

Gesture Controlled Robot

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Abstract— Gesture, which literally is described as ‘a movement of your body (especially of your hands and arms) that shows or emphasizes an idea or a feeling’. By this project what we intend to do is, to create an interface between the human body and the computer via some mathematical algorithms, and hence control a Robot with the same. In this paper, we use real time video feed, to get a gesture input and further process the image (acquired from the video) using MATLAB, using Skin detection algorithms, the output of which is then processed by the Robot, to undergo its necessary movements.

Keywords— Gesture, Robot, Skin Detection, YUV Colour space, MATLAB, Arduino, Gesture Control, Serial Connection

I. INTRODUCTION

The Robot development today is being continuously inspired, for cost-effective and efficient control. Robots have always been a major helping hand to humans in major industries. The Robots used here are controlled by humans, and that requires extra peripherals to do the same. The proposed method uses gesture control to operate these robots which helps to eliminate the use of peripheral devices, thus making it cost effective. It helps the control to be more natural and interactive with the robotic system. Also, for the gesture, only a simple webcam would be used without any special devices being worn by the operator. This would be done by skin detection when a certain hand gesture is shown to the webcam. This mainly involves Image Processing. The gesture input is then identified and fed as an input to the designated Robot, which then performs the functions that a certain gesture would want it to do.

II. GESTURE RECOGNITION

Gestures are simply a form of expression that is attributed with bodily movements, of the hands, head, face, arms or eyes.

These expressions are then used to convey the necessary information.

Hummels and Stappers define four aspects of a gesture:

- Spatial information – the location of the gesture.
- Pathic information – the path of the gesture.
- Symbolic information – the sign of the gesture.
- Affective information – the emotion the gesture puts in.

In the gesture recognition, the gesture that is to be used is to be made known to the system, so it can detect and process the gesture. This gesture after being processed conveys the necessary information to the robot, which in turn does the necessary operation assigned with the gesture.

III. MODEL

A. Module 1: Image Processing

The input of the gesture recognition is hand gesture image that is taken by a webcam or camera, through a live video feed.

1. Initially, Skin is detected from the image using image filtering in the color space of YUV and the largest blob (connected component [Let it be called ‘base_img’ here]) is recognized and retained.
2. This ‘base_img’ is cleared using Morphological Operations (dilation), after which we assume to get the palm.
3. Now, considering the ‘base_img’, we find the nearest point from the centroid of this blob, which is assumed as the palm radius.
4. With a disc element of this radius, the image is eroded, and the new image formed is subtracted from the original image (base_img).
5. The fingers of hand then remain in the image, with each finger being a distinct connected component. Now considering the number of connected components we know the number of fingers being shown.
6. Our task now is to detect the gestures. The algorithm we apply here is recognizing the distance

of the centroids, between the connected components.

- The FORWARD command is initiated when the processed image recognizes one connected component, i.e., a single finger.
- The BACKWARD command is initiated when the processed image recognizes two connected components, and the distance between the two centroids is less than 130 pixels.
- The RIGHT command is initiated when the processed image recognizes two connected components, and the distance between the two centroids is between 130 pixels and 250 pixels.
- The LEFT command is initiated when the processed image recognizes two connected components, and the distance between the two centroids is greater than 250 pixels.
- The STOP command is initiated when four connected components are detected (i.e. 4 fingers are shown).

B. Module 2: Robot

The output obtained after the gesture recognition is forwarded to the robot through a serial connection. The input is received by the Arduino microcontroller which is programmed according to the gestures assigned for a specific movement. The robot then takes the necessary direction of movement.

The hardware used for the robot:

1. Micro-controller: Arduino UNO

When Arduino gets the input from the USB Serial connection, it then compares the input with the pre assigned directions which are programmed using embedded c. It then forwards the command to the L239D motor driver which then enables the robot's

wheel movement. It has five methods for movement which includes forward, backward, left, right and stop.

2. Motor Driver: L239D module

In order to power the motors, we use a motor driver which works like a current amplifier. It has a total of 16 pins with four input and output pins (two on either side of the IC) capable of controlling two either two DC motors simultaneously or one stepper motor in both directions.

3. Motors: 150 RPM Rectangle Single Shaft Plastic Gear BO Motor

The logic of the robot wheel movement includes:

Forward

Right Wheel: Clock Wise
Left Wheel: Anti Clock Wise

Backward

Right Wheel: Anti Clock Wise
Left Wheel: Clock Wise

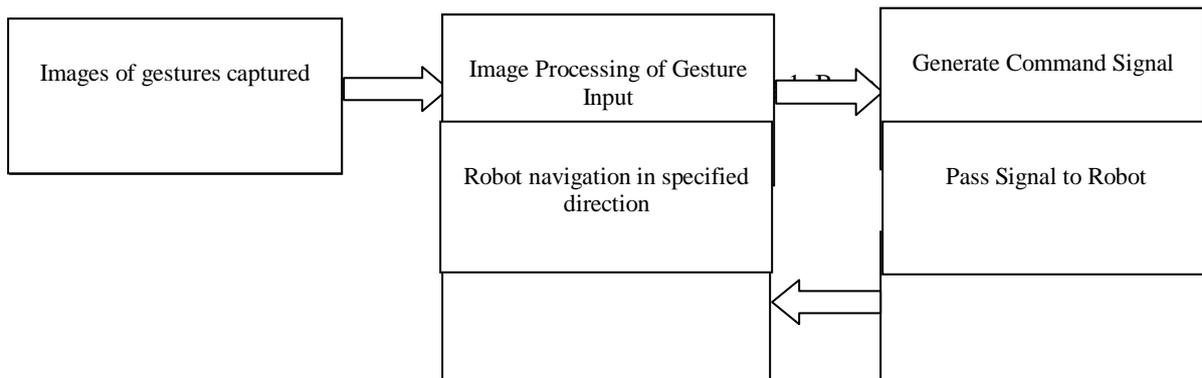
Right

Right Wheel: Clock Wise
Left Wheel: Clock Wise

Left

Right Wheel: Anti Clock Wise
Left Wheel: Anti Clock Wise

IV. BASIC CONTROL FLOW DIAGRAM AND FLOW CHART



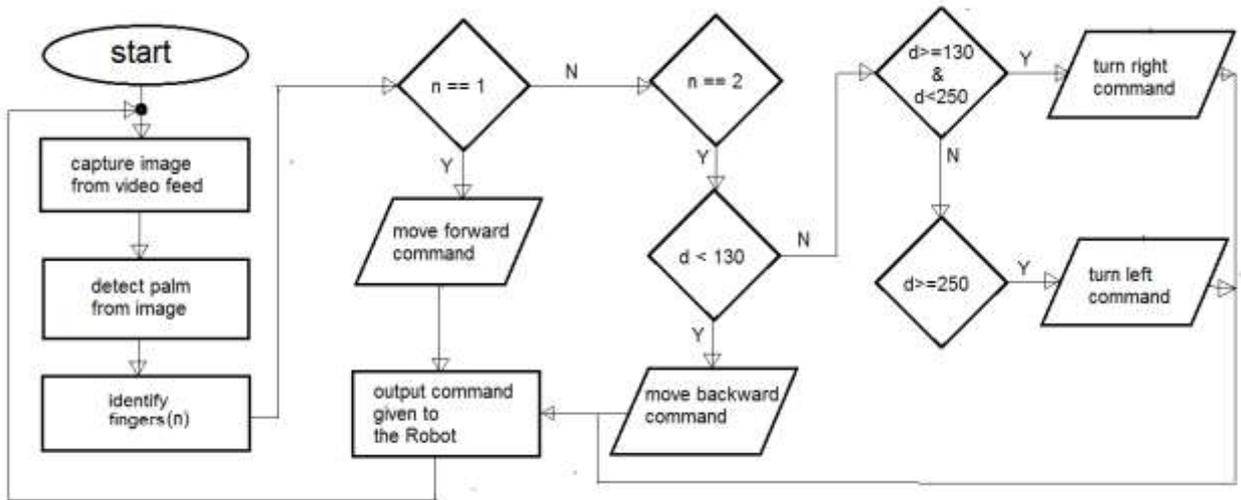


Fig 1: Flow Chart

V. CONCLUSION

The Gesture Control was successfully implemented on the Robot, with it taking the appropriate direction movements that were assigned to it.

An ordinary webcam was used in the process, which served to reduce the cost of any kind of other peripherals, which are generally costly.

Also, no databases were used, which removed the need to maintain one, thus, gesture recognition control using skin detection under a live video feed could be implemented.

VI. ACKNOWLEDGMENTS

Our thanks to guide, Mr. Saurav Paul for his continuous support and also to the department which gave us the opportunity to conduct this research.

REFERENCES

- [1] TarachandSaini, SavitaSivani "Real Time Vision Hand Gesture Recognition Based MediaControl via LAN &Wireless Hardware Control" Dept. of Software Engineering, Suresh GyanVihar University Jagatpuramahal, jagatpura, Jaipur(raj.), India, Vol. 3, Issue. 5, Sep - October 2013
- [2] Harish Kumar Kaura, Vipul Honrao, Sayali Patil, Pravish Shetty, Gesture Controlled Robot using Image Processing, Department of Computer Engineering Fr. C. Rodrigues Institute of Technology, Vashi Navi Mumbai, India, Volume 2, No. 5, 2013
- [3] Raquib Buksh, Soumyajit Routh, Parthib Mitra, Subhajit Banik, Abhishek Mallik, Sauvik Das Gupta. Implementation of MATLAB based object detection technique on Arduino Board and iRobot CREATE 4 Department of Electrical and Electronics Engineering, WBUT, Kolkata, WB, India. School of Electrical and Computer Engineering, Oklahoma State University, Stillwater, OK, USA Volume 4, Issue 1, January 2014
- [4] Arduino: <http://www.arduino.cc/en/Guide/HomePage>
- [5] Ravipati, D., Karreddi, P. and Patlola, A., 2014, March. Real-time gesture recognition and robot control through blob tracking. In Electrical, Electronics and Computer Science (SCEECS), 2014 IEEE Students' Conference on (pp. 1-5). IEEE.