

Wirelessly Hand Glove Operated Robot

Gaurav Gautam¹, Abhijeet Ashish², Anil Kumar³, Avdesh⁴

¹B.Tech Student, Dept. of ECE, Dronacharya College of Engineering, Gurgaon, India

²B.Tech Student, Dept. of ECE, Dronacharya College of Engineering, Gurgaon, India

³B.Tech Student, Dept. of ECE, Dronacharya College of Engineering, Gurgaon, India

⁴B.Tech Student, Dept. of ECE, Dronacharya College of Engineering, Gurgaon, India

Abstract— The research paper describes the robot which is controlled by a hand glove wirelessly via Bluetooth interface. This robot is very helpful for the handicap people as it operated by single hand. The robot cart and robotic arm is controlled by the instructions given by the gesture of the hand. Hand glove is an input section from which we provide input by the movement of fingers and hand where as cart and arm is output section on which movements are performed according to the instructions given. Input section consists of an Arduino board, sensors, LCD display and a Bluetooth device where as output section consists of an NXT microcontroller, motors, wheels, camera etc.

Three types of programming are done here: Arduino programming, NXC programming and MATLAB programming (for interfacing of input and output).

Index Terms— Arduino, Bluetooth, MATLAB, NXT.

I. INTRODUCTION

In our society there are various handicap people who face difficulty in their daily life. They need help of other people to perform their works in daily life. To make their life reliable and comfortable, a Robot is a great machine which can help them as per their need. Moreover in dangerous areas like coal mines, chemical industries and places where explosive gases are found and where human life is in danger, wireless gesture robot can perform such tasks easily without putting the human life in danger.

A wireless gesture control robot which can be controlled by the movement of hand only. It consists of a robotic arm which is fixed from one side and free from another side, which can move in all the directions. It works as per instructions given by the commander wirelessly through hand glove. Hand glove consists of sensors and microcontroller.

II. NXT BRICK

NXT brick is an intelligent brick. NXT brick consists of three motor jacks so that three servo motors can be connected to the brick. These motors can be operated at 0 to 100 percent power. This brick also consists of four input jacks to connect the different sensors like ultrasonic sensor, light sensor, touch sensor etc. Hitechnic DC motor controller can also be connected to these jacks to operate 2 DC motors and 4 servo motors. These all are operated over I2C protocol.

NXT has two microcontrollers, one is 32-bit AVR7 microcontroller with 256 kb flash memory and 64 kb RAM. Second microcontroller is 8-bit AVR microcontroller

with 4 kb flash memory and 512 bytes of RAM. An LCD of 100x64 pixels provides graphical user interface on the NXT brick [4].

A hand glove controlled robot using MATLAB, Arduino and NXT kit. Hand glove is wirelessly connected to the MATLAB. The glove consists of an accelerometer and flex sensors as sensors. Arduino and a Bluetooth module as a microcontroller and a wireless device to communicate to computer. This hand glove sends the data values of accelerometer and flex sensors wirelessly.

III. ACCELEROMETER

Accelerometer is a device which works on gravity. It can measure in which angle it is tilted and with how much speed it is tilted by acceleration due to gravity.

Accelerometer provides three values x, y and z which are calibrated for the four types of movement and a stopped position at center by use of these error values in x, y and z directions.

$$\text{Error}_x = \text{initial}_x - \text{final}_x$$

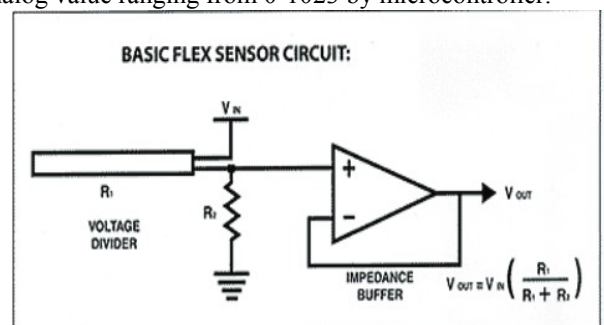
$$\text{Error}_y = \text{initial}_y - \text{final}_y$$

$$\text{Error}_z = \text{initial}_z - \text{final}_z$$

For example if initial value of x is 300 and final value is 305 so error is -5 means x is getting negative tilt. Similarly when final x is 295 so error is +5 means x is getting positive tilt.

IV. FLEX SENSOR

A flex sensor is a sensor which detects bending movements. It can be made unidirectional or bidirectional. It works on the principle of change of resistance [2]. It is available in form of strips. As the strip bends its resistance increases and there is a change in voltage drop according to the amount of bend in the strip. This is measured in terms of analog value ranging from 0-1023 by microcontroller.



V. MODEL ARCHITECTURE

Wireless Gesture control robot is basically a robot. In this as input given to it perform like that. It consist of two sections input and output sections. Input section from which we give input and output section is robot which perform accordingly.

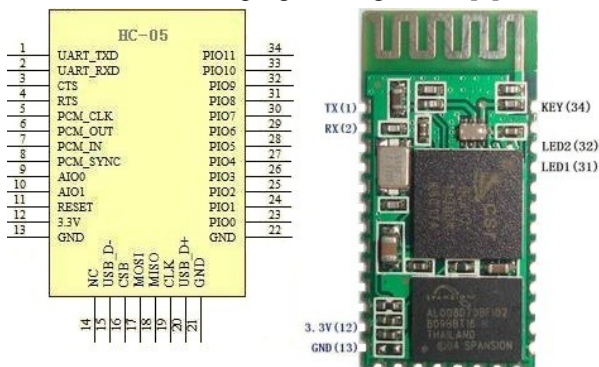
Input section consists a gloves on which a Arduino board, Bluetooth module, a accelerometer, three flex sensors, 9 volt battery and resistances are fitted. Arduino is well programmed by arduino IDE software. Flex sensors are a type of sensors which generates a signal with bending of fingers. Accelerometer works with change of gravity xyz coordinates.

Output section consists a NXT brick .a cart in which two wheels with two motors, a video camera, a robotic arm and a 12 volt battery and Hitech DC motor controller. Nxt brick is programmed by its software consist of two programs one for Arm control and one for bot control.

WORKING: As hand gesture is provided to glove flex sensors and accelerometer generates input signal which is processed by microcontroller and then it goes to the output section via MATLAB by the help of Bluetooth connection. MATLAB is the common interface between input and output section. 9 volt battery gives 9 volt DC power supply to input section. Arduino controls all the action of input section and command all devices present in input section. When the output section receives the input signal by Bluetooth then Nxt brick executes its program and command all output servo motor to work accordingly with the input command. As result the motors can move clock wise direction or in anticlockwise. The arm can move in clock wise or anticlockwise or up or down directions. A 12 volt battery provides DC power supply to Hitech DC motor controller.video camera catches the images which will be displayed on laptop screen, it is the same laptop in which MATLAB program is running.

VI. BLUETOOTH MODULE

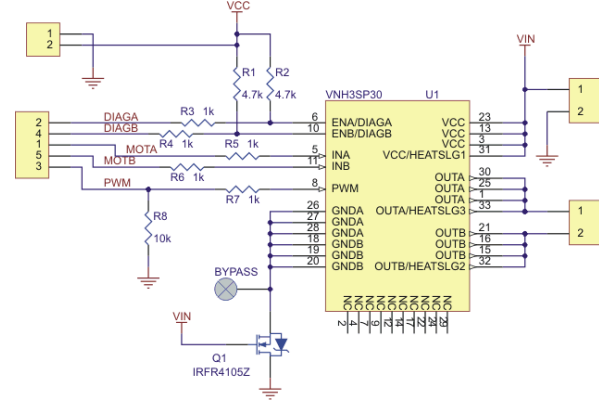
A Hc-05 bluetooth module is used to send data from hand glove to the matlab. This module consist of 6 pins.Two pins for power supply vcc and gnd.Two pins named rx and tx to give recived data to arduino and take data from arduino to Bluetooth module.Key pin is provided for programming purpose of Bluetooth module.Transparent data mode and AT command mode are two programming modes [6].



VII. HITECHNIC MOTOR CONTROLLER

This is the dc motor controller used to drive high current or

heavy motor.it is controlled by nxt brick using I2C communication [3].This controller consist of two VNH3SP30 Motor Driver which can operate on maximum current of 30A and maximum voltage of 36V.This motor driver based on H-bridge concept and also have PWM control.Servo motor can also be controlled using a other servo motor controller with dc motor controller.



VIII. MATLAB ARDUINO INTERFACING

HC-05 bluetooth module is paired with computer with default passkey "1234" [5].Then use `>>instrhwinfo('Bluetooth');` command to find your Bluetooth device.Then to find detail of your Bluetooth device use `>>instrhwinfo('Bluetooth','devicename')` command.Now make variable for Bluetooth device using `>>b = Bluetooth('HC-05',1);` then connect with device using `fopen(b);` command.Now we can send and receive the data using `fwrite` and `fscanf` commands respectively.After doing all transfer of data Bluetooth device is disconnected using `fclose(b)` command in matlab.The data transferred by Bluetooth may be digital(0-1) or analog(0-1023) as we are working with arduino.

IX. MATLAB NXT BRICK INTERFACING

For interfacing nxt brick to the matlab there are two methods.one by usb and second by Bluetooth available in nxt module.

```
>>h = COM_OpenNXT('bluetooth.ini'); [1]
```

Command is used to creat matlab variable for nxt.using this variable we can control motors as per desired power and speed and can gather data from sensors.for controlling a servo motors

```
>> mA = NXTMotor('A'); >> mA.Power = 50; >> mA.SendToNXT();
```

these three commands are used.First declares motor variable second sets the power and third sends the command to nxt.

X. SERVING THE UNDERSERVED AND SOCIETY

This Robot can be well applied in following area in society:

- 1) Physically handicapped people can manage their work through their hand movements.
- 2) It can be implemented in chemical industries and coal mines where human life is in danger.
- 3) It can be applied in defense to load bombs under

emergency or war situation .

- 4) It can be used in CBI to gathers images silently.
- 5) It can be used as a cleaning agent in sewage and drainages.

XI. FUTURE SCOPE

- 1) GPS system can be added to the robot by the help of which its location can be tracked.
- 2) Bluetooth wireless control can be replaced by radio frequency wave by which its range can be enhanced.
- 3) This robot can be upgraded to detect human life in earthquake and landslide rabled people's by implementing the sensor accordingly.
- 4) It can also be upgraded to bomb detecting robot as it has robotic arm it can also lift the bomb.

XII. CONCLUSION

The working of the robot is successful. All the action performed by the robot is controlled by a single hand glove. The maximum range for the wireless operation found in between 9-10m.

REFERENCES

- [1] http://www.mindstorms.rwth-aachen.de/documents/downloads/doc/version-4.03/motor_control.html
- [2] <http://mech207.engr.scu.edu/SensorPresentations/Jan%20-%20Flex%20Sensor%20Combined.pdf>
- [3] http://www.patroumbots.com/uploads/1/3/1/6/13161577/hitechnic_motor_controller_-_brief_v1.3.pdf
- [4] <http://www.legoengineering.com/wp-content/uploads/2013/06/download-tutorial-pdf-2.4MB.pdf>
- [5] <http://www.instructables.com/id/Arduino-AND-Bluetooth-HC-05-Connecting-easily/>
- [6] <http://www.exp-tech.de/service/datasheet/HC-Serial-Bluetooth-Products.pdf>