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An Efficient Finger Gesture Recognition System Using Image

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ABSTRACT: Robots will usually interact with the people directly, and hence it is very important to find an easier way for user interface. Only few robotic systems are user interfaces that possess the ability of controlling the robot by natural means, while issues such as manipulation and navigation in the environment have been focused primarily by earlier works. To promote a beneficial solution to this requirement, a system has been implemented through which the user can give commands to a wireless robot using gestures. With the help of this method, the robot can be navigated by the user by gestures using fingers, and thereby providing a way for interaction with the robotic system. By using image processing, command signals are generated from those gestures. Those command signals are then passed to the robot to navigate it in the specified direction.

KEYWORDS: Arduino Board and Tool, MATLAB Tool, Wireless Module.

I. INTRODUCTION

Hand gesture recognition creates an interaction between computer and humans. This work represents the interaction among computer and robot which serial communication. Hand gestures are performed in front of a simple web camera which is mounted on the personal computer. The user will perform the gesture with bare hand. Dynamic hand motions are recognized with the help of some image processing algorithms such as RGB to gray code, algorithm and the command is given to the microcontroller. As soon as the microcontroller receives a command, it sends it to the motor which ultimately performs movements of the robot.

II. SYSTEM DESIGN AND FUNCTIONING

In this project, interaction between humans and the robot is provided through hand gestures. The general block diagram of gesture controlled robot is shown in Fig.1. Initially, the web camera records the gestures made by the users, and with the help of MATLAB tool the required direction to be made is sent to the robot via wireless transceiver module. Once the arduino board which is mounted in the robot receives the serial signal from the transmitter, the robotic vehicle moves in the appropriate direction with respect to the users gestures and condition. The robot moves according to the numerical points of the fingers shown.

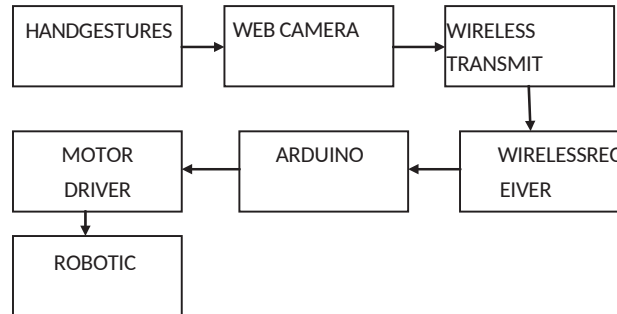


Fig.1:BlockDiagram of Gesture ControlledRobot

SYSTEMCOMPONENTS

- **HardwareComponents**
 - Robotmodule
 - ArduinoBoard
 - WebCamera
- **SoftwareComponents**
 - ArduinoTool
 - MATLABTool

A. ARDUINO MICROCONTROLLER

The Arduino Uno is a microcontroller which based on ATmega328 as shown in Fig.2. It has 14 digital input and output pins, with 16 MHz crystal oscillator, USB connection, 6 analog inputs, power jack and reset button. .Arduino is connected to the PC using an USB port which acts like serial connection.



Fig.2:ArduinoBoard

SPECIFICATIONS: TABLE1: SPECIFICATIONS OF ARDUINO

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage	7-9V
DigitalI/OPins	14

AnalogInput Pins	6
DCcurrentperI/OPin	40Ma
FlashMemory	32KB
ClockSpeed	16HZ

B. L239D

L293D is a motor driver with monolithic and integrated driver circuit as shown in Fig.3. It drives the DC motor on either direction. Two DC motors can be controlled by a single L293D IC.

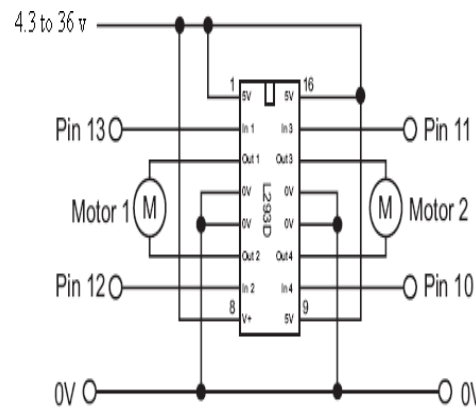


Fig.3: Circuit Diagram of Motor Driver L293D.

A single L293D IC has two h-Bridge circuits which rotates independently with two DC motors. It is mostly used in robotic applications for controlling DC motors.L293D pin diagram is given in Fig.4. It consists of 4 input pins, 2 and 7 on the left and pins 15 and 10 on the right. Pins located at the left controls the rotation of motor located along the left side and the pins located at the right controls the rotation of motor located at the right side. These motors are rotate on the basis of the inputs as logic 1 or logic 0.

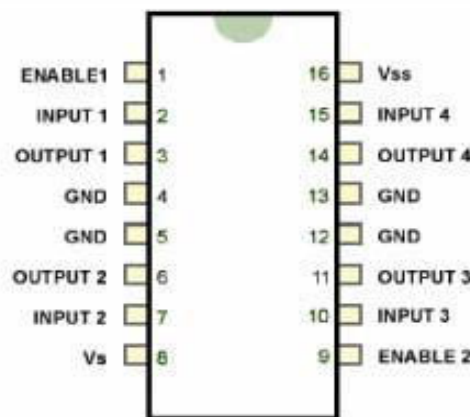


Fig.4:Pin Diagram of L293DIC



C. MATLAB

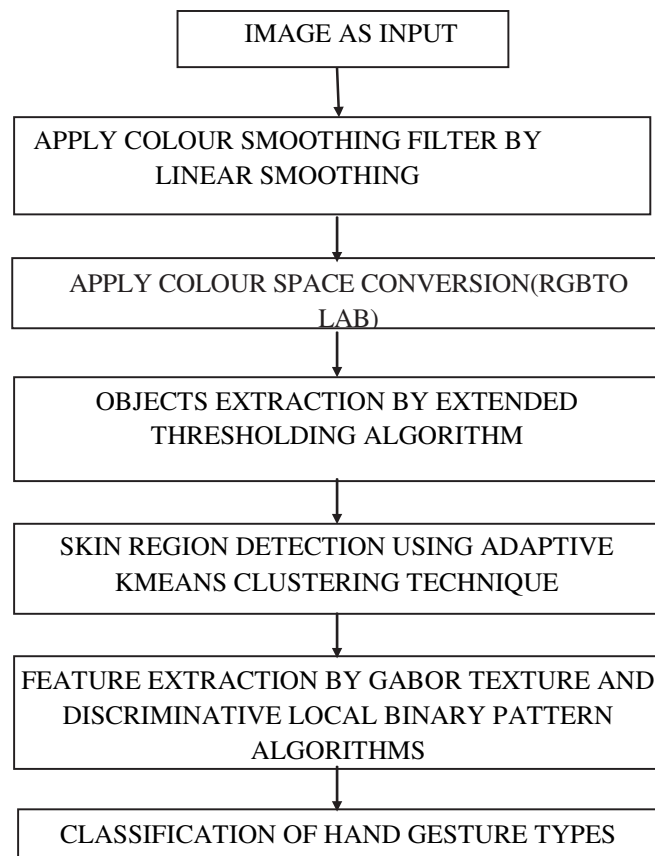
MATLAB is used to integrate computation, visualization and the programming environment. It allows matrix manipulations, implementation of algorithms creating interface between machines and humans. Also it can interface with several programs which are written in other languages including C, C++, Java, FORTRAN, analyzing of data, developing algorithms and create models and applications.

Use of MATLAB Widely used as a mathematical tool is MATLAB that allows matrix manipulation in engineering and science encompassing the fields of chemistry, physics and all streams of engineering. It is mainly used in the applications including

- Computational Finance
- Computational Biology
- Control Systems Image and Video Processing
- Signal Processing and Communications

III. IMAGE PROCESSING IN MATLAB

Computer algorithms are used in Digital Image Processing for processing, displaying and communicating images in digital. The quality of digital image convert signals from image sensor using Digital Image processing to enhance the clarity and removal of noise. Further, several apps and algorithms are introduced for processing, analysis, visualization of digital image in Image Processing Toolbox in MATLAB.



By convolution with a moving window digital image can be worked on linear filters. Kernel is referred as moving window. The center of the kernel is always located at the input pixel. The support of the filter is also called as the kernel has some non-zero part. On every different input pixel the linear filters can operate.

IV. FILTER GABOR EXTRACTION

Generally, the filters are applied on the small segment of image instead of applying in the entire image. The global information is the combination image information of local information which represents the entire image. This technique is used to implement the division of original image into four equal parts and different banks of Gabor filters are applied on the sub images. In feature vector is used for collecting and extracting each sub-.

K-MEANS CLUSTER:

KNN is the iterative algorithm which produces a final result and it uses K-means clustering algorithm. The inputs are number of clusters as (K) and data set are given to the algorithm. This data set are referred as feature collections for each input data point. Thus the K centroids are generated randomly for initial estimation. Finally, the algorithm iterates into two steps:

1. STEP FOR DATA ASSIGNMENT

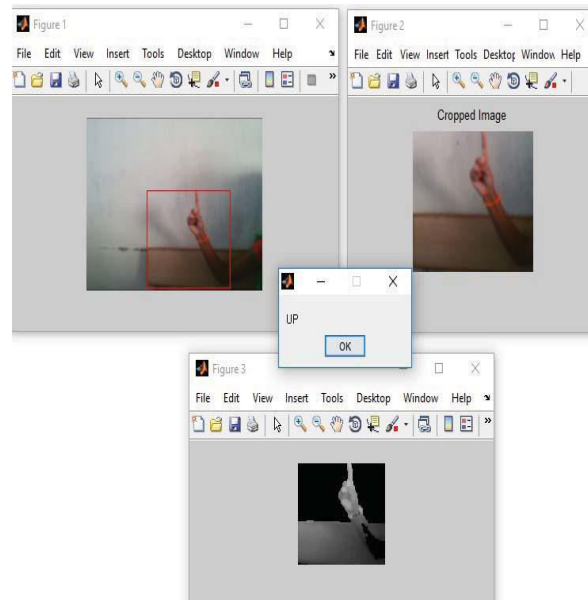
One of the clusters defines each centroid. To the nearest centroid all data points are assigned based on Euclidean squared distance. Each data points are assigned to the cluster with standard Euclidean distance. For each cluster centroid the set of data point assignments are used.

2. CENTROID UPDATE STEP:

In this step the centroids are reconfigured and it done by calculating the mean of all centroids cluster and data points.

BLUETOOTH MODULE HC05

HC-05 is a wireless technology that is very helpful for data transfer over a short range of distances. The approximate distance range is around 10 meters. It is a Master/slave device. It acts as either Master or Slave.



APPLICATIONS

- Industrial Application
- Medical Application
- Defence Sector
- Human prohibited areas lie nuclear plants

V. CONCLUSIONS

The development of image processing system was described in this paper. The moving mechanism is capable for identifying the gesture human. Preliminary approach to perform any type of image processing task in MATLAB was presented in this paper it with serial port to the microcontroller355 was interfaced. Used for controlling the robot motion the Arduino Uno has been used. The use of Bluetooth module HC05 helps in wireless transmission, through which the robot could be handled from larger distance.

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