Automated Wheelchair Embedded System

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Abstract- For many disabled people who have to use a wheelchair, the choice between independence and true mobility is a very real one. Manual self-propelled chairs are fine for the young and fit, but user's arms are weakened or tired after a substantial trip. This paper mainly focuses on field of design and modification of wheelchair for handicapped peoples. Input to system is given through keyboard which is direction and speed of wheelchair. This system is using obstacle detecting sensor which detects obstacles and give signal to controller to change direction. This wheelchair can be useful for both handicapped and blind peoples.

Index Terms- Obstacle detection, automated mobility, speed control.

1. INTRODUCTION

The wheelchair is a fundamental vehicle for orthopedic disabled and old people for mobility. This chair may provide comfort to the disable person to move easily. System is giving mobility capabilities at fingertips of user. This is keyboard controlled wheelchair, which will have the following capabilities:

- Variable speed
- Direction control using the keyboard
- Three to four hour battery backup
- Emergency breaking capability
- Turning with minimum radii of curvature.
- Easy speed control
- Minimum no of controls

2. LITERATURE SERVEY

Johann Georg Klein invented the electric-powered wheelchair in the 1950s.In 2005 the first working successfully Electric wheelchair was developed. This paper comprises the development of an electric power unit to be retrofitted to manual wheelchairs, providing the wheelchair user or an attendant with drive, steering and regenerative braking at a much lower cost (and with much greater flexibility in use) than a standard power chair. This system is using IR sensor to detect obstacle. So the same chair can be used for blind people as well as for handicapped peoples. This system is giving advantage of speed mode to user. [Poot, (2010)] [Holly *et al*]

3. HARDWARE DESCRIPTION

3.1. *Microcontroller*

This is "Brain" of the system. It performs the entire task almost single handily. It takes input from Keyboard and gives the controlling signal to the dc motor through motor driver L293D as per the key pressed. It also takes input from obstacle detector sensor and gives output to buzzer and speeds of the chair also vary as per the distance.

3.2. *IR Sensor*

IR module is used for detecting the obstacle in both sides i.e. left and right of wheelchair.

3.3. *Keyboard*

It acts as input to the system. Each key is having different functions like four keys for direction control, one key for speed selection and one mode key to select blind or normal mode.

3.4. *LCD*

It display obstacle distance from chair as well as pressed key of direction and speed.

3.5. *Buzzer*

If obstacle is detected in path by sensor then buzzer1 emits the sound and intensity of buzzer varies as per the distance from chair, which gives indication to the blind peoples. Fig. 2 shows buzzer circuit.

3.6. *Obstacle detecting sensor*

The sensor transmits an ultrasonic wave in forward direction and produces a pulse which gives time required for wave return to the sensor. As soon as distance is less than 150 cm controller will give sounds buzzer. Speed of ultrasonic wave is 347 m/s equivalent to 0.0347cm/μ-sec. Timer count multiplied with 200 Nano-sec (0.2μsec), internal clock period gives the echo time (ET).

Echo distance(Ed) = echo speed*ET (1)

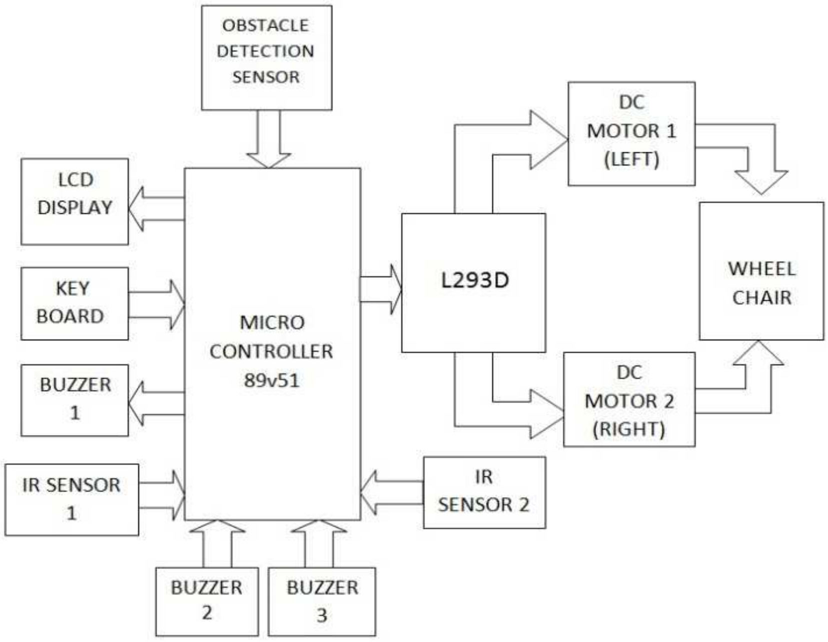


Fig. 1. Block diagram

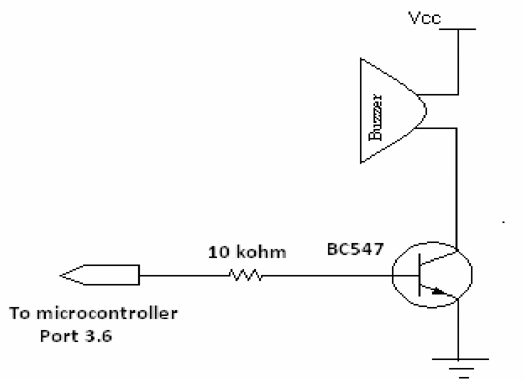


Fig. 2. Buzzer circuitary

Ed= 0.0347cm per μ-sec (EV) * ET (2)

The obtained distance will be twice the actual distance because it is to and fro distance so obtained distance is divided by 2 to get actual distance of the obstacle.

ET = (2/0.0347) * Ed (3)

3.7. *L293D motor driver*

The L293D is mostly used H-bridge driver IC. We can use PWM circuit but it increases cheap area. By connecting two dc motor to this 16 pin IC L293D we can move chair in any direction. Table 1 gives operation. The rotational speed of a DC motor is depending on voltage, and the torque is depends upon current. Speed control is obtained by variable supply voltage, resistors or electronic controls. But system have microcontroller for varying the speed by changing pulse width of pulse going from controller to motor driver.

Table 1. Motor operation

S1	S2	S3	S4	Results
1	0	0	1	Motor moves clockwise
0	1	1	0	Motor moves anticlockwise
0	0	0	0	Motor free runs
0	1	0	1	Motor brakes
1	0	1	0	Motor brakes

3.8. *DC motor*

This system is using dc geared motor for getting more torque. By controlling the speed of DC motor system Control overall speed of the chair. As well as by controlling the direction of rotation of each DC motor, system is monitoring direction of wheelchair.

4. DESIGN STAGES

4.1. *Motor and motor driver*

DC motor needs 530mA current for operation. This system is using L239D which provide 600mA output current. Source current of microcontroller port is 60uA.Current required for L239D input line draws 100uA each. So to provide sufficient current to each input pin of L239D system is using pull-up register of 2.2K which gives 2.2mA current.

4.2. *Speed of chair and wheel structure*

Let diameter of wheel is 0.1 m and Speed of motor is 0.5 rps. For high speed of chair Speed is given by

$$V=R*W=0.025 \text{ m/s} \quad (4)$$

For low speed of chair speed of motor is 0.25rps

$$V=R*W=0.0125 \text{ m/s} \quad (5)$$

5. SOFTWARE DESCRIPTION

5.1. *Tasks assigned to software*

- Microcontroller takes the input from keyboard. According to that it sends the signal to motor driver due to that positioning of wheelchair can be achieve.
- Microcontroller takes the input from sensor, which is nothing but sensor output .Sensor send the signal if any obstacle detected.
- According to the data scan from sensor it decides distance of obstacle from the wheelchair.
- After detection of obstacle, microcontroller send signal to buzzer also. Then it emitted the sound.
- Simultaneously distance displayed on LCD.

5.2. *Algorithm*

5.2.1. *System algorithm*

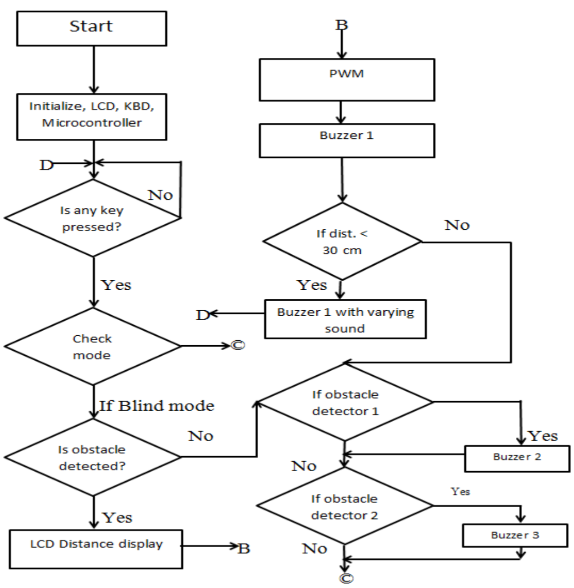
- Start
- Initialize microcontroller, LCD, keyboard
- Check any key is pressed, if not then wait
- Check which mode is selected
- If normal mode is selected, go to step (c)
- In blind mode, if any obstacle detected, give buzzer, go to (a)
- If dist. is <30cm, stop both motor, go to (b)

5.1.2. *Motor algorithm*

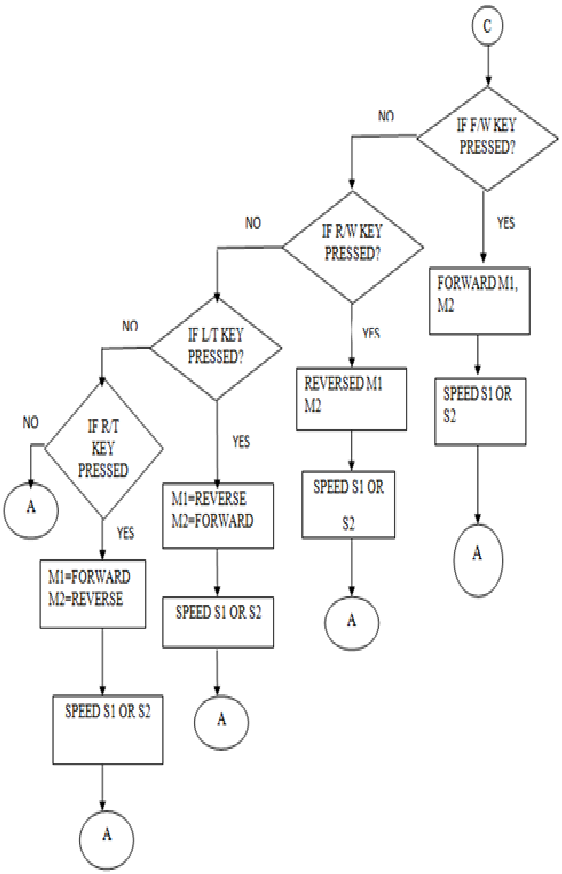
- If forward key is pressed then select motor speed s1 or s2.
- Move both the motor should be in forward direction, go to(a)
- If reverse key is pressed then select speed is s1
- Moves both the motor in reverse direction, go to(a)
- If left key is pressed, speed is s1
- Left motor(m1) will stop
- Right motor(m2) will move forward direction, go to(a)
- If right key is pressed, speed is s1
- Left motor(m1) will move forward direction, go to(a)
- Right motor (m2) will stop.
- If left key is not pressed then go to (a)

5.3. Flowcharts

5.3.1 *System flowchart*



5.3.2 ***Motor flowchart***



6. CONCLUSION

This system is user friendly and cheap product. This product is suited for some special people who have some disabilities. We know requirements of this type of products can be very stringent. Yet system aimed at the common masses and tried to accommodate as many requirements as was possible with our limited resources. This product is a simple application of motor control. To make it user friendly the keyboard is provided. Same chair can be used by blind and old age people for mobility.

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