

Switching Systems for Agriculture by Digitalization Technique using RASPBERRY-PI

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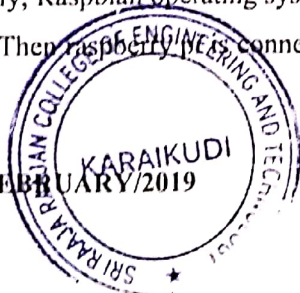
Abstract: Generally, In Agricultural fields, the farmers are facing issues like electric shocks while operating motors and other devices during rainy season. To overcome these difficulties, we are proposing a system, which is capable to operate any device using images without any physical contact. The proposed system captures the image of the control system and captured image will be verified with the predefined images using raspberry Pi processor for authentication. It's a portable interface that augments the physical world around us with the digital information. It allows user to connect with the real world seamlessly. We can also use this system to automate an industry related operations, controlling the high voltage appliances such as different machines; AC's and other devices. We can extend applications of this system in home appliances. It is a technology with which a system could be trained to recognize and percept real world objects and react as desired. This technology bridges the gap between the physical world and the digital world, bringing intangible, digital information out into the tangible world, and allowing us to interact with this information via image processing. In this project we are making use of Raspberry pi for image processing. A USB camera is interfaced with Raspberry pi to enable the project with computer vision. User needs to show the images to camera. Based on the predefined logic the electrical devices will be turned ON or OFF. More than one device can be operated at a time.

I. INTRODUCTION

A raspberry pi based computer vision is a circuit used in control systems to perform different switching operations. Switching system plays a pivotal role in many applications such as agriculture, industries, home appliances etc.

The project aims at designing a system which captures the image of the control system and particular device can be switched on/off based on the image shown to the Camera.

Initially, Raspbian operating system file is burned on to the SD card which is inserted in the raspberry pi. Then raspberry pi is connected with different components like relay, USB camera and



different loads based on the operations to be performed. The code is written in embedded c for image processing. The code is dumped on to the SD card which is written in embedded c.

Whenever an image of the device is shown to the camera. Then the image is captured by camera. The image which is captured by the camera is processed by an open CV library, by pixel to pixel comparison. After the image has been processed, the code will be executed and variety of operations are performed which are connected to general purpose input output pins of execution of Raspberry pi.

The image of the device, when shown to the camera, that particular device is switched ON/OFF. The device which is operated can be either an AC or DC device using the project more than one device can be operated at a time.

II. LITERATURE SURVEY

Humans use their eyes and their brains to see and visually sense the world around them. Computer vision is the science that aims to give a similar, if not better, capability to a machine or computer.

Computer vision or CV for short, is concerned with the automatic extraction, analysis and understanding of useful information from a single image or a sequence of images. It involves the development of a theoretical and algorithmic basis to achieve automatic visual understanding. Computer vision tasks include method for acquiring, processing, analyzing and understanding digital images, and extraction of high-dimensional data from the real world in order to produce numerical or symbolic information, *e.g.*, in the forms of decisions.

On a certain level CV is all about pattern recognition. So one way to train a computer how to understand visual data is to feed it images, lots of images that have been labeled, and then subject those to various software techniques, or algorithms, that allow the computer to hunt down patterns in all the elements that relate to those labels. In the past, supercomputers might take days or weeks or even months to chug through all the calculations required, today's ultra-fast chips and related hardware, along with the speedy, reliable internet and cloud networks, make the process lighting fast.

We investigated and noticed that some of the researches proposed new architectures and models for computer vision, which help to implement computer vision in various fields like industry, home appliances etc. It is also noticed that, it can be used for controlling and operating different AC & DC devices. Computer vision can be implemented using openCV library. we

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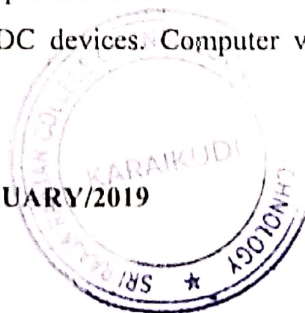
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present a system which can be able to switch any device which is interfaced with this circuit. We have studied about computer vision applications in different fields. We also studied about methods for implementation.

EXISTING METHOD

The recent advancements in technology and the availability of the high speed processors have made implementing a project easy. Different image processing devices are designed. Computer vision is a new concept that enables the computer with vision so that a computer can make decisions based on the images it see. Different devices can be operated using computer vision. In this project, our contribution is to design a system which has the capability to switch any device.

PROPOSED SYSTEM

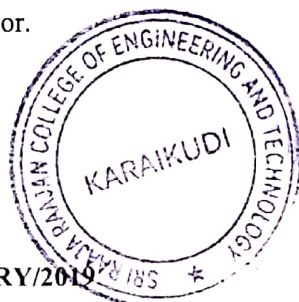
The project aims at designing a system which captures the image of the control system and this image of the system will be verified with the pre-defined Images using raspberry Pi for authentication. Once the image is matched that particular device can be switched ON/OFF. Two different images are used in which one is used for ON and other is used for OFF.

EXPLANATION

Initially, Linux operating system file is downloaded and it is copied on to the SD card using win32diskimager. Then the SD card is inserted into the raspberry pi. Raspberry pi is connected with different components like relay, USB camera and different loads. The code is written in embedded C for Image processing using openCV library. The code is then dumped on to the SD Card. The camera which is connected to raspberry pi captures the image. The captured image is compared with pre-defined Images using Image processing by openCV library. When ON Image of a device is shown, particular GPIO is made Active LOW. So, that the load which is connected to GPIO through Relay is Switched ON. Similarly when OFF Image is shown, particular load is switched OFF.

III. BLOCK DIAGRAM

Fig 2.1 shows the block diagram of raspberry Pi based Computer vision for Switching Systems. It consists of Raspberry Pi, Power supply, USB camera, Relay circuit, Hard disk, Adapter, Bulb, Socket, DC Motor.



Raspberry pi: raspberry pi is the heart of the project. The controlling of different modules is done by this pi. Here we are using the raspberry pi b+ model. It takes the images as inputs and then processing is done. According to the code, it will make the GPIO pins as active low or active high.

Power supply: The power supply to pi is given through a adapter to micro USB port which is in built on the pi board. Power supply of +5v @2A is give via micro USB jack to the raspberry pi board.

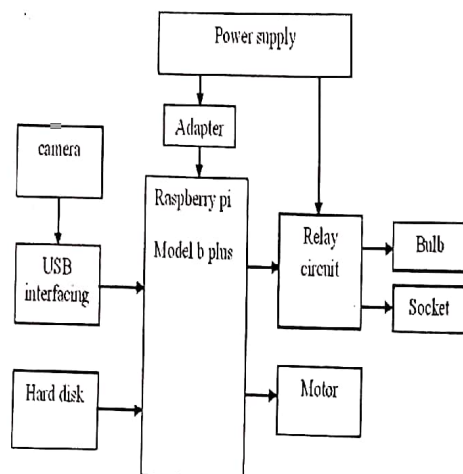


Fig.1 Block Diagram of the Raspberry Pi based Computer vision for Switching Systems

Relay: relay acts as a switch. It is used for driving the ac devices. Here we are using the two channel opto coupler relay. By using this opto coupler relay, we can drive ac devices and also if there is any fault in the power supply, it doesn't affect the raspberry pi. A relay circuit is connected to the general purpose input output present on raspberry pi. This circuit is used to operate ac loads like bulb, fans etc. DC devices can be directly connected to gpio pins present on the pi board.

Camera: it is a USB camera. It is interfaced directly to any one of the 4 USB ports of the raspberry pi without using any driver. Camera is used for capturing the different images of the loads. These captured images are processed through raspberry pi.

Loads: here we are using three different loads. They are bulb, socket and dc motor. DC motor can be directly operated through raspberry pi. bulb and socket requires the ac power supply. so, we are operating the bulb and socket through relay.

Hard disk: SD card is inserted in the SD card slot of raspberry pi. the linux ubuntu mate operating system is burnt on to the SD card. This operating system code and images are stored in the hard disk.

SCHEMATIC DIAGRAM

The schematic diagram of the Raspberry Pi based Computer vision for Switching Systems

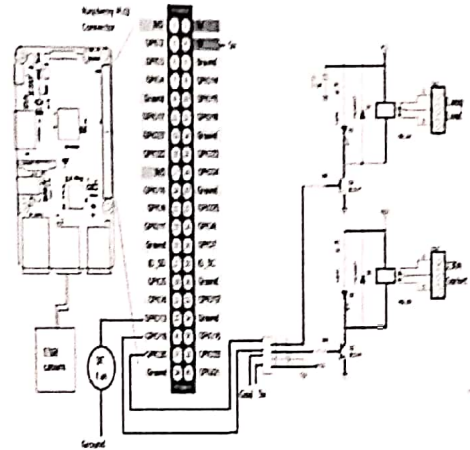


Fig. 2 Schematic diagram of the Raspberry Pi based Computer vision for Switching System

The raspberry pi is given with power supply through an adapter. A USB camera is connected to USB port of raspberry pi. There are three loads connected to raspberry pi GPIO pins. As DC motor is driven by raspberry pi, so that it is directly connected to raspberry pi's GPIO 13 pin. As socket and bulb are ac driven, so that they are connected through a two channel opto coupler relay. Bulb and socket are connected to GPIO 19 and GPIO 26 respectively through a relay.

FLOW CHART

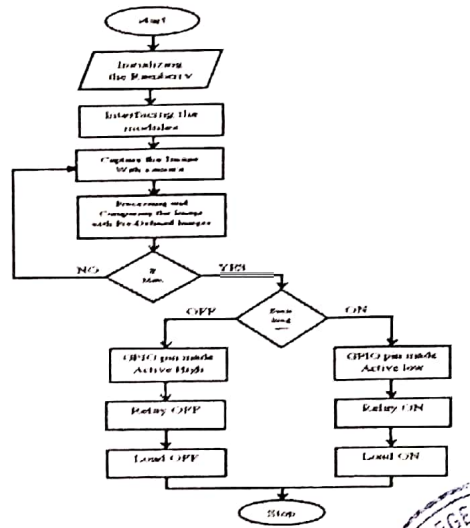
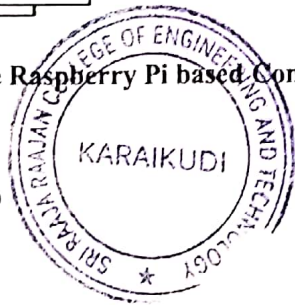


Fig. 3 Flow Chart of the Raspberry Pi based Computer vision for Switching Systems



IV. WORKING PRINCIPLE

Raspbian operating system file is downloaded from the raspbian.org, which is an image file. An empty SD card is taken and formatted using an SD card formatter. The operating system file is then burned on to the SD card. An application named Win32diskimager is used for burning the OS image files on to the SD card.

The SD card with raspbianOS is inserted into SD card slot of the raspberry pi. Then, the raspberry pi is connected to a monitor, keyboard and mouse. Once the operating system is booted, Linux Ubuntu operating is visible on the desktop.

OpenCV library was installed, as it is used for image processing. Then the code is written in VI editor, which is an inbuilt editor of Linux operating system. Different images are selected for switching the devices. For each device, two different images are selected for switching a device in which one is used for switching ON and the other is for switching OFF. The code is written in Embedded C language using openCV library. Once the code is written, it is executed using GCC compiler. Then an executable binary file is created. This file is copied on to the SD card along with the images used.

Different loads like AC bulb, DC motor and a socket are connected to raspberry pi. DC motor is connected directly to general purpose input output(GPIO) pins of the raspberry pi as it can be directly driven by raspberry pi. As raspberry pi can only drive DC devices. A two channel Opto coupler relay is used for connecting AC devices to raspberry pi. Any of the GPIO pins can be used for operating loads. In this project, we are using 13, 19 & 26 GPIO pins for the operating loads. Then a USB camera is connected to any one of the four USB ports of the raspberry pi.-

The camera which is connected to raspberry pi will capture the image. The captured image is processed and compared with pre-defined Images using Image processing by pixel to pixel comparison. When ON Image of a device is shown, particular GPIO is made Active LOW. So, that the load which is connected to GPIO through Relay is Switched ON. Similarly when OFF Image is shown, particular load is switched OFF.

V. ADVANTAGES

- Both AC and DC devices can be operated.
- Multiple devices can be operated at a time.
- User friendly design.
- Easy to operate.

file.

- o Low power consumption.
- o Easy to implement.

LIMITATIONS

For switching a device, the delay is 7 seconds.

APPLICATIONS

1. In agriculture field this device can be used for switching motor ON/OFF in rainy season.
2. In an organization at the entrances this device is used for opening of doors.
3. This device can be used in home appliances like for switching the geyser either ON/OFF.

VI. RESULTS

The project “Raspberry Pi Based Computer vision for switching systems” is used for switching any device. To operate any device, two different images are used. In which one image is used for ON and other is used for OFF. These images are compared with pre-defined images and using open CV library. Once the image is matched with the pre-defined images, particular device can be made ON/OFF.

In this project, we have connected three loads. For switching ON the three devices, three different images are used. In which each image is used for switching ON a particular device.

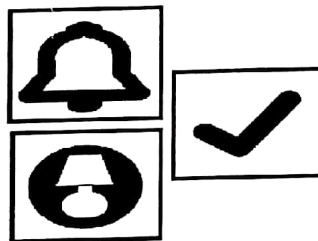


Fig. 4 Images for switching ON

For switching OFF the three devices, three different images are used in which each image is used for switching OFF a particular device. At a time, all the three devices can be operated by shown three images to camera.



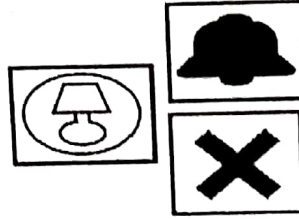


Fig. 5 Images for switching OFF

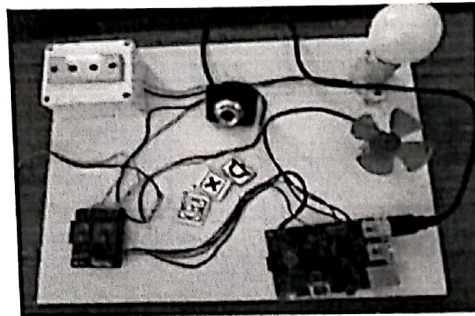


Fig. 6 Project picture

The device which is operated can be either an AC or DC device and by using this project more than one device can be operated at a time.

VII. CONCLUSION

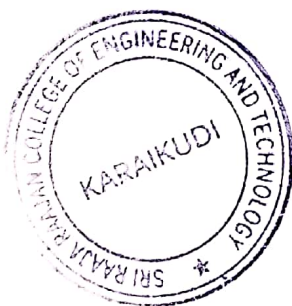
Raspberry pi based computer vision is used for switching different devices. As per the image shown to camera different devices can be operated using image processing technique. The device which has to operated can be an AC or DC device. At a time more than one device can be operated. Thus the project has been successfully designed and tested.

VII. FUTURE SCOPE

Our project "Raspberry Pi Based Computer vision for switching systems" is mainly intended to design a system which captures the image of the control system and can be able to perform different tasks. This circuit can be connected with any industrial application so that they can be operated easily without any physical contact between human and a machine. The speed of operation can be further increased.

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