Hand Gesture Recognition for Automation Applications

K. R. Nimisha[1], S. Saranya[2], R. Suganya[3], Venisha John[4], D. Suganya[5]

Electronics and Communication Engineering, Sri Eshwar College of Engineering, Kinathukadavu, Tamil Nadu, India

ABSTRACT

Gesture is a kind of non-verbal communication where actions are communicated using objects instead of speech or vocal sounds. It was the very first mode of communication before the development of civilization and languages. Gesture recognition based communication is used in various automation applications. Hand gesture is the most commonly used mode of gesture automation which will be very helpful for physically challenged people and in the places where the man power requirements is to be reduced. Diversified applications of gesture automation include switching home appliances, avionics, industrial automations etc. Gesture based on bare hand has some disadvantages in angle detection and setting threshold for gesture recognition. In this paper hand gesture recognition based on color identification approach is actually proposed. Considering the essential factors such as background color, skin tone etc., bright color coatings are given to the glove which is worn on the hand for proper recognition. The steps associated with hand gesture identification are data acquisition, color comparison in lab VIEW and further proceedings based on the color identified in the preprogrammed manner.
Keywords : Lab VIEW, PIC, ADC, RAM, EEPROM, CCP, ICSP, PORT, UART, DCE, DTE

I. INTRODUCTION

User interface with the equipment has been drastically changed in the recent decades. Touch based approach is used to operate mobile phones, tablet pc's etc., but touch operation leaves finger prints on the operating screen. So gesture recognition is considered to be advantageous over touch based operation. Human hand is the most commonly used body part to show the gesture. Glove is worn on the hand to show the gesture. Each finger in the gloves is given with different colors. So each color can be programmed for controlling different equipment. Color to be filled in the glove depends on the user and all the colors are usable.

II. METHODS AND MATERIAL

In the existing concepts touch sensors are attached with the gloves and those sensors transfer the charge from gloves to computer. Power management is an essential factor to be considered essential factor to keep the sensors awake. Gesture identification with bare hand without glove or with fingers filled with color is also not effective. Applying color each time before showing gesture is a time consuming process.

PROPOSED SYSTEM

POWER SUPPLY UNIT

The input 230V electrical AC power is stepped down to 12V AC by using step down transformer. Bridge Rectifiers are widely used in power supplies that provide necessary DC voltage for the electronic components or devices. Here bridge rectifier is used to convert 12V AC to 12V DC. During conversion noise may get added, hence filter is used to remove the noise. Voltage regulator is used to vary the voltage according to the requirement of the components. 7805 is a voltage regulator IC used to maintain such fluctuations. IC 7805 provides +5 volts regulated power supply with provisions to add heat sink as well. The maximum value for input to the voltage regulator is 35V.
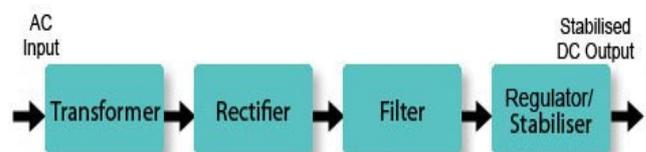
Power Supply Unit

Block Diagram
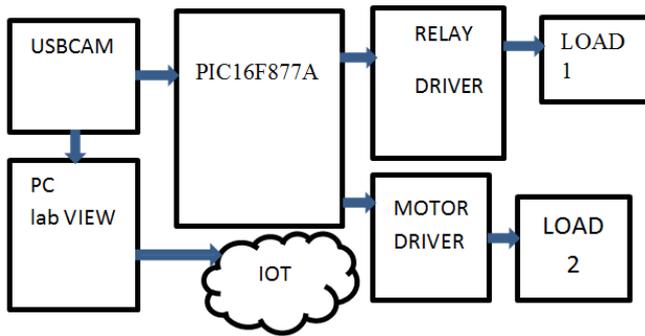
Web Camera

A webcam is a <u>video camera</u> that feeds or <u>streams</u> its image in real time. Once the image or video is captured by the computer, the video stream or image can be saved, viewed or sent on to other networks via systems such as the internet and emailed as an attachment. Web cam acts as a camera sensor here which senses the color which is actually programmed for recognition. <u>Still pictures</u> captured are processed using lab VIEW software tool.

Web Cam

Lab View

Lab VIEW has become the dominant programming language in the world of instrumentation, data acquisition, and control. It is built upon a purely graphical, general-purpose programming language, G, with extensive libraries of functions, an integral compiler and debugger, and an application builder for stand-alone applications. The concept of virtual instruments (VIs), pioneered by Lab VIEW, permits you to transform a real instrument (such as a voltmeter) into another, software-based instrument (such as a chart recorder), thus increasing the versatility of available hardware. All programming is done via a block diagram, consisting of icons and wires that are directly compiled to executable code; there is no underlying procedural language or menu-driven system. Working with research instrumentation, we find Lab VIEW indispensable a flexible, time-saving package without all the frustrating aspects of ordinary programming languages.

Lab VIEW

Microcontroller

PIC (Programmable Interface Controller) is a smallest controller that can be used to carry out huge number of tasks. The name PIC indicates an acronym for **"Programmable Intelligent Computer".** It is easy to interface with other peripherals, hence mostly preferred. PIC16F877A is used here for its inbuilt ADC. Every PIC controller architecture consists of some registers and stack where registers function as Random Access Memory (RAM) and stack saves the return addresses. The main features of PIC microcontrollers are RAM, flash memory, Timers/Counters, EEPROM, I/O Ports, USART, CCP (Capture/Compare/PWM module), SSP, Comparator, ADC (analog to digital converter), PSP (parallel slave port), LCD and ICSP. PIC16F877 has 5 basic input/output ports. They are usually denoted by PORT A (R A), PORT B (RB), PORT C (RC), PORT D (RD), and PORT E (RE). These ports are used for input/ output interfacing. In this controller, PORT A is only 6 bits wide (RA-0 to RA-7). PORT B, PORT C and PORT D is only 8 bits wide (RB-0 to RB-7, RC-0 to RC-7) and RD-0 to RD-7), PORT E has only 3 bit wide (RE-0 to RE-7). The added advantage of this series is of having TRIS register.

PIC16F877A

Glove
A normal hand glove is colored at finger portion and wore on the hand of an equipment operator. User is

independent to choose the color. All the colors are possible to be recognized and possible to be programmed.

Glove

UART

In order to make two devices communicate, whether they are desktop computers or microcontrollers we need a method of communication and an agreed-upon language. The most common form of communication between electronic devices is serial communication which involves sending a series of digital pulses back and forth between devices at a mutually agreed-upon rate. The sender sends pulses representing the data to be sent at the agreed-upon data rate, and the receiver listens for pulses at that same rate. This is what's known as asynchronous serial communication.

Uart

Here the data rate is 9600 bits per second. If the voltage is high (+5V) then PIC will interpret that bit of data as a 1 and if it is low (0V) it will interpret that bit of data as a 0. In telecommunications, RS-232 is a standard for serial binary data signals connecting between a DTE (Data Terminal Equipment) and a DCE (Data Circuit terminating Equipment).

Relay Driver

A relay is an electro-magnetic switch which is useful if a low voltage circuit to switch on and off a light bulb or other equipment connected to the 220v main supply. The current needed to operate the relay coil is more than the actual current supplied by most chips so a transistor is usually needed. A Darlington pair is two transistors that act as a single transistor but with a much higher current gain. It is also called Darlington pair which is a compound structure consisting of two bipolar transistors connected in such a way that the current amplified by the first transistor is amplified further by the second one. In this application the amount of input current available to switch on a transistor is very low. So Darlington pair is used here.

Relay
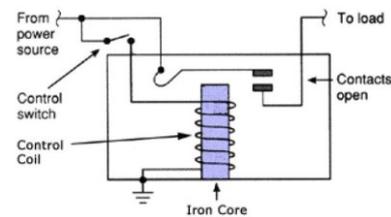
Working

Initially the gesture is captured by webcam and the image is processed in lab VIEW. If the programmed color is identified then the corresponding action to be performed is commanded to PIC16F877A through UART. The required power supply to the microcontroller is supplied by bridge rectifier. The voltage fluctuations are reduced by IC 7805 which provides +5 volts to the microcontroller. Based on the input color corresponding loads either on or off. The loads are driven by motor driver and relay driver

Experimental Setup
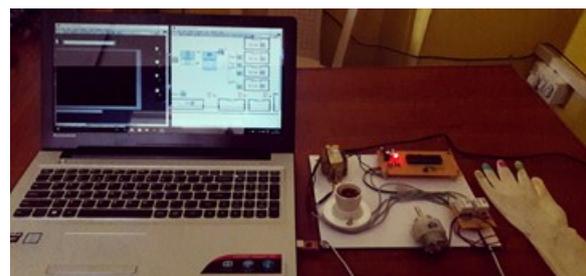
III. RESULTS AND DISCUSSION

Controlling of the load is performed by microcontroller based on the command from lab VIEW. The operation of the load is updated using IOT (Internet Of Things) to the user. Thus controlling of machines without physical touch is achieved in this proposed system.

IV. CONCLUSION

Implementation of automation in household appliances and industrial equipment is possibly easy using this proposed idea. This will be really helpful in the place where man power is to be reduced and very much helpful for physically challenged people. There is no need for extra training for the operator who operates equipment.

V. REFERENCES

[1]. An Intelligent Hand Gesture Extraction and Recognition System for Home Care Application: Wen-Pinn Fang, 2012 Sixth International Conference on Genetic and Evolutionary Computing ,Year: 2012 Pages: 457 - 459, DOI: 10.1109/ICGEC.2012.57

[2]. Three-dimensional gesture interactive system design of home automation for physically handicapped people : Yu-Cheng Fan; Hung-Kuan Liu ,2015 IEEE International Symposium on Medical Measurements and Applications (MeMeA) Proceedings, Year: 2015 ,Pages: 432 - 435, DOI: 10.1109/MeMeA.2015.7145242

[3]. Glove-Based Hand Gesture Recognition Sign Language Translator using Capacitive Touch Sensor: Kalpattu S.Abishek, Lee Chun Fai Qubeley, Derek Ho, 2016 IEEE International Conference on Electron Devices and Solid-State Circuits (EDSSC)

[4]. Hand Gesture Recognition Systems: A Survey: Arpita Ray Sarkar, G. Sanyal, S. Majumder, International Journal of Computer Applications (0975 – 8887) Volume 71– No.15, May 2013

VI. ACKNOWLEDGEMENT

VII. AUTHORS

S. Saranya
Final year, Department of Electronics and Communication Engineering.

R.Suganya
Final year, Department of Electronics and Communication Engineering.

Venisha John
Final year, Department of Electronics and Communication Engineering.

D. Suganya
Final year, Department of Electronics and Communication Engineering.