



## Hand Gesture based Home Control Device using IoT

Mitangi Patel

Computer Science & Engineering,  
Parul Institute of Engineering and Technology,  
Vadodara, India.

Sharnil Pandya

Information Technology,  
Parul Institute of Engineering and Technology,  
Vadodara, India.

Satvik Patel

Computer Science & Engineering,  
Parul Institute of Engineering and Technology,  
Vadodara, India.

**Abstract:** Internet of Things or IoT is nothing but an evolved version of Internet, which includes sensors, consumer electronic devices and other embedded systems connected to it besides computers, smart phones and tablets to collect and exchange data with one another. IoT technology can also be applied to create a new concept for smart homes to provide intelligence, comfort to improve the quality of life. Home automation is control appliances using the remote control, internet, voice and gesture. We control the appliances using the hand gesture. A Human Computer Interaction (HCI) between computers and human understands human language and develop a user friendly interface. Gestures a non-verbal form of communication provides the HCI interface. The goal of gesture recognition is to create a system which can identify specific human gestures and use them to convey information or for device control. Hand gesture recognition is relatively complicated since different persons have different speeds and styles to perform gestures. Hand gesture recognition is suffering from the accuracy of hand detection. Many algorithms are proposed for gesture recognition accuracy. I proposed one approach; they also increase the accuracy of hand gesture detection. In proposed approach OpenCV library is used for solve the problem of accuracy. I proposed one approach; they also increase the accuracy of hand gesture detection. In proposed approach OpenCV library is used for solve the problem of accuracy. In that approach background subtraction is used for better recognition of the hand from the frame and increases the accuracy rate of hand recognition.

**Keywords:** Home Automation, Internet of Things (IoT), Gesture Recognition, Human computer interface (HCI), Hand Detection,

### I. INTRODUCTION

Internet of Things or IoT is nothing but an evolved version of Internet, which includes sensors, consumer electronic devices and other embedded systems connected to it besides computers, smart phones and tablets to collect and exchange data with one another. The system consists of different sensor modules, ubiquitous microcontroller board, various household electrical devices connected to the microcontroller board via the relay and a computer connected to the Internet [2]. The number of things in the living space is larger than the number of world population. Research is going on how to make these things to communicate with each other like computer devices communicate through Internet. The communication among these things is referred as Internet of Things (IoT) [1].

Due to improvement in living standards, everyone loves to have all the facilities without difficulty and at the earliest. This resulted in the use of advanced technology for home automation. People want all the things to be automated from very simple tasks to many complex tasks. User satisfaction and comfort is the main criteria for home automation. There are plenty of electrical appliances in every modern household. Automating the operation of all the electronic and electrical equipment and providing security improves the quality of life and provides more comfort to the dwellers [3]. Home automation is also popular as digital home, e-home, and intelligent house or smart home. For building the home automation system, automation technology, computer

technology, telecommunication technology along with electromechanical technology is used [3].

The home appliances also control using remote control and internet. But it is not understand by the elder people, mentally challenged people and physically disables people. Home automation is also controlling using the gesture. This is a type of home appliance control system where the person must be present in sight to the appliance that is needed to be controlled and a predefined gesture must be used to turn on/off the device.

Gesture recognition is an image-processing technique. Man-made gestures are captured and system recognizes it. This technique can be easily used to interact with machines by making different gestures according to required message to be conveyed [3].

Gestures are important for communicating information among the human. Nowadays new technologies of Human Computer Interaction (HCI) are being developed to deliver user's command to the robots. Users can interact with machines through hand, head, facial expressions, voice and touch. The objective of this paper is to use one of the important modes of interaction i.e. hand gestures to control and household applications [4].

Our system uses OpenCV image processing library to perform the complete process from pre-processing. OpenCV based library makes the system easy to create due to the large amount of inbuilt functions of various image processing tasks like edge detection, feature tracking [9].

The objective of this research is to develop such a system which will help physically impaired to control home appliances by hand gestures using. This provides comfort and convenience for common users. The system is maintaining the accuracy in the different and problematic background.

The remainder of this paper is organized as follows. We first introduce the related work done in this topic and System overview for hand gesture recognition algorithm is described in Section II. In Section III, System Overview, in Section IV Results of Proposed Gesture Recognition approach. Finally, conclusions are given in the last section.

## II. RELATED WORK

As discussed above one of the major bottlenecks in gesture through home automation systems is robustness and performance for classify the gesture. There are few classification algorithms proposed in the literature to improve its performance and accuracy.

Dynamic sign language recognition (DSL) system for smart home interactive applications is used Bag of Features (BOF) method and the nonlinear support vector machine (SVM) for gesture classification. Despite its limitation of only being able to take care of unordered features, BOF became popular for object classification. Because of its discriminative power, we used model for gesture recognition of video data [9]. To recognize the dynamic hand gestures, it has been divided into two stages, which comprise training and testing. Initially, we trained system by extracting features and then clustering them by *k*-means++, classified them using a nonlinear SVM [6].

A machine learning (ML) approach is presented that exploits accelerometers data to deal with gesture recognition (GR) problems for that classification solution defined by SVM is based on a deterministic binary decision, and the number of support vectors that describe such decision boundary typically grows linearly with the size of the training set. To take these issues, relevance vector machine (RVMs) are introduced, which employ an identical functional form to that of SVMs but within a probabilistic framework [10]. Two novel classification algorithms based on RVMs are presented, which exploit Bayesian inference. The one interface is Frame-Based Descriptor Multi kernel RVM and second interface is RVM with Dynamic Time Warping. Online classification with K-NN (K-nearest neighbor) and DTW (Dynamic Time Wrapping) can get a speed-up with the adoption of centroids, as done for DTW in centroids are representative, median, observations for each class, which can be used as a term of comparison for the current observation to be classified, thus avoiding a time consuming analysis with respect to the full historical dataset [7].

Accelerometer-based pen-type sensing device and Feed forward Neural Network and Similarity Matching (FNN & SM) based hand gesture recognition algorithm built upon a preliminary version of gesture recognition system. The accelerations generated by hand movements are collected and transmitted to a computer (PC) via a USB cable. Users can hold the device to perform hand gestures with their preferred handheld styles in free space. The FNN and SM algorithms are successfully combined; the FNN classifier provides good recognition accuracy, while the SM approach enhances the extendibility of the system [5].

Adaptive and Personalized Gesture Recognition Using Textile Capacitive Sensor Arrays is used learning techniques such as Hidden Markov Models, decision trees, and Bayesian inference have been applied to converting data from sensors. In that two classification approaches, Hidden Markov Models and Dynamic Time Warping to our system to convert data from a capacitive sensor array into alphanumeric gestures. We have evaluated our system using a DTW and HMM based classification it can recognize gestures with accuracy with minimal training. In terms of computational complexity, DTW performs well and more computationally efficient [8].

Here some algorithm recognition accuracy shown in figure 1. Its shows that which algorithm is give the recognition accuracy rate. In figure.1 shows the different algorithm accuracy for gesture recognition.

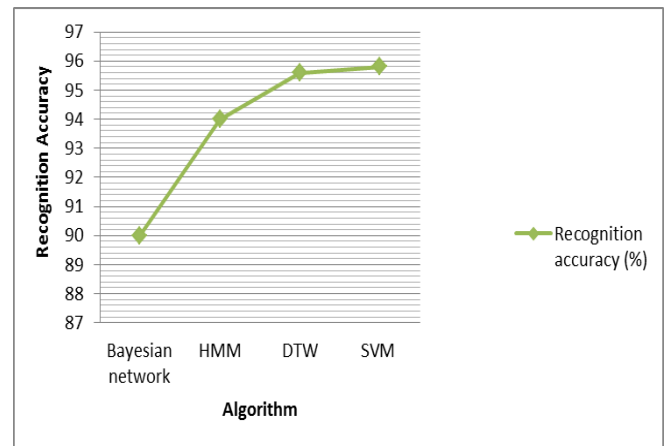


Figure1. Various algorithms gesture recognition accuracy

## III. SYSTEM OVERVIEW

### A. Proposed System

A home automation system is designed for visually challenged and partially paralyzed persons. Proposed system is detect the gesture in problematic background because it will first subtract the background from the detect frame and then detect the hand. So using this approach I will try to improve the hand gesture recognition accuracy.

The system comprises web camera, Raspberry Pi, Internet, for communication. Raspberry Pi is send and receive signal using the internet. So that we have access the data anytime using raspberry pi.

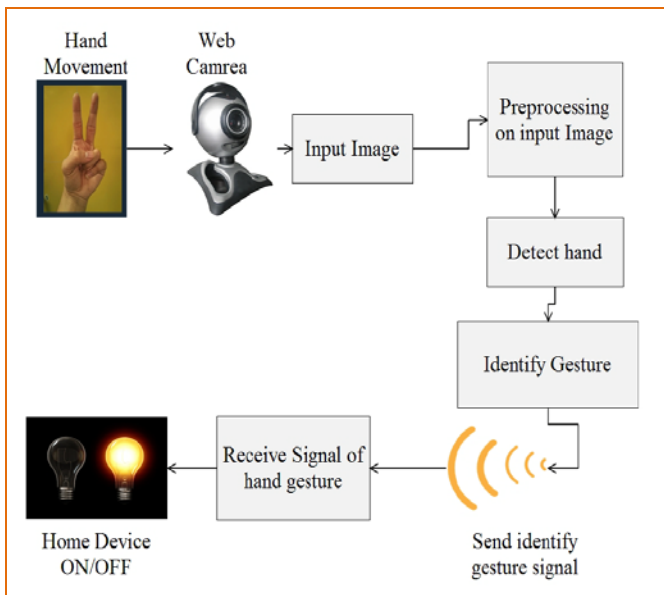


Figure 2. Proposed Diagram

In this proposed diagram we can give the input as a hand gesture to the web camera. This hand gesture is processing using the background subtraction morphology, and threshold. After hand is detecting on the web camera, it count the number of finger and circle to the palm. This detect gesture is convert into the binary value and send that value as a signal using the Internet. At receiver site receive that gesture signal through internet. This signal is processing in the Raspberry pi. Raspberry pi connect with the device, according to the signal Raspberry Pi is control the device like on the device or off the device.

**IV. EXPERIMENT RESULTS**

In this section we discuss about the results of our proposed design.

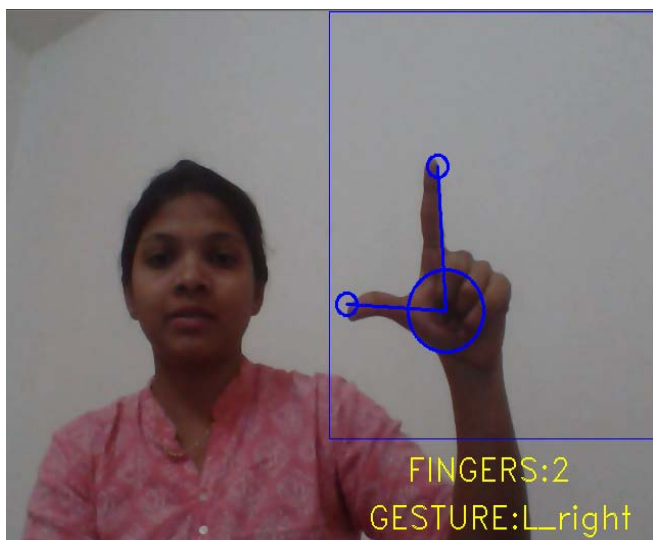


Figure3. Mark finger, Count Number of finger and type of the Hand gesture

Our proposed system showed good results to recognize the real time gestures. The system was implemented in python OpenCV library. We had total 6 gestures. The frame contain the background and hand and the figure 3 show that the hand

with mark finger and palm center. The frame counts the number of finger and type of gesture which we define in the dictionary.

Our system contain the raspberry Pi and webcamera with is shown in figure 4. when we give the hand gesture input to the web camera internet through we have to access connected device on and off. The figure.4 contain the leptop web camera and rasparry Pi connected with the Led. We access the device using hand gesture using the internet.

Proposed system is identify the six different hand gesture like V, L\_right, Index\_position, three finger, four finger, five finger. We compare all this gesture in fifty time and measure the accuracy of that gesture according to the recognition. Figure 5 show the different gesture recognition accuracy out of fifty. In that correct recognition, incorrect recognition, and correct recognition accuracy rate.

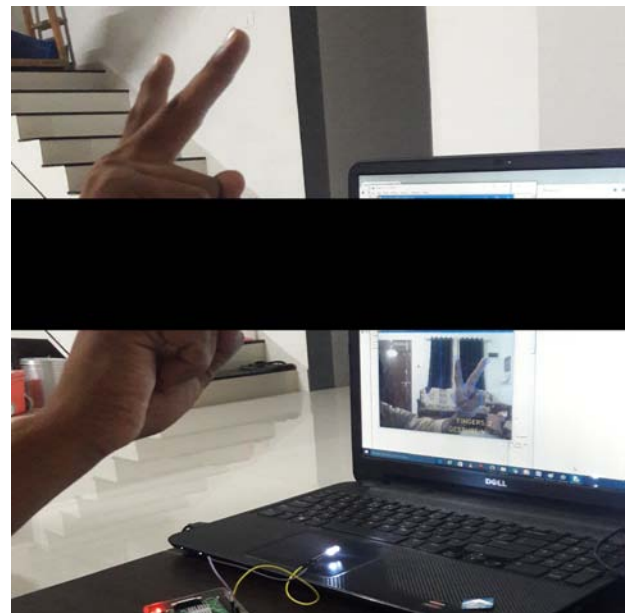


Figure4. System module consist the raspberry pi and web camera

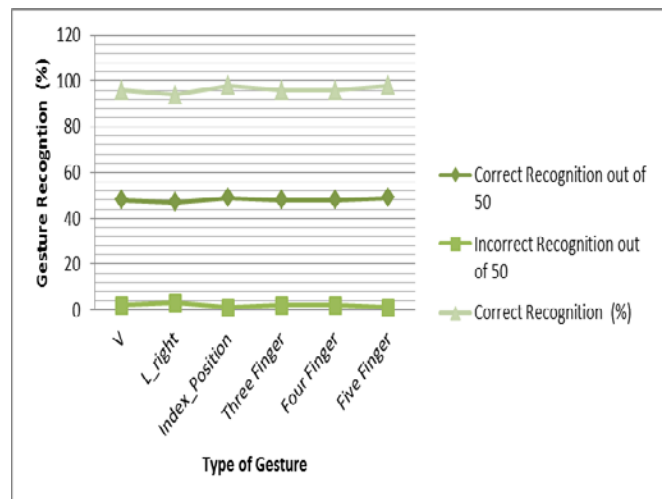


Figure5. Different gesture recognition

**V. CONCLUSION**

Internet of things is the concept of basically connecting any device with an on and off switch to the Internet. IoT technology

can also be applied to create a new concept and huge development space for smart homes to provide intelligence, comfort to improve the quality of life. Home automation is the control of any or all Electrical devices in our home, whether we are there or away. Home automation is also controlling using the gesture. Gestures are a natural way of communication, which can be interfaced with a computer to establish human machine interface. Gesture recognition is suffering from the recognition accuracy. In my proposed approach I solve the recognition accuracy and control the home device which is more useful to people for better quality of life. This system will allow the user to control it in a way that reduces the gap between the physical world and the digital world with an output more intuitive.

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