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MICROCONTROLLER BASED ROBOTICS SUPPORT FOR BLIND PEOPLE

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Abstract

Blind people are too much dependent to others because of their disability. They need help from others to find a destination, to get any object or to execute any command. A person is required to guide the disable people, to provide any bearable object such as water, medicine etc. or support him. Minimizing the problems of the person, a microcontroller based robotic support system is proposed. Robotics car, surveillance system and android controller are the main three parts of this system. The robotics car is assigned to deliver any light objects and also contains a mobile device which is dedicated to capture live streaming video. The surveillance system is used to display the captured video from the robotic car using remote control application. By using the surveillance system, the android application controls the robotics car by the assigned person. The android controller also contains a servo motor where the mobile device located which is rotated up to 180 degree. In the robotics car, the mobile device contains an android application which converts the received text message into voice. The message is used as an instruction and the eyeless people can work according to these instruction. The purpose of this research is to surveillance the blind people, provide any bearable objects and provide any text message which is converted to voice which minimizes the difficulty of supportive person.

***Keywords*:** Android, Arduino, Microcontroller, Robotics, Surveillance.

Introduction

An approximate 253 million people live with visibility impairment, 36 million are blind and 217 million have moderate to severe visibility impairment. It is approximated that the number of people with visibility impairment could triple due to population growth and ageing. It also shows that 115 million people could be blind in 2050 and in 2020 it will be 38.5 million.

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When we care for a blind person, one of the basic skills need to teach is personal care. It is really too tough to go in a fixed place for a blind people. And a person is always assigned to guide the blind people. To receive an instruction or message from an adviser is also tough for them because they are not able to use phone or any device which convey messages. Sometimes it is necessary to send some objects to them because to go in a certain destination and take an object is totally impossible for them.

In order to mitigate the problems, we want to propose a microcontroller based robotics support for blind people. It helps to reach bearable objects to a blind person and is also able to carry a text message which is converted into speech whenever needed controlled via remote device. The system also contains a surveillance system which is used to monitor the blind people. It minimizes the burden from the extra person by monitoring the blind people.

Background for the system

The proposed system can be useful for the blind people to monitor them, send any information as voice to them and provide any object to them by using microcontroller based robotic system. The proposed system has three parts. The robotics car contains Arduino (Göbel et al., 2011), L293 D Motor Controller, Bluetooth Module, mini bread board, male-male jumper wires, Male-Female Jumper Wires, smartphone, 4- wheel, 4-Dc Motor, and battery.

A. Arduino

Arduino is an open-source physical platform based on microcontroller board. The overall design for the aurdino (Patil et al., 2017) is displayed in Fig. 1.

The key features for the board are

1. Arduino boards are able to read analog or digital input signals from different sources
2. Turn the input signal into an output such as activating a motor
3. Controlling various functions by providing instructions to the Aurdino.
4. The board is integrated to the compute via USB cable.

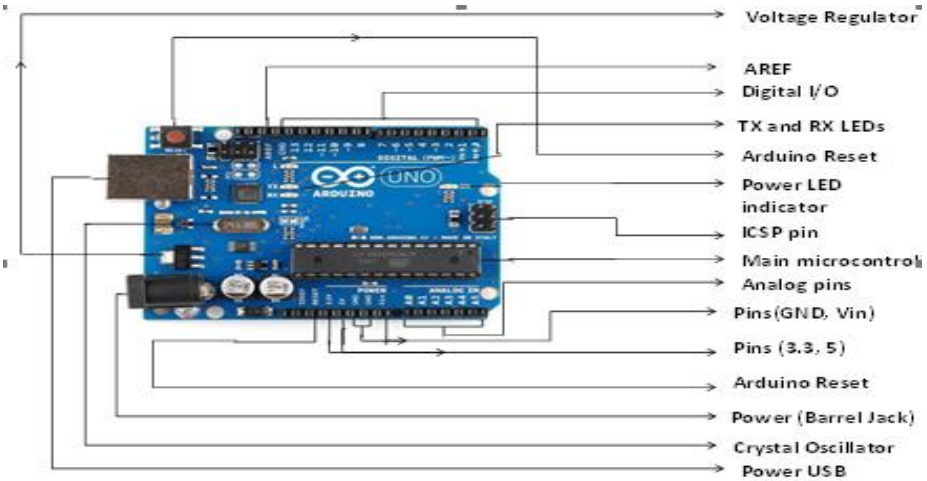

Fig. 1. Arduino UNO

B. Bluetooth transceiver module

Serial wireless data transmission can easily be achieved by the Bluetooth device. The frequency to operate the module is among 2.4 GHz ISM frequency band which adopts Bluetooth 2.0+EDR standard. The module is set for serial data communication.

Fig. 2. Bluetooth module HC-05

Table 1. The specification for bluetooth module HC-05.

Configuration	Description
Bluetooth protocol	Bluetooth 2.0+ EDR standard
USB protocol	USB v1.1/2.0
Operating frequency	2.4GHz ISM frequency band
Modulation mode	Gauss frequency Shift Keying
Transmit power	≤ 4dBm, second stage
Sensitivity	≤-84dBm at 0.1 Bit Error Rate

Transmission speed	2.1Mbps(Max)/160kbps(Asynchronous) 1Mbps/1Mbps(Synchronous)
Safety feature	Authentication and encryption
Supported configuration	Bluetooth serial port (major and minor)
Supply Voltage	+3.3 VDC 50mA
Operating temperature	& -20 to 55-
Size	36.5*16mm
Weight	4g

Table 2. Pins of the bluetooth module HC-05.

Pins	Descriptions
VCC	Positive pole of the power source
GND	Ground
TXD	Serial interface, transmitting terminal
RXD	Serial interface, receiving terminal

C. Mini bread board

Creating a circuit using series or parallel connection, breadboard is the most meaningful device. To form a fully completed circuit, wires and components are simply pushed into the holes and power can be applied. Incorrectly positioned components are easily moved to a new position on the breadboard which is the main advantages of using a breadboard.

D. L293 D motor controller

L293D IC is a 16-pins integrated circuit. It is used to control a set of DC motors instantaneously in desired direction. It works on the base of H-bridge, this motor control circuit allows the voltage to be flowing in the desired direction. In the research, the motor controller is used to control the 4-wheel of the robotic car. Table 3 describes the specification of the motor controller and Fig. 3 contains the circuit diagram of L293D motor controller.

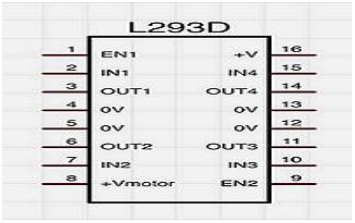

Fig. 3. Motor controller IC

Table 3. Description of motor controller.

Pins	Descriptions
Pin-1(Enable 1-2) pin-9(Enable 3-4)	When the enable pin is high, then the left part of the IC will work. This pin is also called as a master control pin.
Pin-2(Input-1)	When the input pin is high, then the flow of current will be through output-1.
Pin-3(Output-1)	This output-1 pin must be connected to one of the terminals of the motor.
GND Pin	It is connected with the GND pin of arduino**.**
VCC Pin	Connected with the 5v pin of arduino.
Pin-7 (Input-2)	When this pin is HIGH then the flow of current will be though output 2
Pin-8 (Vcc2)	Supply the voltage to the motor.
Pin-16 (Vss)	Power source to the integrated circuit.
Pin-14 (Output-4)	Connected to the terminal
Pin-12 and 13	These pins are ground pins.
Pin-11 (Output-3)	Connected to the terminals
Pin-10 (Input-3)	When this pin is high, then the flow of current will through output-3.

E. DC motor

Direct current (DC) are the source of the motor, where source can be from a battery or DC power supply. Brushed or brushless are the two type of the motor. The speed of a brushed DC motor can be controlled by changing the voltage alone. On the other hand, an AC motor is powered by alternating current which is defined by both a voltage and a frequency.

F. Servo motor

In order to push or rotate an object at desired angles with high accuracy, servo motor can be used. It is just made of simple servo motor which run through servo mechanism. Pulse wide modulator signal is used to control the servo motor.

System design

The total proposed system consists of three main hardware and software components. Those are:

A. Robotic car

Robotic (Kulkarni et al., 2014) car contains a Arduino uno, DC motors, Motor controller, Bluetooth Modulo, servo motor, Mobile device and the power supply. When the Bluetooth Modulo is connected with the android device then it passes signal between the arduino and controller. The most important thing is the camera that can be control by the android application with the support of the servo motor which is better than the web cam. Because the web camera can take the capture and sent it through a network as an attachment. But in our proposed system it returns all live stream as video or image through network and the camera can focus around it. The Robotic car (Barber et al., 2013; Zhao and ZHU, 2014;) is displayed in Fig. 4.

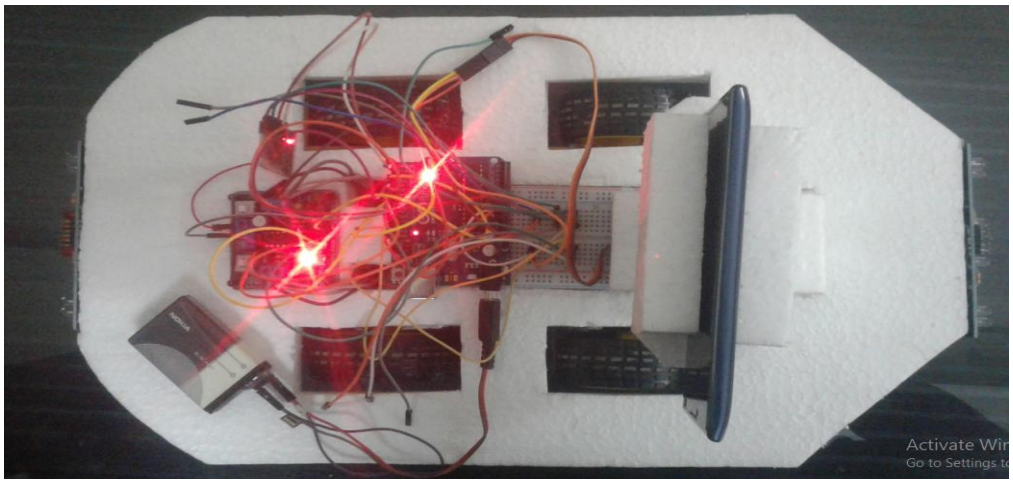

Fig. 4. Robotic car

B. Android controller

As our proposed system contains a robotic car so basically we need to control this through web command or bluetooth device. In initial position we use bluetooth device. The overall process can be control by a android application (Pahuja and Kumar, 2014; Göbel et al., 2011;). It will control the movement of robotic car left, right, front and backward. It also control the camera to focus around it up to 180 degree with the support of servo motor. Fig. 5. views the overall design of our proposed system's android application.

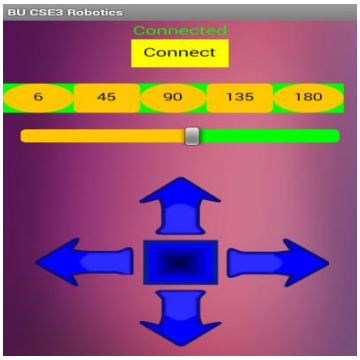

Fig. 5. Android app

C. Surveillance system

As the camera is control through android application and it will produce live streaming video through a network Video displayed in a monitor which help a person to control the robotic car for ones purpose. It is the best surveillance system (Selvam M, 2014; Harmon S,1987; Lee, Lin et al., 2011;)

Architectural design

A. High level design

By viewing the live streaming in surveillance window, anyone can control the robotic car with bluetooth modulo using the android controller. The high level design for the microcontroller based robotic support system is displayed in Fig. 6.

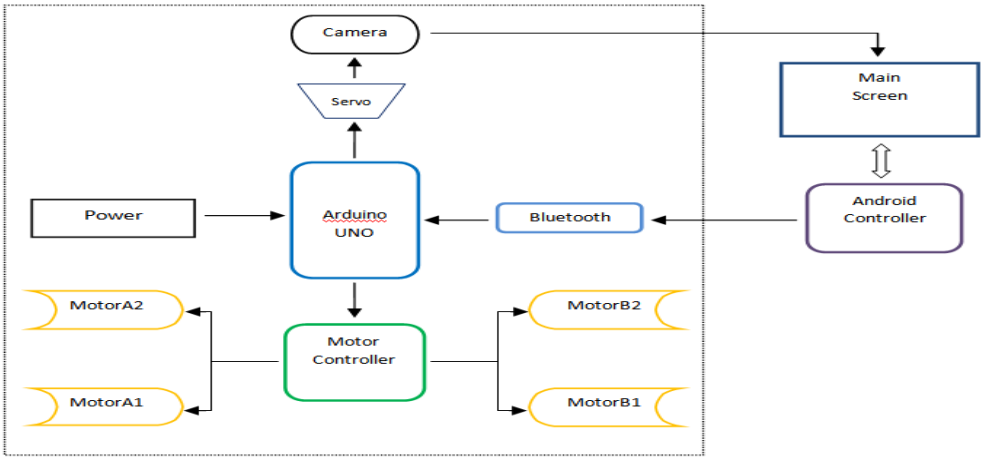

Fig. 6. High level design

B. Circuit diagram

Pin diagram describes the overall circuit diagram for the proposed system. It also describes the overall connection of the used pin. The overall pin description is displayed in Table 4 and circuit diagram is viewed in Fig. 7.

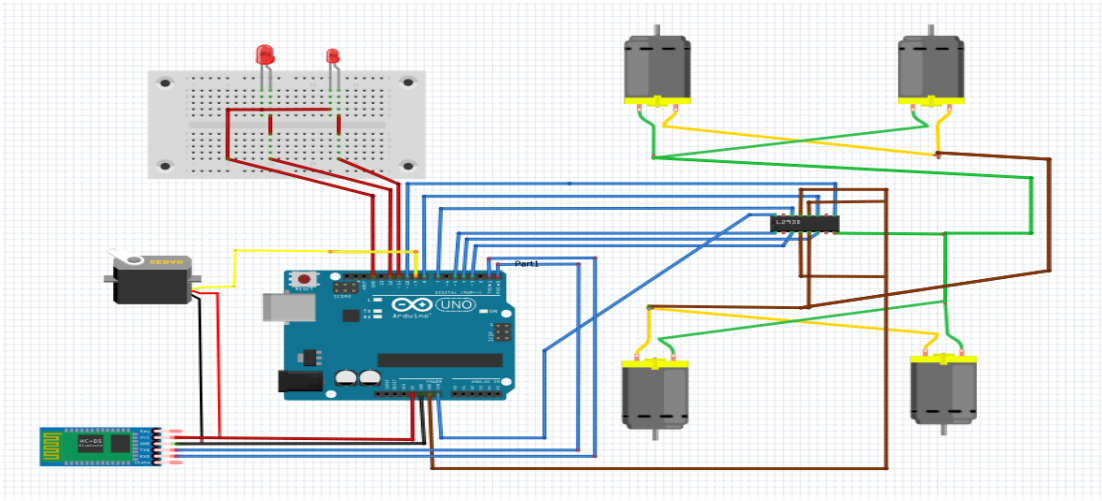

Fig. 7. Circuit diagram of proposed system

Table 4. Descriptions of circuit diagram

Pins	Description
ENA pin of motor controller	Enabling the power supply in DC motor of left side.
ENB pin of motor controller	Enabling the power supply in DC motor of right side.
Pin1, Pin2, Pin3 and Pin4 of motor controller.	Those pins are connected with the arduino as the input pin at 3, 4, 7 and 8 respectively.
Pin GND	This pin is connect with the GND pin of arduino.
Pin VCC	This pin is connect with the 5v pin of arduino.
VCC, GND and controller pin of servo motor.	VCC connect with arduino Vcc GND with arduino GND and other attached in arduino pin 9.
Pin VCC of bluetooth	This pin is connect with the VCC pin of arduino.
Pin GND of bluetooth	This pin is connect with the GND pin of arduino.
TX pin of bluetooth	This pin is connect with the RX pin of arduino.
RX pin of bluetooth	This pin is connect with the TX pin of arduino.
Pin 12 and 13 of arduino	Pins are connected with the bread board.

Working procedure

The overall system has used micro controller based technology to the system architecture. The system has three parts, one is the robotic car to carry any object or surveillance system, second one is the monitoring window and the last one is an android based application to control the robotic car which is connected via bluetooth device that works remotely. Mainly the app sends instructions to the Arduino microcontroller. The Arduino supervised all over the system. It controls the motor driver as well as motors including servo, when it's required to move forward, backward, left, right or stop. There is a live camera attach with the servo motor which is control by android app can rolling up to 180 degree. By the controller app camera can be moved to capture picture and videos. As a result anyone can see the exact location of the robot and the surroundings.

Algorithm for the proposed system

Input: Commands such as forward, backward, left, right, or pause and camera angle as integer value.

Output: Set pin value HIGH or LOW.

Begin:

```
While (Bluetooth_Connected)
{
        Read (input);

        if (input==1)
        {
                FORWARD;
        }
        else if (input==2)
        {
                BACKWARD;
        }
        else if {( input==3)
        {
                LEFT;
        }
        else if ( input==4)
        {
                RIGHT;
        }
        else if (input==5)
        {
                PAUSE;
```

```
                }
                else if (input>=6 and input <=180)
                {
                        SET CAMERA ANGLE;
                }
        }
```

Flowchart

According to the algorithm, the stepwise flow chart for the system is

1. Start the task.
2. Connect to the Bluetooth.
3. If successfully connected then command will be taken otherwise repeat step 2.
4. If command equals to 1, 2, 3, 4 or 5 then the robotic car will move forward, backward, left, right or stop respectively.
5. Otherwise, if the command is between 6 to 180 then it set up the value as camera angle.

Let the flowchart be discussed in Fig. 8.

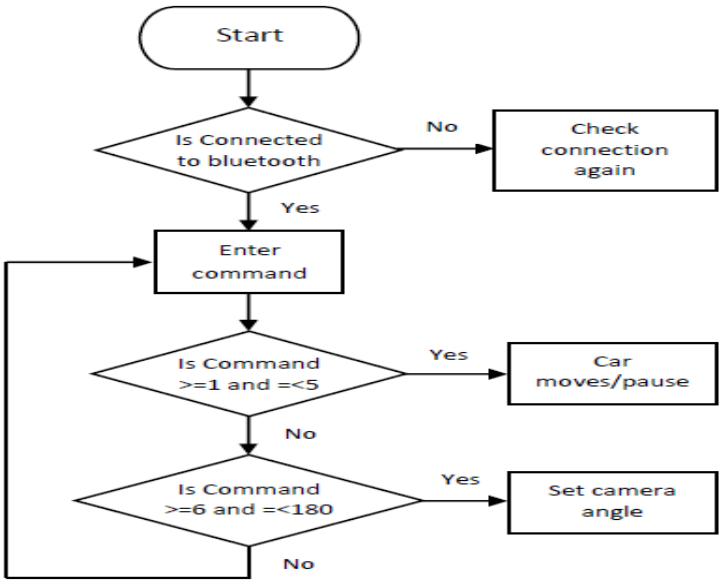

Fig. 8. Flow chart

Conclusion and future work

To minimize the disability of a blind people and burden of their surroundings, our proposed system can be considered as one of the better solutions. To the best of our knowledge, there is no arduino base robotics support system for blind people. The proposed system has robotic car, surveillance system and an android controller which is used to monitor and support the blind people. The system is controlled by Bluetooth device so it has limited range but this microcontroller based system can be upgraded to web based controlling system and can be used to perform any specific tasks at risky places which is our future consideration.

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