

Hand Gesture Based Switching Using MATLAB

Kishor P Jadhav¹, Santosh G Bari²

Assistant Prof., KCE'S COE&IT, Jalgaon (M.S.), India¹

Assistant Prof., DY Patil School of Engg Academy, Ambi, Talegaon, Pune (M.S.), India²

Abstract: Controlling the Electrical Appliances and Electronic Gadgets through an Infrared Remote Control is now in general. But the same controlling tasks can be done more easily. Primary motive of proposing the new system of Virtual Switch Control is to remove the need to look in to the hand held remote and to search for a specific key for specific function. Here we present a novel system to control Various Appliances by just using hand gestures recognition like showing first finger will switch the first device. It uses real time image processing for hand gestures Recognition using a simple web-camera and microcontroller based embedded system. This project/paper proposes a possible solution to control the gadgets for physically challenged or people in industries, who can not touch electric panels too often during their work, so better they just by showing hand gestures, devices get controlled. There will be a computer application designed in MATLAB to have a real time image processing. A web camera giving images to the computer application. After processing the images and recognizing the command for switch, decision data is send to a microcontroller hardware based on AVR environment. This hardware sends the data to the gadgets in same way as a remote control does for general use. To implement the algorithm and its logic for run time image processing, a MATLAB based processing environment is used. To process the images, Image Processing & Acquisition toolboxes are used.

Keywords: Hand gesture recognition, Virtual switch, Image processing, AVR micro-controller, Embedded system.

I. INTRODUCTION

Automation plays an increasingly important part in the global economy and also in daily experience. At present, the purpose of automation has shifted from growing productivity and reducing costs to broader issues. For example: increasing quality and flexibility in the engineering process. Until now many projects have been designed in the field of automation by using android, Bluetooth technology, GSM etc.

But in our project, instead of using physical switches, we are going to implement virtual switching system with the help of embedded and MATLAB by using this project we can switch on or off the device just by using hand gesture like by showing finger. So, due to the use of virtual switches this project having many applications areas in industry, in home automation and for smart office also, it is very advantageous because of its durability, easy operation.

The primary goal of hand gesture recognition system is to create a system which can identify specific hand gestures and use them to convey information or device control.

II. AIM OF THE WORK

The main aim of this project is to design a Virtual switch operating on hand gesture. The controlling device of the whole system is an AVR Microcontroller. Relay driver IC and web camera are interfaced to the AVR Microcontroller. The data received by the web camera is fed as input to the AVR Microcontroller. The controller makes a decision according to the hand gesture of user. Hence we can turn on or off any appliances which we have interfaced with our circuit.

III. SYSTEM DESIGN MODEL

Fig (1) shows the block diagram of virtual switching for smart office automation. Firstly camera captures the image of user's hand gesture & then sends it to PC for further image processing. PC loaded with MATLAB, images are captured by using camera and are processed. Block diagram consist of AVR microcontroller, relay driver IC, relay, camera, PC, USB to TTL converter and load.

Various processes like image enhancement, image segmentation takes place init. AVR microcontroller is used for decision making. According to the users hand gestures, device will be switched e.g: showing Finger1 will switch on the device one, while again showing finger1 will turn of the device. Relays used are equal to devices used for switching. Relay is a device used for switching of AC appliances. Relay drivers IC is used for driving of Relays.

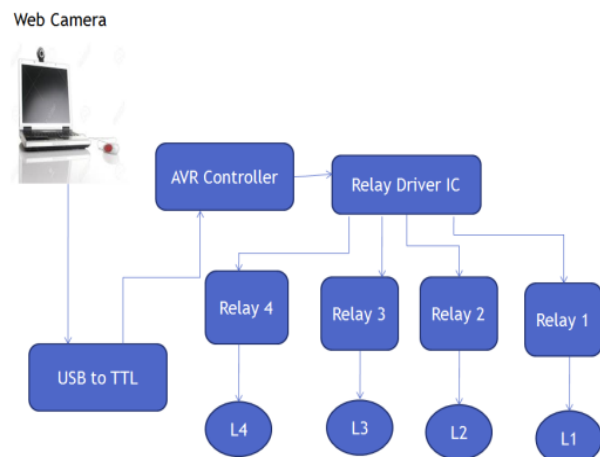


Fig.(1) System design model

It is ULN2803 IC. It is used for interfacing of microcontroller with PC (MATLAB). As serial communication takes place is microcontroller while PC parallel communication takes place and speed and baud rate of microcontroller and pc is also not same. Hence USB to TTL conversation is used for compatibility between PC and microcontroller. Loads are devices that have to be switched eg. Bulb, Fan, etc.

IV. AVRATMEGA8 MICROCONTROLLER

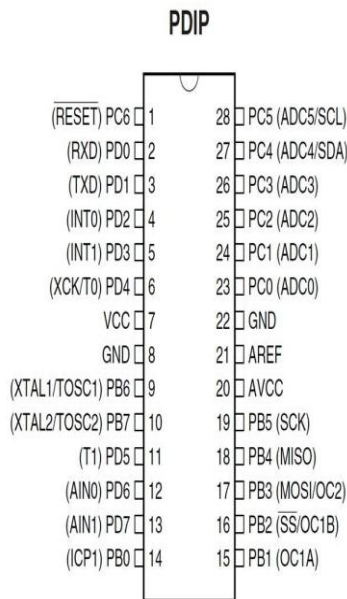


Fig. (2) Pin diagram of AVR microcontroller

A. Features of AVR Microcontroller:

- High-performance, Low-power
- AVR@8-bitMicrocontroller.
- Advanced RISC Architecture.
- 8-bit Timer/Counters.
- 8K Bytes of flash memory.
- 1K Byte Internal SRAM.

V. DESIGN PROCEDURE

Input: Hand gesture

Output: Assigned action executed.

A. Step I: Image capturing:

Capture the input image from camera. Image will be taken as final if it has been occurred for 3 consecutive frames.

B. Step II: conversion of Image:

Image captured by camera is in the RGB format, hence it is converted into gray image for processing.

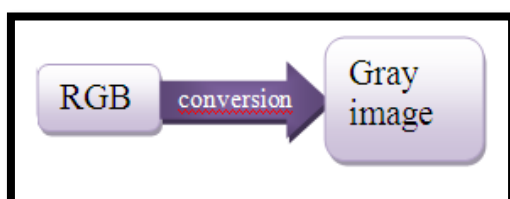


Fig.(3a) RGB-gray conversion

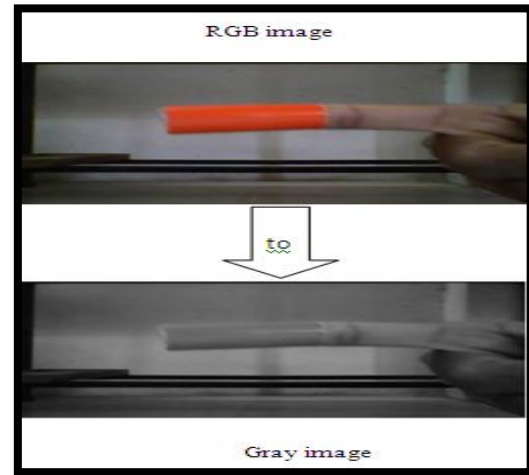


Fig (3b) RGB-gray conversion

C.Step III: Image pre-processing

Image pre-processing is performed in which boundary detection, contrast enhancement; noise elimination, etc. are carried out. Typical parameters of GUI for processing are given in below table.

Table(a) GUI parameters

Parameter	Values
Frames	3
Morphing	20
Area	1000
B/W	0.4
Contrast	1.3
Noise	100
RGB	1

D.Step 4: Extraction of marker color (Red)

In order to extract the region of interest i.e red color finger,gray scale image is subtracted from red image. [Red image - Gray scale image=Region of interest]

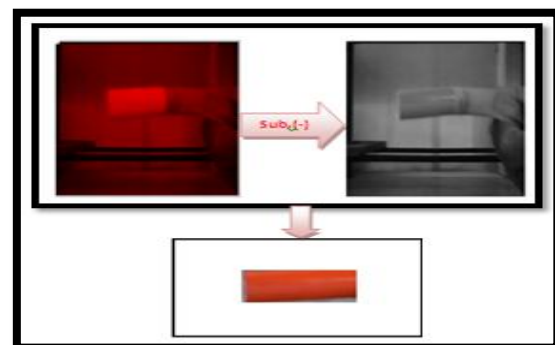


Fig.(4) extraction of marker color (red)

E.Step 5: Thresholding process

Finally,user hand gesture get converted as white color and background as black color by using thresholding process. In thresholding, pixels having value greater than

11 0 will be decoded as 1(white) and pixels having value less than 110 will be decoded as 0(black background) as shown in figure.

Table (b) Thresholding process

Threshold value	Pixel value	Pixel color
0-110	0	Black
110-255	1	White



Fig.(5) GUI image

This image is processed for device switching. Hence, device get switched on the basis of object present in GUI image. Ex.If there is one object in GUI image, then device 1 will get switched.

VI. DESIGN OVERVIEW

The circuit has been developed by using MATLAB and Embedded system. Firstly the circuit of Relays in which switching devices are connected the output of Atmega 8 Microcontroller IC is given to this Relay driver circuit.

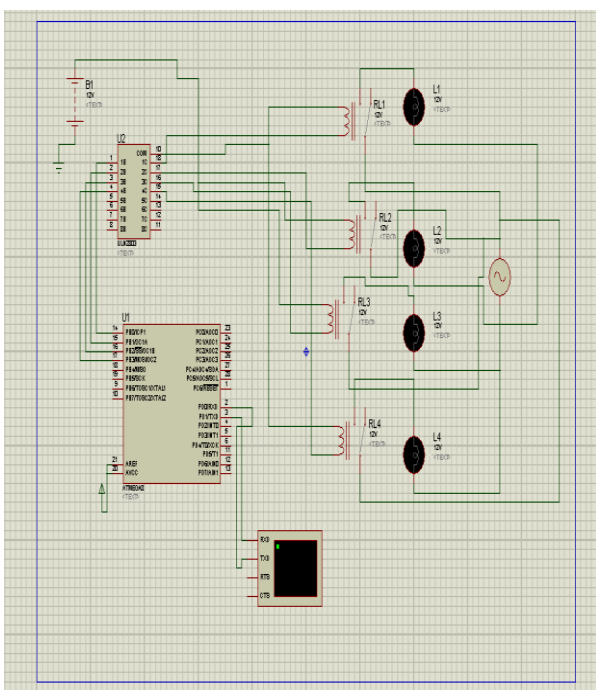


Fig.(6) circuit diagram of system

The programming of Atmega 8 Microcontroller is done in AVR Studio and is done as if A is given as an input signal device 1(D1) will get turned ON, if B is pressed, device 2 (D2) get turned ON and so on. The signals A, B, C, D are extracted from the hand gestures of user by using MATLAB.

VII. RESULT

In our implementation the background is strictly black because shadow does not add noise in the image under the adequate light condition. We have chosen the input images as gray scale so as to save the time of conversion. The result of our implementation is shown in the figures. It consists of four figures A to D which will change state of the devices 1-4 as ON/OFF respectively depending on the gesture shown.



Fig. (7a) device 1 turned ON

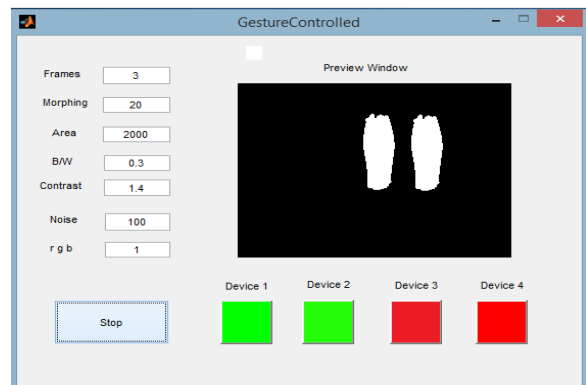


Fig.(7b) device 2 turned ON

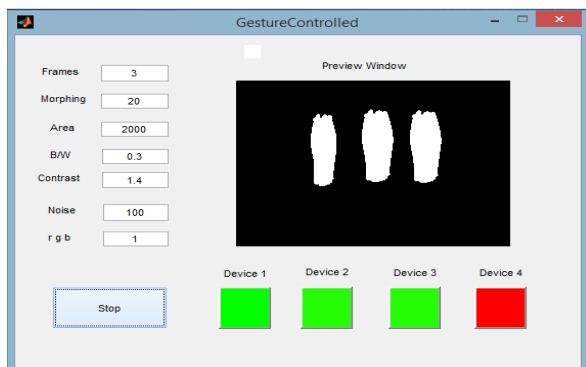


Fig.(7c) device 3 turned ON

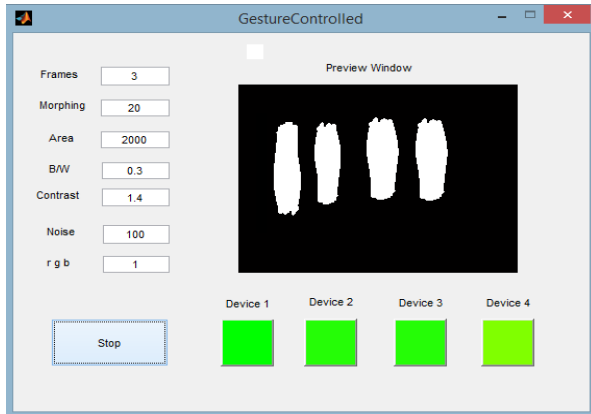


Fig. (7d) device 4 turned ON

VIII. FEATURES

1. Mechanical switches are replaced by virtual switches.
2. Hand gesture based user friendly technology.
3. Low power consumption.
4. Controls high and low voltage devices.
5. Long life.
6. Low cost.

IX. APPLICATIONS

1. In industrial environment where combustibles are used.
2. For house hold automations.
3. In corporate sectors.

X. CONCLUSION

Finally, in this way, GUI image get processed and device will get switched according to the number of objects present in GUI window.

REFERENCES

- [1] Mr. Ann Abraham Babu, Prof. Satish Kumar Varma, Prof. Rupali Nikhare , “Hand gesture recognition system for human computer interaction using contour analysis” , IJRET, Vol.4 Issue 3, March 2015
- [2] Ms. K. Thakur, Ms. A. Daphal, Prof. S. Ahankari “Monitor and control using virtual switch technology”, IJERT, Vol.3 Issue 3, March 2014
- [3] Grant R. McMillan ‘The Technology and Applications of Gesture Based Control’
- [4] Raj Kumar Bansal, Ashok Kumar Goyal, Manoj Kumar Sharma ‘MATLAB and Its Applications In Engineering’.
- [5] Daniel Thalmann, “Gesture Recognition Motion Capture, Motion Retargeting, and Action Recognition”, EPFL – VRlab.
- [6] Manoj Harsule, Prashant Ingole, “Home appliances control using hand gesture based command”, conference paper june, 2013.