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ANALYSIS ON SOFTWARE IMPLEMENTATION OF METHODOLOGY FOR PYTHON-BASED RASPBERRY Pi

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ABSTRACT
It must be easier for humans than computers to communicate. A mechanism was therefore developed that works via gesture signal processing. To understand gesture commands, the prototype uses the object algorithm for tracking. The main function of the hand gesture recognition system is to interact between human and computer systems for control purposes. Recognized movements monitor in real time the movement of a mobile robot. The mobile robot is designed and tested to demonstrate its performance. The elimination of this obstacle can be rendered by computer viewing and machine learning techniques by constructing a working model that automatically detects the gesture done. In this paper, the Raspberry Pi with camera module will be used as a real-time implementation for digital recognition.Python programming language provided in the OpenCV library is programmed with Raspberry Pi. The device template matching uses digital recognition methods for Linear Discriminant Analysis / Logistic Regression (LDA-LR), Principally Component Analysis Logistic Regression (PCA-LR), K-Nearest Neighbors (K-NN) and Support Vector Machines (SVM).

1. INTRODUCTION

Vision-based and image processing systems have separate pattern recognition applications and robotic navigation applications. It is an input image processing that generates output that requires image-related functions or parameters[1]. It is significant and covers a variety of applications worldwide with its application in robotics, monitoring, tracking and protection systems. Object tracking is the primary computer vision operation and the underlying concept is the retrieval of its properties. It is commonly used to manage traffic, human machine communicate, recognise movements, increase reality and track [2]. The best performance of higher image tasks is obtained by an effective tracking algorithm. A surveillance device has been used in securing territories or particular areas to assist individuals in the universe[3]. It has contributed to a device with the ability to track a known entity and to track it.Raspberry pi is a small PC board[4] that is ideal for projects in real time. The main aim of the work in this paper is to ensure that a device can detect and track certain functions for artefacts that are defined using a Raspberry Pi and camera module in accordance with an image processing algorithm. The Python programmed extraction algorithm supported by OpenCV libraries and runs on the external camera, with the Raspberry Pi.

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Even in bad lighting conditions, this device works well. Hand gesture algorithm embedded in the Raspberry Pi is used to control a moving robot that is designed to build a robotic system based on vision that relies upon the interaction of human machines.

Management recognition is the mechanism by which a stream of continuous sequence gesture from a given collection of inputdata is recognised and interpreted.Gestures are non-verbal information that helps computers understand the language of humans and create an easy-to-use human computer interface. Human movements are visually interpreted and the purpose of this paper is to use computer vision to examine and interpret various sets of movements with human fingers to control the device. Most recognition systems are PC based but their weight, size and power consumption restrict the portability of a PC. By using an integrated system that is low cost, efficient, to avoid disadvantages in a computer. The solution is straightforward and cost-effective, since less hardware is needed and no sensors are necessary. The device is programmed to interpret a variety of movements as instructions for mouse control. FingerMouse is a free interface used as an alternative to the mouse.A viewing machine watches the hand continuously and watches the colour markings on each finger and moves the display cursor with various movements.

Various techniques are developed for static and dynamic sign language recognition. The techniques are designed on the basis various features of the hand. Contour, convex hull, centroid, moments, hand shape, skin color, hand motion and palm image extraction [1]are the various features of the hand. These extracted features are classified using various classifiers such as SVM, K-NN, NN, ANN and PCA-LR. Skin color is a convenient feature because it is human skin color[2] which encountered first while detecting the hand gesture. Also, color is selected as a feature because of its computational simplicity. YCbCr and HSV are the best skin color model for finding the hand region from the image. But, the variability of skin color under different lighting conditions may lead to failures in detecting skin color. Sometimes light skin color is harder to detect in bright lighting condition while dark skin color might be similar to their background in dim lighting condition. So, for further work, we use additional features such as contour and convex hull. From that, we extract the features like centroid, fingertip and Euclidean distance. Then PCA-LR, LDA-LR, K-NNand SVM are used for classification purpose.

The effort to conduct everyday activities including starting entertainment equipment and room lighting can be rendered by hand movements for elderly individuals who remain in a self-sufficient living[2]. This type of device is known as a home automation system, a technology which can automate all tools in the house. The automation system often includes any instrument relating to everyday life, including domestic security device

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automation[3][4]. They also conducted a hand gesture identification based on similar studies such as [3][5][7][8]. Studies do not use this as an implementation or as a device prototype for the domestic automation system. The study related to control the connected home system by hand movements can still be thoroughly explored.That's why this study would create a prototype for home automation that controls home devices and the senior consumer simply uses the hand gesture to control it. The Quick algorithm is selected as a function extractor as it is capable of detecting a function and also of implementing in real time[6].

2. LITERATURE REVIEW

The Raspberry Pi for control of the Robot Arm is embraced by Ron OommenThomas[5]. It also writes forward and backward movement using the Python language. Tohari Ahmad et al[3] proposed a relatively inexpensive surveillance device, which can detect an object and measure its distance between its coordinate and its image. This data is sent to the user via e-mail. Alaa [6] has suggested a way of planing the path of a robot from start to finish, while avoiding barriers on robot paths using the APF algorithm. The Dharmateja[7] has shown that an attempt is being made to create a low-cost stand-alone Pi-Pad that can be used to teach the Raspberry Pi as its brain for connecting peripherals with Bluetooth and interacting with local devices, such as Wi-Fi, keys and mous.

The algorithm of Jalab [8] recognising a series of four basic hand gestures: Play, Pause, Forward and Reverse. The ChuanZhao[9] suggested a way to track artefacts of their size and shape based on the community of medium-size and affinity structures that change over time. The results showed that the object is able to detect significant variations and partial blockages.

Several methods of corner detection are compared in [9] to establish which is the best method for gesture detection. The comparative corner detection methods are the SUSAN detector (Smallest Univalent Segment Assimilating Core), IPAN, and Swift (Speed Segment Test Features). The methods used to detect movements by IPAN, SUSAN and Quick are fine. The FAST, however, is the quickest and can be used in real time, depending on the processing time.

For the interaction between a person and a computer, such as the mouse feature is replaced, the next study[7] will be hand-gesture detection and tracking. The hand gesture in this study is divided into two phases that use the hair-like process of context subtraction and facial elimination. The segmentation of the edges will be achieved with the detector of Canny Edges, then followed by the extraction of skin colours. After that, a palm centre and a fingertips are found, including a simple wave of the hand. The research is carried out using many scenarios such as mouse cursor control, earth navigation, fruit game and 3D viewers. All scenarios are calculated by means of 5 fun, intuitive, accurate, functional and comfortable parameters.The first study results in an average value of

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61,33% which is increased by a mean correctness of 86,66% when the second test is presented.

AlekseiTepljakov discovers a number of approaches for the computer's visual understanding of the real world, offers alternatives to OpenCV 's methods. In a Raspberry Pi programme to detect and monitor objects he has implemented some of them. Any of the helpful information, such as coordinates and height, is also transmitted through the application to other network computers that send a proper query. It may not be sufficient for real-time applications as a delay may occur. Mirjana Maksimović et al[12] analysed, described and presented Raspberry Pi capabilities and the advantages and inconveniences of using Raspberry Pi in the creation of the Internet of Things (IoT) next century.

3. METHODOLOGY

For recording movements the device uses a USB camera connected to the Raspberry Pi 3 Model B as an embedded computer. OpenCV libraries are fitted to the embedded device for the identification of gestures and to convert them to control lamps linked to a relay. The following figure shows the design of the proposed system:

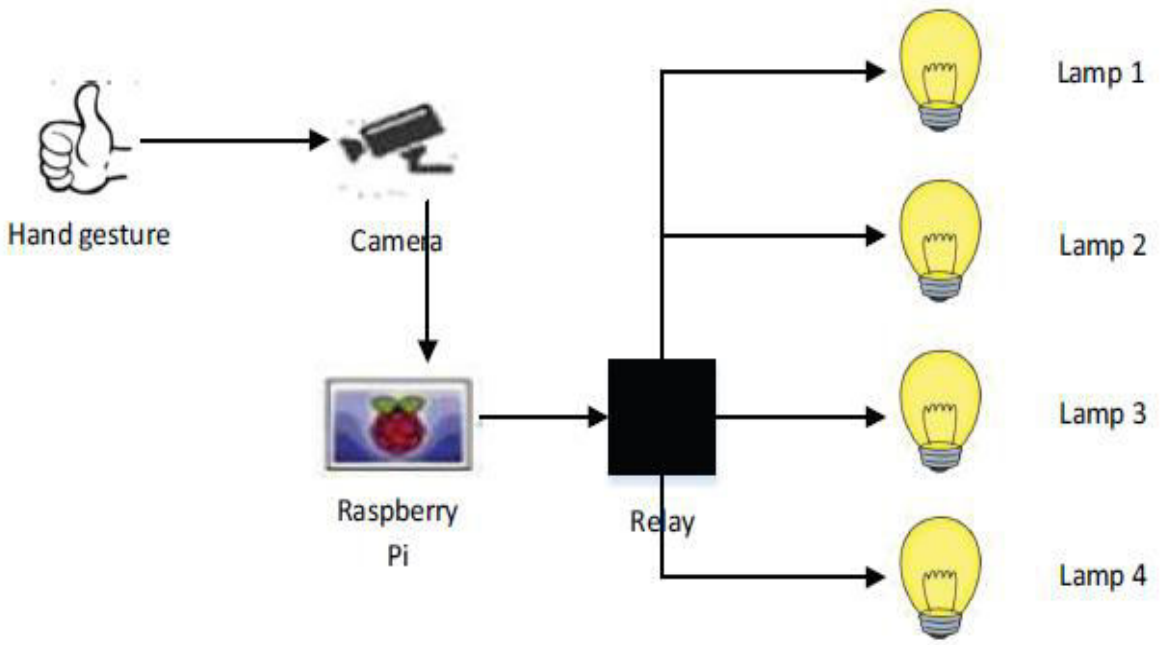

Figure 1. The proposed system prototype

Usage of a flow chart is generally seen in the following figure as the proposed framework scheme described:

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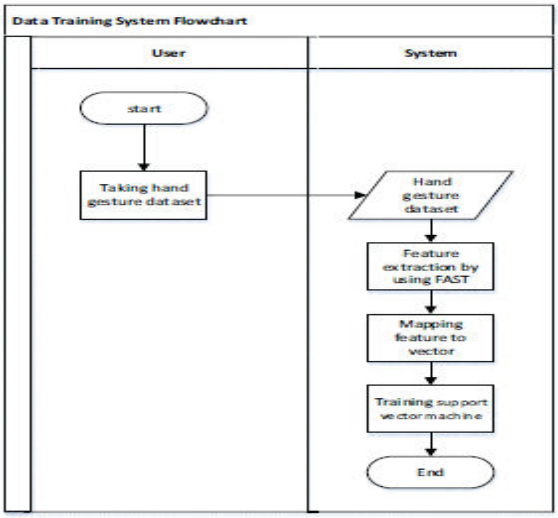

Figure 2. The data training of proposed system.

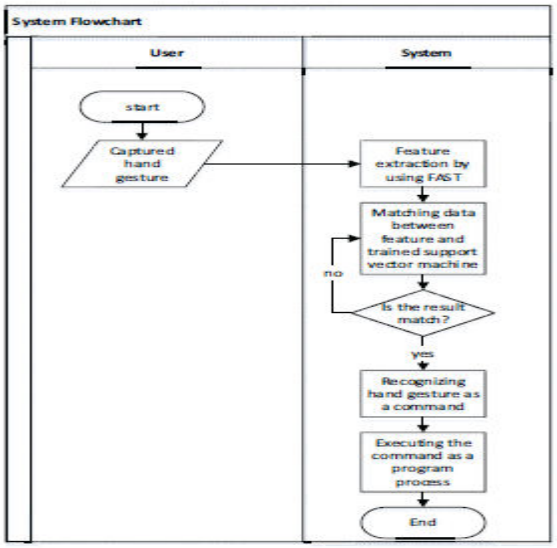

Figure 3. The hand gesture recognition process.

The figure shows that the operation of the device takes two phases. Firstly, the picture for a dataset recording a hand gesture. Second, using the Quick algorithm to make a feature extraction to make it vectors. After this, you practise on the basis of the previously captured data using the dataset. Next, real-time hand movements are registered for the identification of hand gesture with a level of indoor light in the range of 100 to 300 lux.

Raspberry Pi is used to understand the hand gesture. The Quick algorithm is used to match the similarity to compare the function of real-time data to the qualified support vector machine data.The Raspberry Pi

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processes a translation to execute a system command that is connected to that command, and is fit for the recognised hand gesture if corresponding hand gesture data are found.

Contour-based digit gesture recognition

A general block diagram is shown in the picture of the digit gesture recognition method. 4. It involves multiple sub-blocks such as frame extraction, preprocessing, function extraction and training database storage.In testing phase, additionally, feature database, sign recognition and its corresponding label display are the blocks.

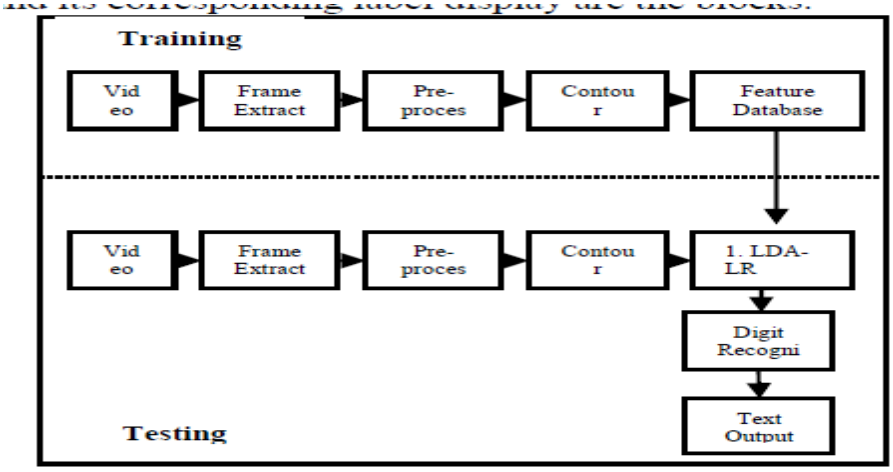

Fig. 4. Block diagram for contour-SVM based digit gesture recognition

In the hand gesture signal recognition system for digit recognition, a video is captured from the raspberry pi camera. This video is then passed sequentially through various blocks as shown in Fig. 1 for digit recognition. Contours are those curves that are included in the continuous points with the boundary. The points are of the same intensity. The contour is drawn around the hand image. The convex hull is established in the Euclidean space. These points are connected to contours. The convex hull is drawn around the contour. Contours points lie within the convex hull. Convex hull works as envelop around the hand [10].

Steps used in contour-based digit gesture recognition are as follows- Capture the video using USB Samsung camera having resolution 720X480 Converted recorded video into frames

Read frames

Apply pre-processing techniques.

Extract hand region using the bounding box

Convert RGB image to grayscale image

Apply thresholding (Otsu's method) to obtain a binary image

Extract the Region of Interest(ROI)

Apply a Gaussian filter for blurring the image

Find the contours

Contours, hierarchy = cv2.findContours (thresh1, cv2.RETR_TREE, cv2.CHAIN_APPROX_SIMPLE)

Find the largest contour

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Draw convex hull
Hull = cv2.convexHull (cnt)
Find Moment for finding the centroid of hand palm.
Find convexity defects
Apply cosine rule to find angles for all defect between the fingers
Find the fingertip position
Find the distance between centroid and fingertip point and stored as a feature Train the LDA-LR, PCA-LR, K-NN and SVM model using training feature set Load the testing gesture Extract the features Test with LDA-LR, PCA-LR, K-NN and SVM model Display the recognized digit Feature extraction is carried out in training phase. During the training phase, extracted features are stored in the database. In the testing phase, different classifiers such as LDA-LR, PCA-LR, K-NN and SVM are used for classification of features extracted from testing images. In the feature extraction stage, we have more information about the fingertips, finger counting the palm center position. For good feature detection of hand, we have used the relative distance between the fingertips and the hand center by using following formula.

Euclidean distance

$$= \sqrt{(x_1 - x_0)^2 + (y_1 - y_0)^2}$$

Point (x1, y1) is a fingertip position and (x0, y0) is the center of hand palm. Depending upon the number of defects and length we classify the corresponding gesture using LDA-LR, PCA-LR, K-NN and SVM.The output of recognition system will be displayed in the form of labels (1-5 digits).

4. RESULTS AND DISCUSSION

4.1 SOFTWARE IMPLEMENTATION

The Raspberry Pi is an environment with a Python as the major language for the Linux-based operating system. The IDLE (Integrated Development Environment), the fundamental python framework, is the development environment used. In accordance with version 2.4.8 of IDLE OpenCV library, computer vision problems are resolved. OpenCV-Python is the Python binding library designed to solve computer vision problems and offers the full range of functions for gesture motion creation. Python enables programmers to define their own classes that are most commonly used for object-oriented programming. Python has one of Python's key strengths and a broad standard library, which offers resources for several tasks.

Figure-5. Python shell window.

For the code and the Code Results viewing, the Python Shell window shown in Figure-5 is used. The debug menu bar includes the

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execution module to debug the code and to display the effects of the execution.

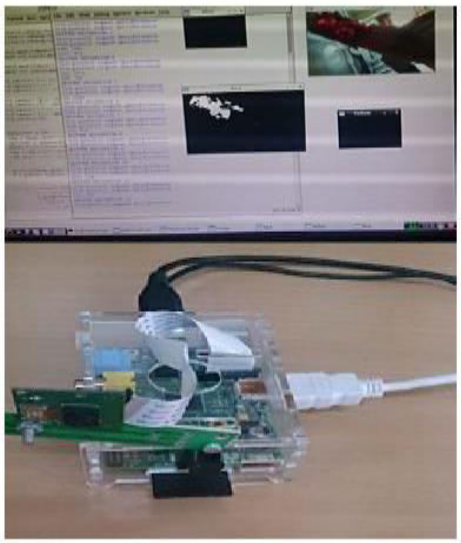

Figure-6. Raspberry Pi interfaced with Raspbian camerawith the monitor window.

The system includes a Raspberry Pi interface with a Raspbian camera, which monitor the system using colour markers placed in the fingers. Figure 6 shows the Raspberry Pi interfaced with the Raspbian camera and the display window.

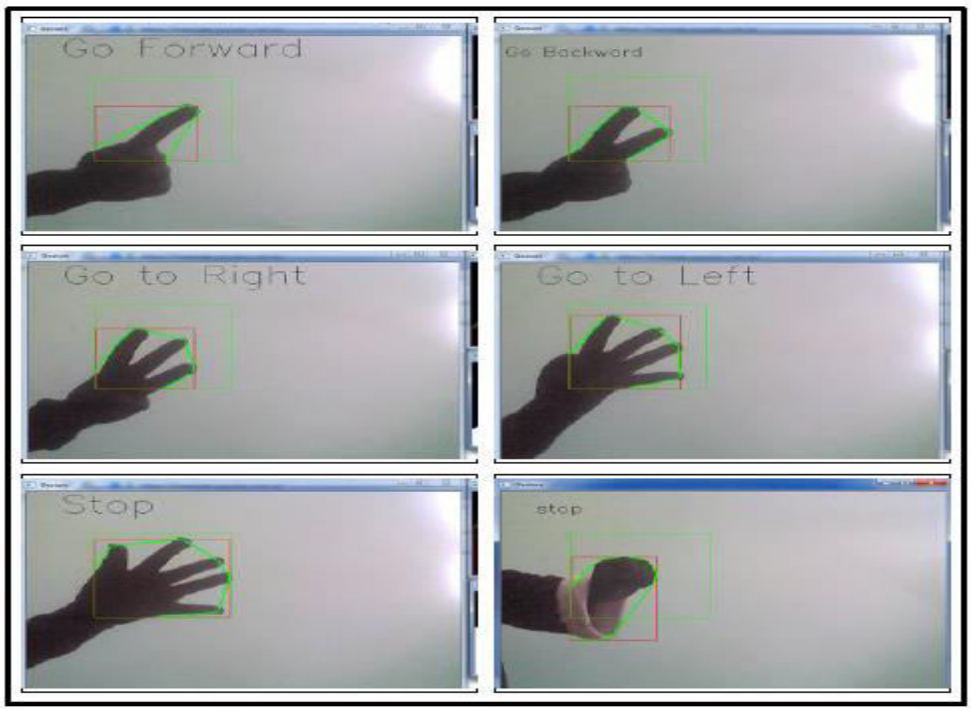

Fig 7: Samples of hand gestures

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CONCLUSIONS

Based on a recognition of the hand movements, the effects of the algorithm presented will be evaluated. The hand gesture algorithm for recognition and robot motion control was not used previously with Raspberry Pi. The database used for the identification of human hand signals is provided by five forms of hand controlled gestures for five movements. Designing an embedded Raspberry Pi device that is smaller , cheaper and less powerful than the conventional PC-based gestures recognition system is more practical. The python-language development environment enables the identification of gestures with colour markers. In the future , different colour-marking gestures for such features such as scrolling, zoom in, zoom out, etc. can be added. This is ideal for other applications such as robotics, immersive video games.

REFERENCES

[1]. G.Senthilkumar1, K.Gopalakrishnan2, V. Sathish Kumar3 Embedded Image Capturing System Using Raspberry Pi System, Volume 3, Issue 2March–April 2014 Page 213.

[2]. Sahani, M., Rout, S.K., Sharan, A.K., Dutta, S. real time color image enhancement with a high regard for restoration of skin color by using raspberry pi Communications and Signal Processing (ICCSP), 2014 International Conference IEEE.

[3]. Y.Saahithi, E.SaiSpandana Reddy, P.Samskruthi Reddy, Advanced Embedded Security System With Image Capturing In SD Card, Volume No: 1(2014), Issue No: 12 (December).

[4]. Ajinkya Patil1, Mrudang Shukla2 Implementation Of Classroom Attendance System Based On Face Recognition In Class, IJAET, Vol. 7, Issue 3 July, 2014.

[5]. Umesh P Image Processing in Python, CSI Communications, December 2012.

[6]. Jan Erik Solem, Programming Computer Vision with Python, 2012.

[7]. Raspberry pi – www.raspberrypi.org