Gesture Controlled Bot

Mega Session 2.0

INTRODUCTION

A Gesture Controlled robot is a robot which can be controlled by your hand gestures. You just need to have a small transmitting device in your hand, which included an acceleration meter to transmit an appropriate command to the robot so that it can do whatever we want.

Using OpenCV - OpenCV (Open Source Computer Vision Library) is a library of programming functions mainly aimed at real-time computer vision, developed by Intel. The library is platform independent. It focuses mainly on real time image processing and computer vision. OpenCV is written in C and its primary interface is C with wrapper classes for use in C++. Also there are full interfaces available for Python, Java, MATLAB and Octave. It is used for recognition of gesture commands given by the user for the robot.

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

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. These operations are necessary for implementing both the techniques of Gesture Control, following two main processes are done to detect hand palm.

Thresholded Image:

Image frame taken as input from webcam is thresholded starting from minimum thresh value till single contour is formed in an image, same is in the case of intensity based thresholding

After obtaining thresholded image two main things are done, drawing the Contour on the thresholded part and fitting this contour in the Convex Hull. Contour is drawn in the thresholded image by using function drawContour() in the library OpenCV. This is done on the intermediate image, this image is then passed for drawing the convex hull. This covers the whole contour by joining the minimal points to form Convex Hull. These two basic operations are performed on every image frame taken from the webcam, and then depending on the kind of gesture technique chosen by the user, further processing on the images is done. These two techniques are Finger Count based gesture control and Direction of Hand Palm Gesture Control.

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.
These two methods of giving gesture commands are as follows.
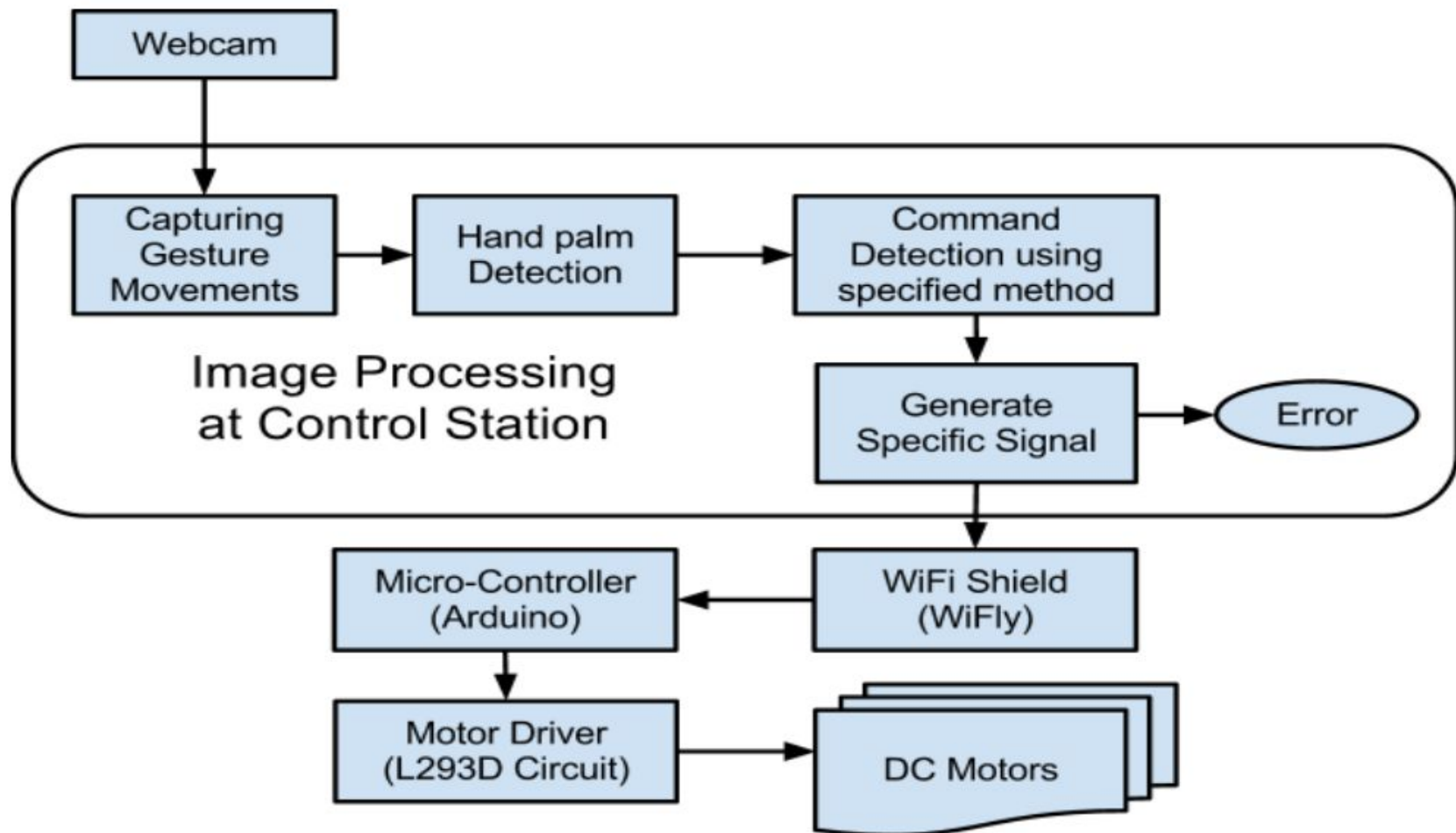
1) Finger Count based Gesture Control:
In this technique of giving gesture commands, first defects in the convex hull are found out using function convexityDefects(). Convex hull is formed using minimal set of points, so it does follow the contour path always, this causes the formation of defects in the convex hull. convexityDefects() function gives information about these defects stored in the form of vector.

2) Direction of Hand Palm:
Thus an orientation of hand palm gives direction in which robot is to be moved. This command can be given with minimum two fingers or with the whole palm. For deciding orientation of the palm two things are used, depth point and end points of the line of defect. These parameters have been found out by initial processing of the gesture command recognition.

Flow Chart of What Happens:
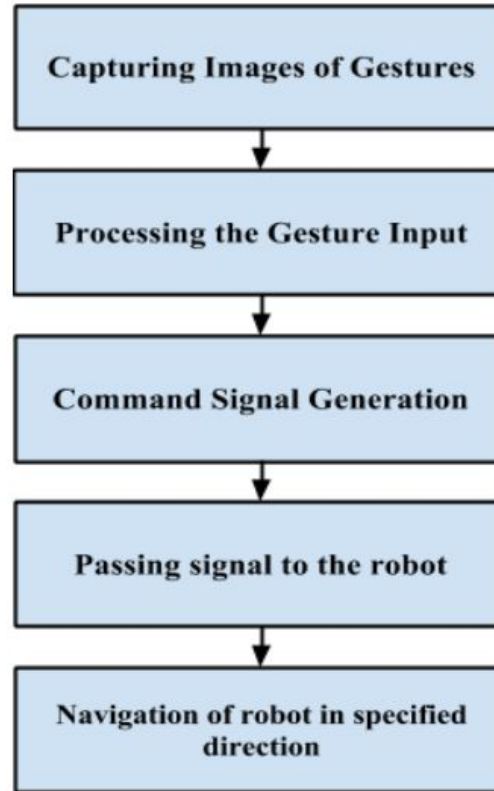
Finger Counting & Contour Making:
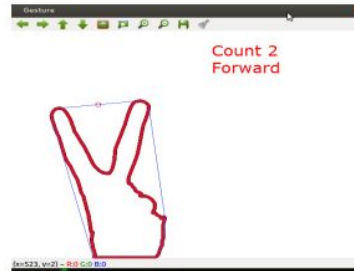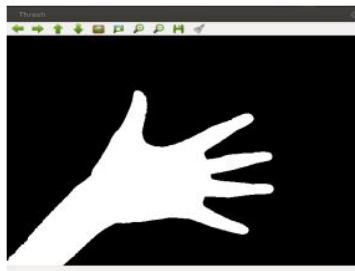

Fig. 7. Input Image Frame

Fig. 10. Finger Count based Gesture Control I

Conclusion:

Gesture control being a more natural way of controlling devices makes control of robots more efficient and easy. We have provided two techniques for giving gesture input, finger count based gesture control and direction of hand palm based gesture control.

Now lets see how the Code Works!!!

Communication

- The data that we obtained from live camera feed is in the Python code.
- How do we tell the board about it?

Communication Methods

- Bluetooth
- Over the World Wide Web
  - Socket Server built in Python
  - Webserver on ESP32
  - Cloud - Adafruit IO

Communication Methods

- Adafruit IO - UI and operation.