it sends signal to Atmega microcontroller and the controller will control the movement of DC motor making it stop. The touch screen in the present prototype has keys as the input mode. Also, the wheelchair can be controlled by the user himself by pressing the input mode. The wheelchair can be GSM based, where the patient sitting on the wheelchair can have access to additional features. If the patient on the wheelchair feels uncomfortable or will have some issue regarding health, he/she can send message to his/her relatives or friends indicating the need for help.

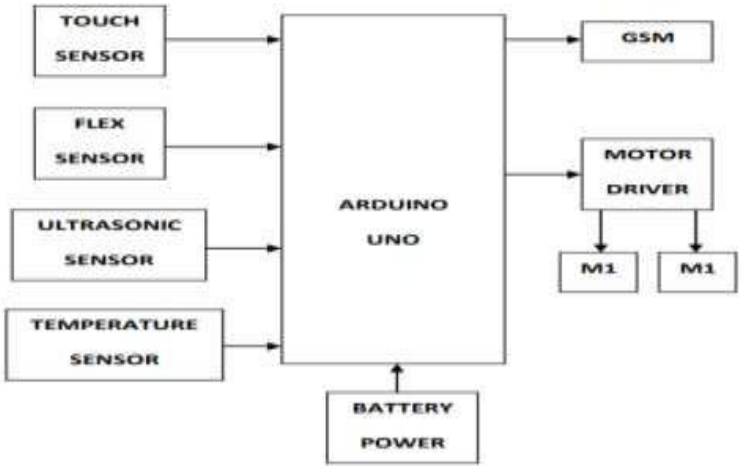

Fig- 1: Proposed diagram

1.2 Working Principle

The wheel chair has receiver side and the transmitter side. The transmitter side consists of ATMEGA328 microcontroller(Arduino Uno), touch screen, and an ultrasonic sensor. A DC motor is used to move the wheel chair in left, right and forward and backward directions. L293D motor drive module controls the DC motor to move in the direction. The direction of the movement is decided from the signals given by the touch screen inputs. Ultrasonic sensor uses infrared signal to find if there are any obstacles present in front of it. The ultrasonic sensor are placed in front, right and in left directions. If any sensors sense any obstacle it changes to the direction where there is no obstacle. This makes the robot move automatically without external source controlling it. GSM technology is used to send text message, voice call and also the location to the patients guide.

2. MATERIALS AND METHODS

Materials used in this project are Arduino UNO, GSM Module, DC Motor, Ultrasonic Sensor, L293D Motor Driver, Temperature Sensor, Flex sensor.

2.1 Arduino UNO

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller. Simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip.

Fig- 2: Arduino UNO

2.2 GSM Module

A GSM module or a GPRS module is a chip or circuit that will be used to establish communication between a mobile device or a computing machine and a GSM system. The modem is a critical part here. These modules consist of a GSM module or GPRS modem powered by a power supply circuit and communication interfaces for computer. A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it can be a mobile phone that provides GSM modem.

Fig- 3: GSM Module

2.3 DC Motor

A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor. Most types produce rotary motion; a linear motor directly produces force and motion in a straight line. DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems.

Fig- 4: DC Motor

2.4 Ultrasonic Sensor

An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity. High-frequency sound waves reflect from boundaries to produce distinct echo patterns. Ultrasonic sensors work by sending out a sound wave at a frequency above the range of human hearing. The transducer of the sensor acts as a microphone to receive and send the ultrasonic sound. Ultrasonic sensor, like many others, uses a single transducer to send a pulse and to receive the echo.

Fig- 5: Ultrasonic sensor

2.5 L293D Motor Driver

The L293D motor driver is available for providing User with ease and user friendly interfacing for embedded application. L293D motor driver is mounted on a good quality, single sided non- PTH PCB. The pins of L293D motor driver IC are connected to connectors for easy access to the driver IC's pin functions. The L293D is a Dual Full Bridge driver that can drive up to1Amp per bridge with supply voltage up to 24V. It can drive two DC motors, relays, solenoids, etc. The device is TTL compatible. Two H bridges of L293D can be connected in parallel to increase its current capacity to 2 Amp. L293D IC is a dual H-bridge motor driver IC. One H-bridge is capable to drive a dc motor in bidirectional. L293D IC is a current enhancing IC as the output from the sensor is not able to drive motors itself so L293D is used for this purpose. L293D is a 16 pin IC having two enables pins which should always be remain high to enable both the H-bridges. L293D IC is a dual H- bridge motor driver IC.

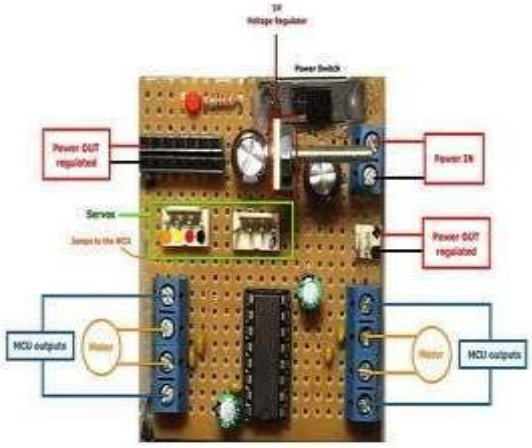

Fig- 6: L293D Motor Driver

2.6 Temperature Sensor

Temperature sensor is a device, to measure the temperature through an electrical signal it requires a thermocouple or RTD (Resistance Temperature Detectors). If the difference in voltage is amplified, the analogue signal is generated by the device and it is directly proportional to the temperature.

2.6.1 Thermistor

The thermistor is a semiconductor used as a temperature sensor. It is manufactured from a mixture of metal oxides pressed into a bead, wafer or other shape. The bead is heated under pressure at high temperatures and then encapsulated with epoxy or glass . Beads can be very small, less than 1 mm in some cases. The result is a temperature sensing device that displays a very distinct non-linear resistance versus temperature relationship . The resistance decreases as temperature increases. This is called a negative temperature coefficient (NTC) thermistor.

Fig-7: Temperature Sensor

2.7 Flex Sensor

A Flex Sensor or sometimes called as Bend Sensor is a device that measures the amount of bend or angular deflection. Usually, a Flex Sensor is made up of a variable resistive surface and the amount of resistance is varied by bending the sensor. Since a flex sensor is basically a resistor (whose resistance varies depending on its bend), it has two terminals (or leads). Coming to the variable resistance part, an unflexed sensor i.e. a flex sensor as rest, exhibits a normal resistance value. In my case, the normal resistance of the Flex Sensor is around 6 KΩ. At a bend angle of approximately 45, the resistance of the flex sensor has increased to 65KΩ and when I continue to bend it at an angle of 900, the resistance further increases to 7 KΩ. If I further bend it towards a complete 180 angle, the resistance of the flex sensor shoots up to around 75KΩ.

Fig-8: Flex Sensor

3. SYSTEM IMPLEMENTATION

The LM35 is an ideal temperature sensor for measuring ambient temperature. It provides a linear output proportional to the temperature. LM35s are easier to use than thermistors and thermocouples because they are so linear and require no signal conditioning.

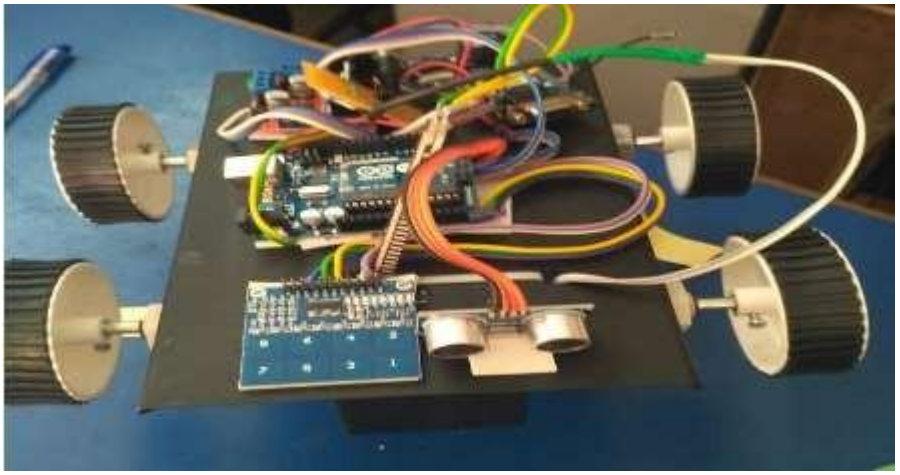

Fig-9: Smart Wheelchair using touch screen with obstacle detection

Initially burn the code into the Arduino board. Connect the transmitter and receiver to the wheel chair. The touch screen is capable of detecting and effectively locating a touch over its display area and it's a four wire touch screen. While the wheel chair is moving if any obstacle is detected by the ultrasonic sensor wheel chair stops moving and move in the alternate path. Driver motor module is connected to two DC motors. This driver motor module is used for the movement of the wheel chair based on the instruction from the micro controller. The Temperature Sensor LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature.

GSM Module is basically a GSM Modem (like SIM 900) connected to a PCB with different types of output taken from the board. At a bend angle of approximately 45 degree, the resistance of the flex sensor has increased to 65KΩ and at an angle of 900, the resistance further increases to 7 KΩ. Further bending it towards a complete 18 angle, the resistance of the flex sensor shoots up to around 75KΩ.

4. CONCLUSIONS

The designed smart wheelchair enables the movement of wheelchair in any desired direction (forward, backward, right, and left) with the help of a touch screen. The touch screen is mounted on the arm rest. This touch screen is made portable fort better usage. The recumbent smart wheelchair can be transformed into the bed through separate keys that are provided in the touch screen. The back panel's and the front panel's angle can be adjusted depending on the user's requirement. This greatly decreases the dependency on the family members and the care-takers. The wheelchair also provides efficient risk management by obstacle detection and obstacle avoidance. To provide further safety to the disabled the wheelchair has a LED to provide light when the surrounding environment is dark. During any emergencies that is when the disabled have to alert any of the care-takers around him he/she can easily do this with the help of a buzzer that is placed on the wheelchair.

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BIOGRAPHIES

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