GESTURE CONTROLLED ROBOT /USING IMAGE PROCESSING AND RASPBERRY PI

B.VISWANATH*, ** Mr. J.S. Ananda Kumar

*P.G. Scholar (M.C.A), Siddharth Institute of Engineering and Technology, Puttur-517583.
**Assistant Professor, Siddharth Institute of Engineering and Technology, Puttur-517583.

Abstract— In this paper, we designed an efficient hand gestured wheelchair using Raspberry pi and image processing. This Novel system completely depends on the Python OpenCV software and Arm11 controller. By using USB Web Camera and DC motor we control the movement of the wheelchair. This Proposed system not only captures hand movement, but also control the wheelchair depending on the hand movement i.e. wheelchair will move according to the number of fingers. By recognizing the number of fingers wheelchair will move in all four directions. Here we used different image processing techniques like conversion of RGB to grayscale, Thresholding, contour detection and Finding convex hull and convexity defects in order to increase the efficiency of detection of hand gesture. This proposed system completely based on vision based methodology and useful for physically handicapped people.

Keywords--Raspberry pi 2 Board; Dc motor; web camera (Intex IT306EC); image processing; LED Indicator; Dc motor driver; OPEN CV software;

1. INTRODUCTION

The main objective of this project is to design an effective gesture controlled wheelchair using image processing on credit card sized computer Raspberry pi microcontroller. Previously the Way of Human and Machine Interaction is Gesture Reorganization using accelerometer sensor, But the main disadvantage of this system is low efficiency. Recently there have been so many advances in image processing and Microcontroller technology. Raspberry Pi is the credit card sized microcontroller capable to perform on chip image processing techniques. Gesture communication is the common medium in order to communicate easily with others.[1] Hand movement indicates different jobs effectively and others understand properly for e.g. By using hand gestures cricket umpire and traffic police do different jobs [1]. In our proposed project we developed an algorithm in OpenCV software using Raspberry Pi 2 that detects the hand movement or finger movement. This algorithm can be used to find hand movements by contour detection and the convex hull of ROI using OpenCV Library. Here by using web camera we capture images and process them using Raspberry Pi. The entire system mounted on wheel chair and it operates wirelessly.

Raspberry Pi has the built in Graphical user Interface module Then it is possible to perform on board image processing techniques. We interface web camera through Raspberry pi USB port and interface DC motors through GPIO port. By using web camera we capture hand movements and according to algorithm the wheel chair move in specific direction i.e. Front, Back, Left, Right. This Algorithm mainly focus on the number of fingers and perform operations according to that. Whenever user shows 2 fingers wheel chair move in forward direction, 3 fingers wheel chair move in backward direction, 4 fingers right and 5 fingers wheel chair move in left direction in all other cases wheel chair is in stop position.

This is completely based on vision based methodology useful for Physically Handicapped persons and also in Military applications.

2. LITERATURE SURVEY

It's possible to capture gestures from any body movement or state but common way is to capture from face or hand. In the proposed system we mainly concentrate on Hand gesture recognition. There are many ways to capture the gesture.

As per author Xie, Xia Sun, Xiang Xia, and Eating Cao in "Similitude Coordinating Based Extensible Hand Signal Acknowledgment", By using closeness matching they detect hand motion.[2] As per the author Shivam shinde, Dr, S.D.Lokhande," Hand motion redesign for substantial cranes", They had utilized the strategy for signal coordinating with utilization of ARM 11 Raspberry pi and Zigbee module [3].

As per the author Jobin Francis, Anoop B K," Hugeness of Hand Signal Acknowledgment System in Vehicular Computerization An Overview",By using wearable hand gloves they capture the hand movement[4]. Diksha Goyal and Dr. S.P.S Saini Presented the "Accelerometer based hand gesture controlled wheelchair "Which describes the work in gesture reorganization use as application as a wheelchair. In this case was conducted is gesture is recognized through 3 axes accelerometer sensor.[5] ChengLi,KrisM.Kitani presented by "Pixel-Level Hand Detection in Ego-Centric

Videos "in this system other describes that hand gesture recognized by pixel-level using image processing.[6].

3. NEED

At present wheel chairs will operate manually or by using accelerometer sensor. But the main disadvantage of accelerometer sensor is it produces an analog signal. In order to overcome that we want an effective algorithm that produce reliable results based on hand gesture.

4. Implementation

After we go through the literature survey we understand that there were so many ways to recognize the hand gesture but the proposed system is mobile and effective technique to recognize the hand gesture through web camera and Raspberry pi Microcontroller.
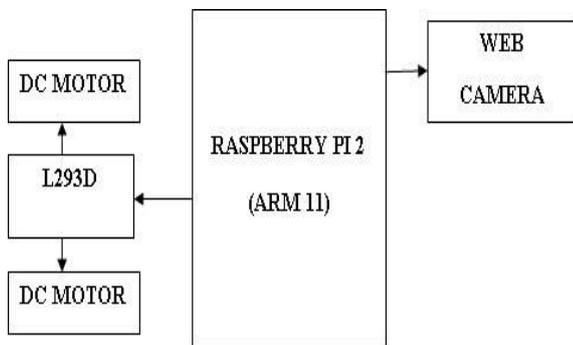
A. Block Diagram and Description:

Fig 1. Block diagram of Robot section

B. Description:

Block diagram consists of Raspberry pi, Web camera, L293D and two DC motors. Web camera interfaced with Raspberry Pi through USB port and used to capture images. The captured images will be processed through python OpenCV library. Interface DC motors to Raspberry Pi through a Motor Driver L293D. DC motors will move in Forward, Backward, Left and Right according to number of fingers web camera captures.

- *Introduction of Raspberry Pi 2*

Raspberry Pi is a credit card sized pocket personal computer with Linux operating system manufactured and designed by the Raspberry Pi foundation with an objective of encourage school students and every other person interested in computer hardware to learn basic computer science programming and DIY-Do-it Yourself projects.
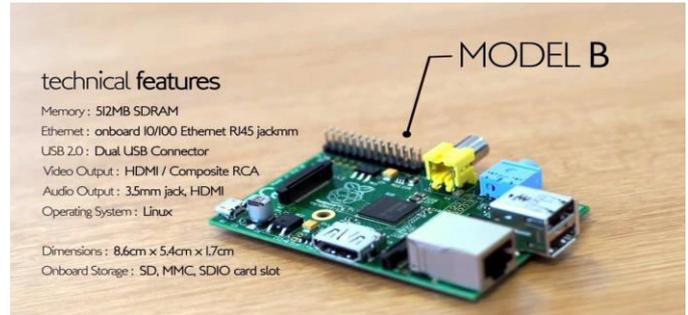
In this proposed system we have used Raspberry Pi as the controller of image processing. Rpi is the small, inexpensive minicomputer. It continuously captures the images from web camera and process them using pre installed OpenCV software. Based on image captured it operate the wheelchair.

- **GPIO and motors**

Two 12V DC motors (figure-2) interfaced with the L298 Driver (figure-3) are used to move the robot to desired location. 300RPM 12V DC geared motors for robotics applications. Very easy to use and available in standard size. Nut and threads on shaft to easily connect and internal threaded shaft for easily connecting it to wheel.

The L298 Driver is a high voltage, high current dual full bridge driver designed to accept standard TTL logic levels and drive inductive loads such relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals.

Fig 2. 12V DC motor

Fig 3. L298 Driver

- **OpenCV**

OpenCV (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision, developed by Intel Russia research centre in Nizhny

Novgorod, and now supported by Willow Garage and Itzel. It is free for use under the open source BSD license. The library is cross-platform. It focuses mainly on real-time image processing. If the library finds Intel's Integrated Performance Primitives on the system, it will use these proprietary optimized routines to accelerate itself.

OpenCV is written in C++ and its primary interface is in C++, but it still retains a less comprehensive though extensive older C interface. There are now full interfaces in Python, Java and MATLAB/OCTAVE (as of version 2.5). The API for these interfaces can be found in the online documentation. Wrappers in other languages such as C#, Ch, Ruby have been developed to encourage adoption by a wider audience.

- **Intex Web Camera**

Intex webcam night vision 601k is a high resolution USB 2.0 interface camera. It,s image resolution is 3280 x 2460 and we can vary it to change resolution according to our requirement. It has some more special features like high quality CMOS sensor to capture images at night time, motion detection and video recording function. Here in our project we used it to capture hand movements.

Fig 4. Intex Webcam

C. Gesture Identification Process :

Heart of the system is to detect the gesture through image processing. We have to introduce the new gesture reorganisation system using open CV software to detect the convexity of hand.

This following flowchart shows the new technique for Finger Identification. Steps for the Finger reorganisation as given below

1] Configure the open CV with python in windows
2] Capturing the frames and displaying
3] Extract the ROI (Region of interest) from input frames or background subtraction
4] Find out the contour draw the convex hull
5] Find the convexity defects depending upon the number of defects and find out the gesture

The Gesture is recognize by this way, firstly creating the camera object taking the images from web camera it is in from of videos because the frame rate of camera is 30 frames/s its look like video. Open these video files for reading read those frames and displaying the frame then we have convert the

input RGB images into the Gray scale images here input is in the RGB from and output is in the Gray from. Remove the blurring to reduce the high frequency noise to make our contour detection process more accurate image using Gaussian filter then applied the binary thresholding (i.e. only black and white) for the extracting ROI or background subtraction. Find the counter and draw the convex hull to set the points for the contour and find smallest area convex hull that covers the contours.
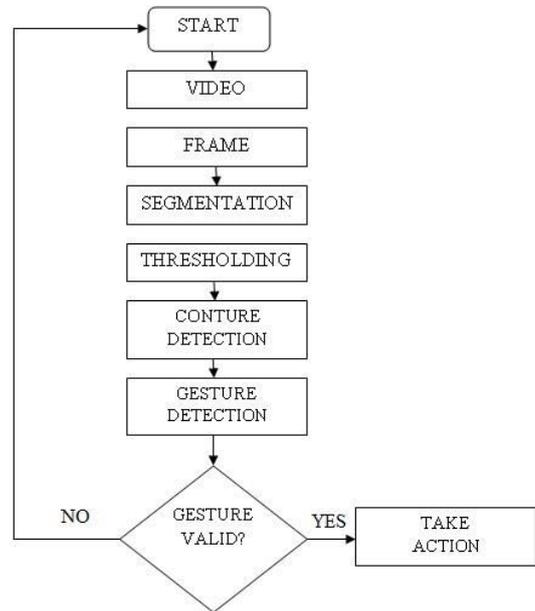

Fig 5. Flow chart of OpenCV Algorithm

5. METHODOLOGY

This system is real time system. Gesture or finger is detect the wheelchair will move quickly we have to use the open cv software is same as that of Matlab this software is open source and its operating system is Linux open cv is image processing library function. Communication between open CV and raspberry pi board is serial. Data is serially send through open CV to raspberry pi board and wheelchair move according to the input is given.

Initialize the GPIO pins which is programmed in the raspberry pi board and taking the input to the web camera read these fingers coming from the camera and identifies this finger and perform the work as input. Wheelchair will move according to the detecting the number of fingers.

6. RESULTS AND DISCUSSIONS

The proposed system was fully developed and tested to demonstrate its feasibility and effectiveness. The screenshots of the Gesture controlled robot developed has been presented in Figure below.

Fig 6. Hand Gesture Robot

Fig 7. Hand Gestures for Different Directions

7. CONCLUSION

A New technique is introduce to recognize the gesture through image processing this technique to build to give the best results to implement the physical illness, injury or any disable person through wheelchair this system is easy to handle and easy to operate and more user friendly to reduce the social problems occurs for the disable person using this type of wheelchair patient can easy to interact with the web camera perform the operation as we required. Hence we to conclude that this system provides best features.

REFERENCES

1. DevikaraniPatil, Varalakshmi B.D"Hand Gesture Recognition for MP3 Player using Image Processing Techniques and PIC16F877"*Inernational Journal of Soft Computing and Engineering (IJSCE)*Vol-4Issue-4, September 2014.

2. Renqiang Xie XiaSun, Xiang Xia, and Juncheng Cao"Similarity Matching –Based Extensible Hand Gesture Recognition"IEEESENSORSJOURNAL, VOL.15NO.6JUNE2015.

3. Shivamshinde, , S.D.Lokhande, " Hand gesture recognization for heavy cranes",*ARIJEET*,2015.

4. Jobin Francis, Anoop B K," Significance of Hand Gesture Recognition Systems in Vehicular Automation- A Survey", *International Journal of Computer Applications (0975 – 8887) Volume 99– No.7, August 2014.*

5. Diksha Goyaland Dr. S. P. Saini " Accelerometer based Hand Gesture Controlled Wheelchair" *International Journal on Engineering Technologies 4(2):15-20(2013).*

6. Cheng Li and Kris M.Kitani "Pixel-Level Hand Detection in Ego-Centric Videos"*IEEE Conference on Computer Vision and Pattern Recognition 2013*

7. Rafiqul Zaman Khan and Noor Adnan Ibrahim "Hand Gesture Recognisation: A Literature Review *International Journal of Artificial Intelligence Application (IJAIA), Vol.3, No.4, July 2012.*

8. SmithaPaulose, M.P.Fathima, Anooda GeethuMohan, M.S.Sajana, K.A.Anupama" Automatic wheelchair using Gesture Recognition

9. Feng-shengChen, Chin-Ming Fu, Chung–Lin Huang" Hand Gesture Reorganization using a real time tracking and Hidden Markov Models" *Image and Vision Computing 21 (2003) 745–758.*

10. Nariman habili, cheng chew lim, alireza molini "segmentation of the face and hand in sign language video sequence using color and motion cues"IEEE vol.14 issue.8 aug 2004

11. Xing- han wu muchun su pa chun wang "a hand gesture based control interface for a car robot" IEEE Oct 2010

Along with Room Automation"Transaction on Engineering and Science Vol.2,Issue5,May2014

About authors:

[1]**Mr. B. VISWANATH** currently pursuing MCA In Siddharth institute of engineering & technology, Puttur, Andrapradesh,India.

[2]**Mr. J.S. Ananda Kumar,**Assistant Professor in Dept. Of MCA, Siddharth Institue of Engineering & Technology,puttur, Andrapradesh,India