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DESIGN AND IMPLEMENTATION OF AN ELECTRIC-WHEELCHAIR BASED ON IR SENSOR AND ULRASONIC SENSOR FOR HANDICAP PERSON

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ABSTRACT

The objective of paper is to design a low cost prototype of a self driven, power assisted smart wheelchair is equipped with all the necessary electronics to ensure safety and ease of operation. The wheelchair will be made user friendly to reduce the load of caretaker and will boost the confidence level of the disable person by making him/her self-dependent. Wheelchair are design for handicap people. Children, young or old people can use it. When a person is unable to walk or even when a person is disabled, deformed or paralyzed from the legs, a chair with four wheel is generally used for their movement.

Key Words: Joystick, ADC, Ultrasonic Sensor, IR sensor, Microcontroller, LCD.

1. INTRODUCTION

In India, there has always been a tremendous need for a affordable and well designed electrical power wheelchair to provide to the needy[7]. Aged people and disabled people who have difficulty in walking and increasing[2]. The significance of “electric power wheelchair” and “electric power-assisted wheelchair” which assist driving force using electric motors on both wheels and spreads there area of life has been recently enhanced a normal powered wheelchair may cost between Rs.60,000 to Rs. 10,50,000 , the new low-cost electric wheelchair is said to reduces the price by half[5]. The objective is not only to develop a low-cost electric wheelchair, but to develop technically best suited for Indian environment, whether urban or ruler.

2.HARDWARE DESIGN

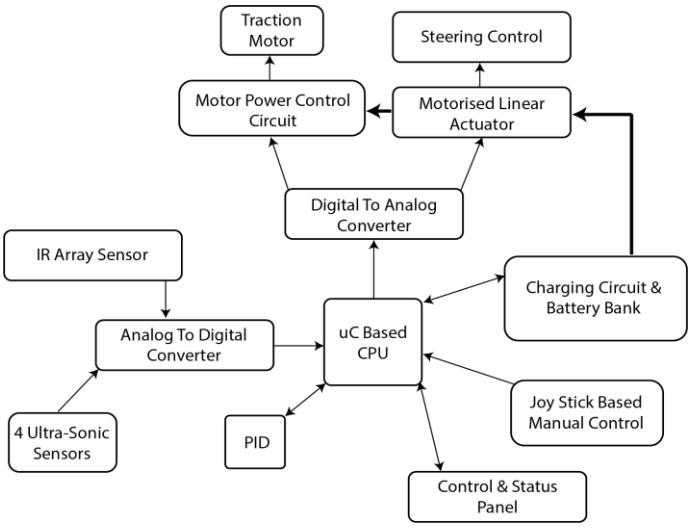

Fig. 1. Block diagram of the system

An IR array sensor is used in the wheelchair to track the pre-designed path. IR sensor and ultrasonic sensor gives the signal to microcontroller via AD converter and those digital signal is given to linear actuator motor via DA converter for steering control, Servo motor is used for linear operation. control and status panel which is basically a display receives a data (speed, battery %, status of vehicle etc.), from microcontroller and show it on 24*4 LCD display, joystick gives signal to microcontroller and those signal is fed to motor power control circuit Via DA converter, which runs the traction motor (dc Brushed geared motor), charging circuit and battery Bank is used to powers the motor control circuit and systemultrasonic sensor emmiting ultrasonic sound wave and covert in to electric signals same as IR sensor (distance 1 to 13 feet), control & status panel is basically display receives data from UC & show it like speed of vehical, autonomous and manual controll, battery indication condition and problems in vehical, joystick give some signal to UC, it process by UC and send it to motor drive, motor drive coverts these signal into actuating signal, traction motor UC gives command to the motor power control circuit which

run the traction motor via DA coverter, charging circuit and battery bank use for giving power to CPU as well as motor power controller circuit.

3. GENERAL DESCRIPTION

3.1 ULTRASONIC SENSOR

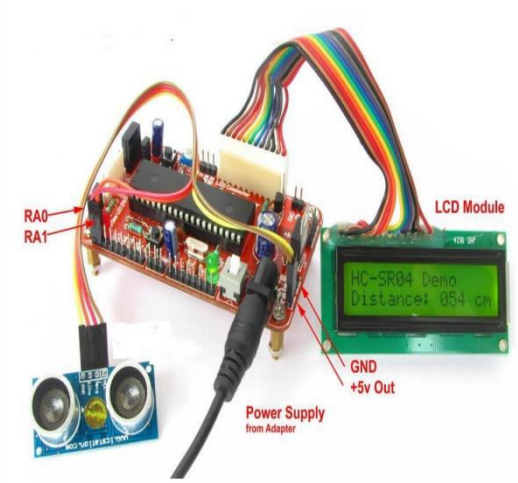

Fig. 2. Ultrasonic Sensor Kit

Ultrasonic Sensor are device that use electrical-mechanical energy transformation to measure distance from the sensor to the target object by emitting ultrasonic sound waves. Ultasonic waves are longitudinal mechanical waves which travel as a sequence of compression and rarefactions along the direction of wave propagation through the medium. Apart form distance measurement they are also used in ultrasonic material testing (to detect crack, air bubbles, and other falws in the products), Object detection, position detection, ultrasonic mouse etc. - Here we use HC SR04 ultrasonic sensor, this sensor is mainly used for object avoidance in various robotics project operating current of sensor is 15mA, operating voltage is 3.3 to 5V DC, measuring distance is 2cm to 80cm.

3.2. MOTOR ASSEMBLEY AND BREAKING SYSTEM

The motor we uses is geared DC brush motor with drive pully, which is having an oerating voltage of 24V and rated rpm output of the shaft of the drive pully is upto 3000 rpm at full load & in unload condition it is 3850 rpm. AT full load the current down by motor is about 12.5A i.e. the estimated full load is about 120kg at no load condition, the correct demanded by the motor is 2A. The break callipers are 6.25 inch standard break callipers made up of high Anodise still material & the braking capacity of disc break is 200kg. Braking and power regeneration The braking of a vehicle in the past based on mechanical system such as disc brake. The braking method of an EV should be integrated with both mechanical and the electrical braking. This is usually for deceleration or going down a slope, the kinetic energy of the vehicle can be returned to the battery. The final region of the braking, mechanical braking is used. This provides a compromise of the energy saving and safety. Today, we can make motors with high power of regeneration that is in the expenses of the motor size, a compromise between the motor weight, cost, power regeneration efficiency and safety are needed. The motor drive should also be implemented with high frequency decoupling capacitor to absorb the fast transient of the reverse current.

3.3. WORKING

The proposed model is a wheelchair prototype buit around eight bit microcontroller platforms. The microcontroller takes the input from various sensors installed on the wheelchair covering all the directions and provides corresponding output that hepls user to take decision and make judgements for the safe movement and control of the wheelchair. For movement control an analog joystick is to be installed on the wheelchair left arm-rest that will be responsible for the forward, backward and left-right movements of wheelchair. The output of joystick is analog-to-digital converter before being fed as an input to the microcontroller will continuously poll for the inputs from the joystick and corresponding outputs will help controlling the wheelchair motors for movement control. A 24 x 4 LCD module is interfaced through microcontroller to display necessary information for the user. The Ultrasonic sensor will send the signal to the microcontroller and according to that signal microcontroller can turn the wheelchair left or right with the help of geared DC brushed motor.

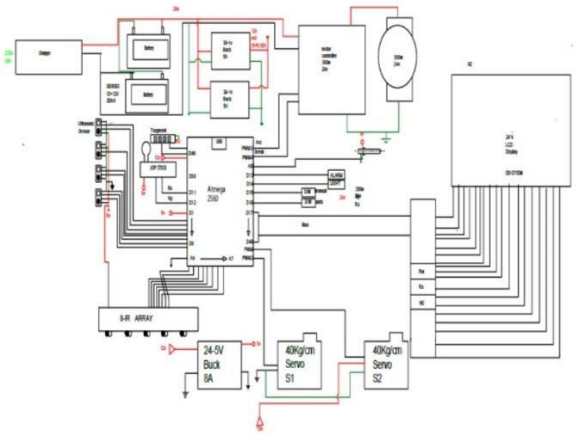

Fig. 3. Functional Circuit

Atmega 2560 Pro microcontroller and associated sensors and control equipments are shown in fig. 3. In center we can see Atmega 2560 pro that is our main microcontroller. It is having 54 digital pins for I/O devices and 16 Analog I/O pins. As per the connection ultrasonic sensor array has been see at the one side, there are 4 different ultrasonic sensors which are connected to digital pin from D1 to D8 other remaining two pins of each sensor are ground and 5v power supply data connected. Then second sensor array which are having 8 IR array sensor for line following system for that we have two pins i.e. for ground and 5V and have 8 analog signal output pins A0 to A7. There are two servo motors rated 40kg/cm. Servo 1 & servo 2 for each steering front wheel. Power supply required for each servo motor is 12V is symbolized as an inverted triangle and have two wires one is ground & another is 12v, each servo motor having one signal wire i.e. PWM signal wire. The servo motor is connected to PWM 1&2 port of the microcontroller. For the control panel we have 5 main part, pin no. d13 alarm, in case of problematic condition or battery down, alarm can be connected with horn also, pin no. D14 light control includes indicator light and head light, switch 1 manual and 2 auto are connected to pin no 15&16, if we press both pins by default it goes in manual control. Joystick has 4 wire, ground, 5v, Rx & Ry. Rx and Ry are connected to pin no. P11 & P12. Lcd 24*4 display screen has used. It displays status of vehicle, battery and percentage. D0 to D7 are the data pins of the LCD display this are connected through bus by data pins A, Rw, Rs, Vo, Vss, Vds, Vdc, E2, Vee, K. 230v 1 phase charge is used to charge the battery connected in series. Battery motor controller circuit. Dc brushed motor is connected to motor controller circuit. Which take variable voltage form controller circuit. Accelerator and breaks are connected to PWM 3 and 4. For motor control PWM send the signal. There has manual accelerator connected in pin no. 48 Buck converters are used for different voltage level required for servo motor. Buck converter get 24v from battery as an input and gives output as 12v. 5V buck converter is used where 5V is required.

RESULT AND CONCLUSION

This paper proposed a work of fiction safety driving control scheme for electric power assisted smart wheelchair based on the keypad interfacing with microcontroller. We have designed an electric power monitoring and management system based upon wireless sensor network. This system employed the ATmega 2560 pro as MCU to satisfy real-time, compatible and reliable monitoring requirements. Some driving experiments on the practical plain road verified the effectiveness of the proposed control system. The bulky and complex designs have, however, been overcome by exploring new smart wheelchair. Interfacing these special sensors to the wheelchair was controlled by the ATmega 2560 pro. In addition, the sensors types can be improved to play a secondary role in sharing the control of the smart wheelchair. Most importantly, the developed system can measure multiple electric parameters automatically such as Tilting, Obstacle and battery power backup which are desired by the electrical administration. More software work for this module is in development stage such as speech synthesis and speaker identification. These works should improve the application in the next future.

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