ISSN2394-3777 (Print)
ISSN2394-3785 (Online)
Available online atwww.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Special Issue 11, April 2018

# HUMAN GESTURE RECOGNITION FOR IoT BASED APPLICATIONS

P.Subha
Sri Venkateswara College of Engineering
Electronic and Communication Engineering
Tamilnadu , India
subhapaulson@gmail.com

Dr.S.Muthukumar
Sri Venkateswara College of Engineering
Electronics and Communication Engineering
Tamilnadu, India
hodec@svce.ac.in

***Abstract*—In this paper the gesture control using image processing and machine control using IoT technology were implemented using software as well as arduino hardware. integration of these two operation/works will results in efficient and optimized control of machine in remote access. since using IEEE 802.11(Wifi module) in this work, the range of control can be efficiently increased than existing work. Also the usage of crop function, finger calculation in image processing provides the extraction of result. This work can be applicable in real time Home automation, vehicle control and industrial automation.**

***Keywords*— *IoT; Digital Image Processing; Hand Gesture Recognition; MATLAB; Arduino; Robot..***

## I. INTRODUCTION

Interaction between human and computer has become an important part in day to day living . It is concerned with the design, evaluation and implementation of interactive computing system for human use. The most popular device that are used for communication are keyboard , mice, twinkle pen, trackball , keypads etc. These devices are familiar but not so natural for communication. Due to the development of visual -based interface, now computers are able to see, which makes the human computer interaction rich . This employs a new communication and dominance facility that is more reliable, substance abuser -friendly and time saving. Plenty of research piece of work has been done on hand gesture recognition based on different methods and proficiency . The main purpose of using gestures is to provide a more natural way of controlling and provides a rich and intuitive form of interaction with the robotic system. This mainly involves Image Processing and Machine Learning for the system or application development.

This robot has multiple application here we are demonstrating one of the application. Further the robot captures the video signals with its camera (fixed on the board of the robot). The live video of the movement of the robot are received at base station (computer). It is processed in the MATLAB software.

## II. RELATED WORK

### *A. Existing system*

There are many techniques that are used to control the robot through gestures.

#### *i. Sensor based method*

The sensor-based method uses different sensors such as radar, tilt, acceleration, pressure etc. to measure movement. For example[5] wrist watch-type gesture recognition device using acceleration sensors to detect basic hand and finger gestures. One drawback was that it required extensive training for four individual sensors, though commendably their system was integrated onto a small everyday device such as a watch. One interesting implementation of acceleration-based gesture recognition, was in the area of musical performance control and conducting systems [6].

#### *ii. Smart clothing based method*

Smart clothing is where technology merge with textiles creating fashionable, functional and comfortable solutions solvent to meet everyday needs whether it is in sports and fitness, outdoor and leisure, home and leisure, home care and

ISSN2394-3777 (Print)
ISSN2394-3785 (Online)
Available online atwww.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Special Issue 11, April 2018

health care[8]. But use of special gloves and wrist bands will affect the ease in accessing the system.

*B. Proposed system*

In this system, user operates the robot from a control station that can be a laptop or a PC with a good quality in built webcam or external webcam. This webcam is used to capture real time video stream of hand gestures to generate command for the robot. Gesture command are given using hand palm. Mainly four kind of gesture are used. Robot is moved in four possible directions in the environment using image frame is taken as an input and processed using image processing. Processed image is then used to extract the gesture command. This gesture command can have one of the four possible command as specified. From this generated gesture command, signal is generated and it is passed to the robot using ESP8266-01(transceiver)

This generated signal is stored in the file at the control station. As soon as the ESP8266-01(transceiver) on the robot gets command from the control station, controlled by the IoT technology. Robot side ESP8266-01 generate some output signals that are passed to the motor driver. This output signal generated depends on the gesture input, for every four possible gesture input, different output signals are generated. The motor driver is used to drive the DC motors of the robot. Once a command signal is given to the robot , it continues to move in that direction until the next command is given or any obstacles comes in its path. Fig. 1 shows basic flow of the system.

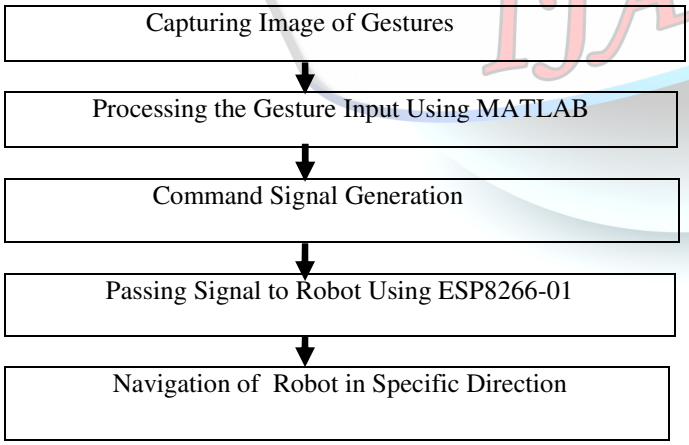



Fig.1 Basic Flow of the System

## III. TECHNOLOGIES USED

A. MATLAB

We use MATLAB image processing Toolbox, but fortunately, no toolboxes are needed for most operations. Some of the commands which we have used here are imread & imwrite which helps MATLAB to read and write image respectively. The user can run the MATLAB code to recognize the gestures in order to move the robot in the desired direction.

B. Operations

The gesture recognition is done by using the some operations. The crop function, Otus method, morphological operation are used.

- Otus technique is used to set the threshold in the image.
- Morphological operation is used to erosion and dilation operation is performed.
- Finaly the crop function is used to crop the upper portion of the image is cropped.
- Croped image to count the number of fingers.

C.Embedded C

In arduino embedded C programming is used. C is most widely used programming language for embedded processor/controller. Embedded C uses most of the syntax and semantics of standard C, e.g., main () function, variable declaration, data type, condition statement (if, switch), loop (while ,for) array, string etc. Hera we used one embedded c code to control movement of the robot .

## IV . DESIGN

Our design is mainly divided into two parts. The first part focuses on hand gesture command recognition using MATLAB. Second part is the generated command signal which is sent via ESP8266-01 to control the movement of robot using IoT technology.

A. Hand Gestures Recognition

The plain background image which has to be captured using webcam before the user gives gestures. The hand gesture recognition system generate a commands and that commands are used to control the robot. There are mainly four probable gesture commands that can given to the robot. These gesture commands are given by the user based on the Finger count. The hand gesture command is given in front of the reference image using webcam.

Once the image has been captured the user can run the MATLAB code to recognize the gesture I order to move the

ISSN2394-3777 (Print)
ISSN2394-3785 (Online)
Available online atwww.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Special Issue 11, April 2018

robot in the desired direction. Image frame is taken as input from webcam on the control station and further processing is done on each input frame to detect hand palm. These recognized gestures are further transmitted to the receiver serially through an USB to UART converter

B.ESP8266-01 Wifi module

The ESP8266 is low cost wireless module with a complete AT command library. This allows for easy integration with WIFI network through wireless communication. ESP8266 explore two modes: station mode and access mode. Fig. 2 shows esp8266 pinout.

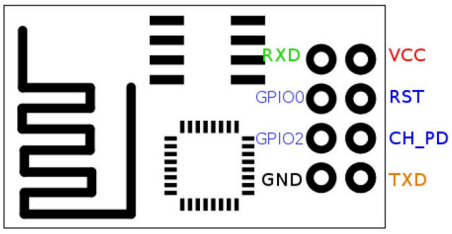



Fig. 2 ESP8266 pin out

C. Arduino

ATMega328P microcontroller. ATmega328P is a CMOS 8 - bit microcontroller is a low - power RISC architecture. By executing powerful instructions in a single clock cycle, ATmega328P be approaches 1 MIPS (million instructions per second) per MHz allowing the system designed to optimize power consumption with the processing speed. The microcontroller on the board is programmed using the Arduino programming language (based on wiring) and the Arduino development environment (based on processing). Fig.3 shows Arduino.


Fig. 3 Arduino

D. DC Motors

A DC motor is mechanically rotated electric motor powered from direct motor (DC). The stator is stationary in space by definition and therefore so is its current. The current in the rotor is switched by the commutator. DC motors better suited for equipment ranging from 12V DC systems in automobiles to conveyor motors, both which require fine speed control for a range of speeds above and below the rated speeds. The speed of a DC motor can be controlled by changing the field current. Fig.4 shows DC Motor.

Fig. 4 DC Motor

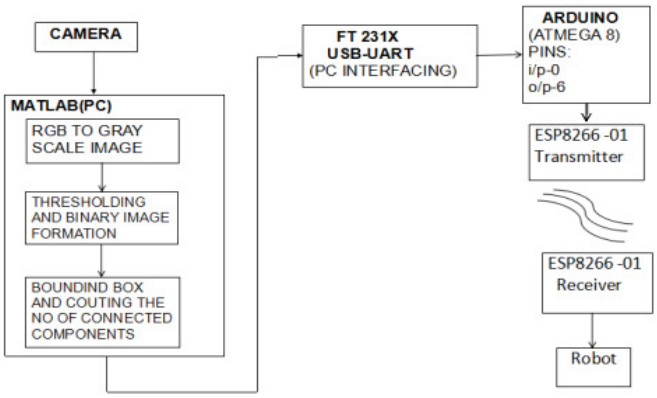



Fig. 5 Architecture of the system

## V. IMPLEMENTATION

A. Capturing Gesture Movements:

Image frame is taken as input from the webcam on the control station and further processing is done on each input frame to detect hand palm.. This involves some background constraints

ISSN2394-3777 (Print)
ISSN2394-3785 (Online)
Available online atwww.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Special Issue 11, April 2018

to identify the hand palm correctly with minimum noise in the image.

B. Hand Palm Detection

After capturing the image frame from the webcam, some basic operations are performed on this frame to prepare it for further processing of command detection. Following process is done to detect hand palm.

1) FEATURE EXTRACTION

An image frame is taken as input through webcam. The RGB input frame is converted to a grayscale image. After obtaining a grayscale image, we use Median filters to remove noise from input image, and then threshold the image to a binary one. The unwanted porting are removed and it unnecessary pixels(0) have to be removed from original image.Binary Thresholding is then done on this image frame for the recognition of hand palm.

C. Command Detection using Specific Method:

After completion of pre-processing of an input frame, further processing is done on the extracted image according to specified technique. The method of giving gesture commands are as follow


Fig. 6 Gesture commands

Robot is moved in all possible directions in the environment using four possible types of commands which are Forward, Backward, Right, Left for the finger count of 1,2,3,4 respectively as shown in the above figure.

D. Generate Specific Signal:

After detecting gesture command specific signal value is generated, unique for every gesture commands. This signal value is written in the file using MATLAB functions

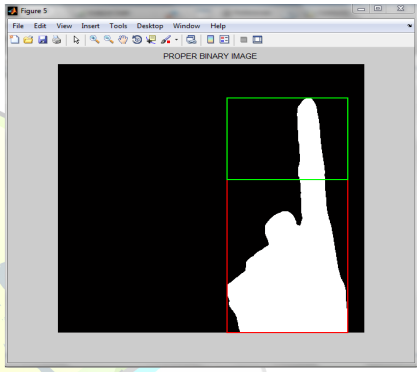
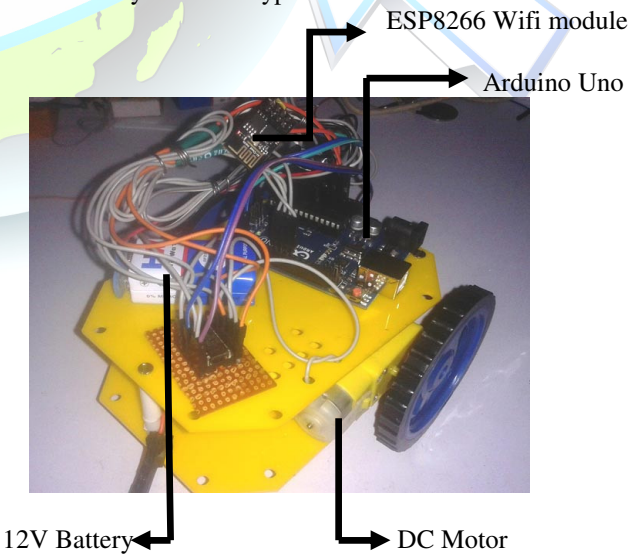



Fig. 7 Detection of Gesture

H. DC Motors in Robot:

This is the final end product of robot consisting of all the hardware .Two DC motors are connected to this robot chassis as shown in Figure 8. This is controlled through gestures by the user at control station. The pick & place robot is controlled by the 1*4 keypad circuit



ISSN2394-3777 (Print)
ISSN2394-3785 (Online)
Available online atwww.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Special Issue 11, April 2018

## V.CONCLUSION

In this paper we have tried to control the robot in a novel method. Gesture control being a more natural way of controlling devices, makes controlling of robots more efficient and easy. We have used finger count techniques for giving gesture input. The crop function was incorporated in the proposed project for finger calculation from the hand gestures and analyzed the accuracy of hand recognition using MATLAB version 2014a.In which each finger count specifies the command for the robot to navigate in specific direction in the environment. After gesture recognition command signal is generated and passed to the robot via IoT technology, then it moves in a specified direction.

## REFERENCES

[1] Durga .S1, Gabriela Roselene .F1, M. Harshini1, M. Haneesha1, Prof. Raghavendra Mulimani1"digital image processing based hand gesture recognition robot for multiple applications ",International Journal of innovative research in electrical, electronics, instrumentation and control engineering Vol. 4, Issue 5, May 2016.

[2] Xiao han and M A Rashid,"gesture and voice control of internet of things",IEEE 11th conference on ind.electron.and application,2016.

[3] Assadmohammed,amarseeam,xavierbellekens,kamilanieradzinska,visha mramsuurrun," Gesture Based Iot Light Control For Smart Clothing", IEEE International Conference on Emerging Technologies and Innovative Business Practices for the Transformation of Societies (EmergiTech),2016.

[4] G.Plouffe and A.M.Cretu (2016), "Static and Dynamic Hand Gesture Recognition in Depth Data Using Dynamic Time Warping", IEEE Transactions on Instrumentation and Measurement, Volume: 65, Issue: 2, Pages: 305 – 316,2016.

[5] E. Morganti, L. Angelini, A. Adami, D. Lalanne, L. Lorenzelli, and E.Mugellini, "A Smart Watch with Embedded Sensors to Recognize Objects, Grasps and Forearm Gestures," Procedia Engineering, vol. 41, pp. 1169–1175, 2012.D.

[6] Schmidt, "Acceleration-Based Gesture Recognition for Conducting with Hidden Markov Models," 2007K.

[7] Tsukadaa and M. Yasumurab, "Ubi-Finger : Gesture Input Device for Mobile Use," Ubicomp 2001 Informal Companion Proceedings, p. 11, 2001.

[8] S. Sen, S. Chakrabarty, R. Toshniwal, and A. Bhaumik, "Design of an Intelligent Voice Controlled Home Automation System," International Journal of Computer Applications, vol. 121, no. 15, pp. 975–8887, 2015.

[9] S. Lian, W.Hu and K.Wang, "Automatic user state recognition for hand gesture based low-cost television control system", IEEE Transactions on Consumer Electronics(2014), Volume: 60, Issue: 1,Pages: 107 – 115

[10] S. Mitra, and T. Acharya,"Gesture Recognition: A Survey", IEEE Transactions on systems, man and Cybernetics, Part C: Applications and reviews, (2007), vol. 37 (3), Page. 311- 324.

[11] A.R.Varkonyi-Koczy and B.Tusor, "Human–Computer Interaction for Smart Environment Applications Using Fuzzy Hand Posture and Gesture Models", IEEE Transactions on Instrumentation and Measurement, (2011), Volume: 60, Issue: 5,Pages: 1505.

[12] Z.Ren, J.Yuan, J.Meng and Z.Zhang, "Robust Part –Based hand Gesture Using Kinectic Sensor", IEEE Transactions on multimedia, (2013), Volume:15, issued:5,Pages:1110-1120.