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ANTI-THEFT CONTROL AND MONITORING SYSTEM USING RASPBERRY PI ANDSIMPLECV

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Abstract

Surveillance and monitoring have become very important for security reasons these days. Residential areas, government organizations, commercial spaces, schools and hospitals, industries, banking and other challenging indoor andoutdoor environments require high end surveillance systems,which are very expensive. This paper proposes the motiondetection and tracking system for surveillance in this paper. The proposed system uses Raspberry Pi and computervision using SimpleCV to detect moving objects in thesurveillance area, switch on the lights to capture images andstreams the camera feed online using MPJG Streamer, whichcan be viewed by any authorized person on the go.

Keywords: Camera, Raspberry Pi, Computer vision, SimpleCV,MPJG Streamer.

1. INTRODUCTION

The Traditional surveillance system is enabled by high-end cameras, video servers, network switch andmonitoring computers[1]. All these resources lead tocomplexity, high expense, and high power consumption andalso require more area to establish. Also, the feed can be viewed only in one particular area and cannot be accessed ifthe person is in motion. In the new surveillance system proposed, Raspberry Pi [3]operates and controls motion detectors and video cameras for remote sensing andsurveillance, streams live video and records it for futureplayback. Computer Vision technique used is SimpleCV,which detects motion in the surveillance area and streamsthe live feed online using MPJG Streamer and alerts the authorized personnel via a message or email or an alarm. [2]The authorized person can check the live feed from wherever he is located by just logging in online. According to the characteristic of the system, such as small size, lowpower consumption, quick speed and so on, it proves to be avery efficient surveillance system.The rest of the paper is structured as follows.Section II explains the functional description of all thecomponents. Section III explains the system design. SectionIV deals with the algorithm of the program. Section V shows theresults. Section VI discusses the conclusion and future work.

2. FUNCTIONAL DESCRIPTION

The functions of the various components are given below:

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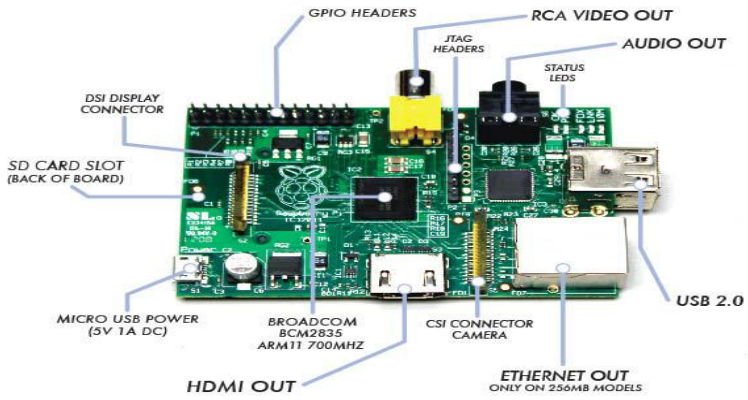

Fig.1. Raspberry Pi B+ Board

A. USB Camera:

USB Cameras are imaging cameras that use USB2.0 or USB 3.0 technology to transfer image data. USBcameras are designed to easily interface with dedicated computer systems by using the same USB technology that is found on most computers. The camera model used here isUSB Camera model 2.0. The accessibility of USB technology in computer systems as well as the 480 Mb/stransfer rate of USB 2.0, makes USB Cameras ideal for manyimaging applications.

B. Raspberry Pi:

The Raspberry Pi is a low-cost single board, packing considerable computer power in a size of a creditcard. The Raspberry Pi board contains many features like camera connector, Ethernet port, GPIO pins for interfacingsensors and switches, USB ports to connect to externaldevices(like keyboard, mouse, Wi-Fi adapter etc.,), HDMIport to interface to monitors (like LCD screens, projectors,TVs etc.) and an audio jack also available[7]. By all these embedded on a single board. The Raspberry Pi has nointernal mass storage or built-in operating system and henceit requires an SD card preloaded with a version of the LinuxOperating System. Refer the fig 2.1.This system proposed here uses Raspberry Pi Model B+, shown in Fig2.1. This model board is a microcontroller kit with in-built ARM11 processor provided with internet/Ethernet connectivity, dual USB connector, 512MBmemory and supports Linux operating systems like Raspbian, Pidora, Raspbmc etc.

C. SimpleCV for motion detection:

Computer vision is moving from a niche tool to an increasingly common tool for a diverse range of applications, such as facial recognition programs,automotive safety systems, industrial automation,biometrics, planetary explorations etc. One of the things that makes it feasible is that these days, the hardware requirements are inexpensive enough to allow more casual developers entry into the field, opening the door to many new applications and innovations.[5]We use SimpleCV technique here in this surveillance system for motion detection in the area of surveillance.[7]SimpleCV is an open source framework for building computer vision applications. It is a collection oflibraries and software that can be used to develop vision applications. It provides the feasibility to work with theimages or video streams that come from USB Cameras,webcams, Kinects, FireWire and IP cameras or mobilephones. SimpleCV is written in Python, and it's free to use.It runs on Mac, Windows, and Ubuntu Linux, and it islicensed under the BSD license.

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D. MPEG Streamer for video streaming:

There are few modern streaming protocols for web browsers like HLS for Apple products, Fragmented MP4 etc. But HLS supports only iDevices, but not much else where. Fragmented MP4 is supported by Adobe andMicrosoft, but requires browser plugins from these companies on the player computer, so Windows and Maccomputers can do it, but Linux and mobile cannot.[4]MJPG-streamer is a command line application thatcopies JPG-frame from a single input plug-in to multiple outputs plug-in. It can be used to stream JPEG files over anIP-based network from the webcam to a viewer like Firefox,Video LAN client or even to a Windows Mobile device running the TCPMP-Player. It was written for embedded devices with very limited resources in terms of RAM andCPU.

3. IMPLEMENTATION

System Design

The basic aim of system design is to continuously capture the surroundings under surveillance and if there is any moment is noticed, it turns on the lights and captures thescreenshots and sends those over internet and it also alertsthe authorized persons about human presence.

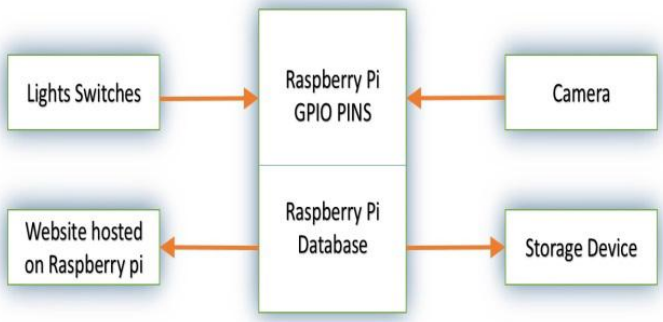

Fig.2. System Design For Surveillance System

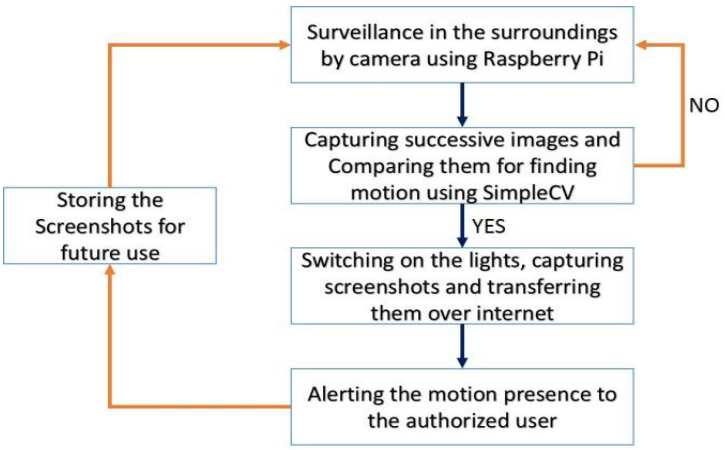

Fig.3. Coding Algorithm For Surveillance System

A program is written for continuouslycapturing the surroundings using camera and comparingthem with the image frame of time shift. Thiscomparison detects the motion and to switch on lights. Afterswitching on lights it takes screen shots and they aretransferred over internet. A storage device is

connected toraspberry pi through USB port to store the screenshots.This system uses MPJG-Streamer to streamthe video on monitor connected to Raspberry Pi throughHDMI port. And this is also used to stream the video online .i.e., we can see the live streaming anywhere overinternet. We can connect it to several monitors at a timeusing HDMI extension switch.

4. ALGORITHM

In Raspberry Pi[1]Raspian operating system isinstalled. This Operating System is a Linux based itsupports all programming languages like Python, C etc.Python programming language is used in the system tocommunicate with General Purpose Input Output ports andeasy connection with databases using MySQLdb andSimpleCV modules.In Raspberry Pi a program is written in python using SimpleCV module to capture the successive images,finding the motion and alerting the user.By following the below steps the system is implemented:

- First import all the modules required to for GPIO andSimpleCV
- Communicate with the camera connected to RaspberryPi with SimpleCV
- Capture the successive images with SimpleCV usingcamera
- Compare the images to find the human presence
- If motion is detected, switch on the lights and takescreenshots of surrounding area
- Transfer the screenshots over internet and store them inlocal storage
- Alerting the user about human presence
- If motion is not detected, then surveillance continued

RESULTS

Surveillance system is practically implemented andthe results are obtained. Results of ARS system are as follows: A sequence of images showing the results of ouralgorithm by comparing successive images captured bycamera to detect motion. Refer the After detection of motion fig 5.2 shows theswitching on lights and transferring the screenshots overinternet. Fig 5.3 shows the website with live feed fromcameras connected to Raspberry Pi.

CONCLUSION

In this paper, we have designed and implemented alow-cost and efficient Surveillance System capable of recording/capturing video/image and transmitting to theinternet. [6]It is advantageous as it offers reliability and privacyon both sides. It is authenticated and encrypted on thereceiver side; hence it offers the sensitive information onlyto the authorized personnel. Also because of its small sizeand portability, it can be placed in any kind of surroundingfor surveillance. Areas where movement is restricted such assensitive military/nuclear sites or in banks, this kind ofsurveillance and monitoring systems can be implemented.This will not only omit the requirement of physical presencefor surveillance, but will also capture all information in thestorage which will be proving very beneficial.

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Fig.4. Detection Of Motion By Algorithm

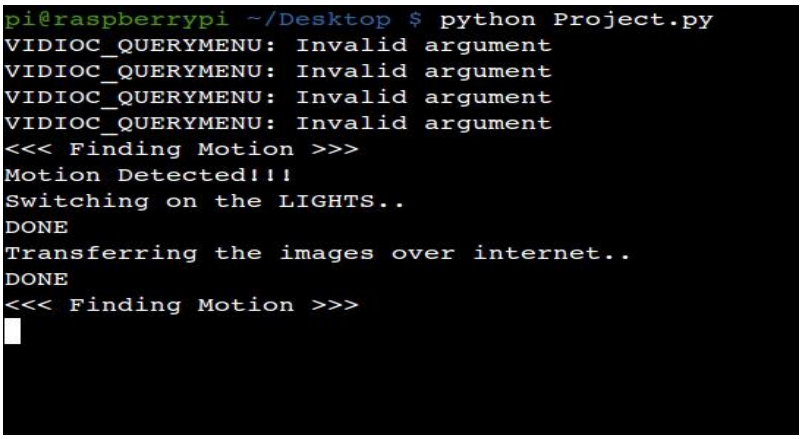

Fig.5.Transferring Images After Detection Of Motion

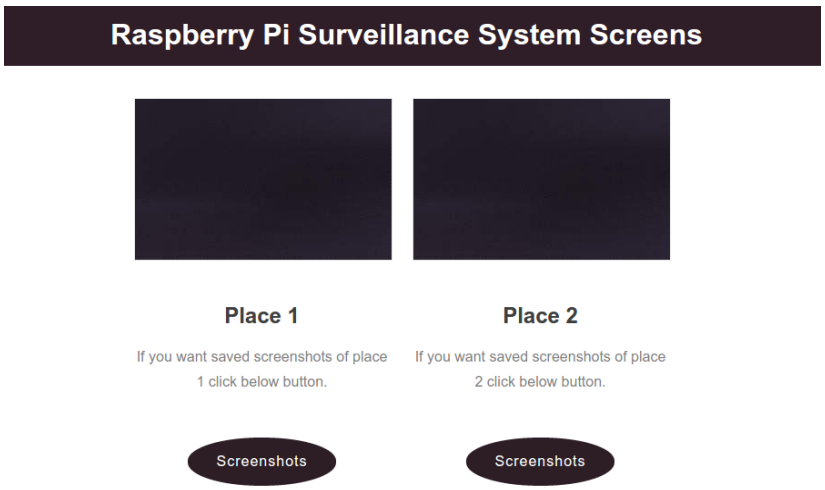

Fig.6.Website Showing The Live Feed From Cameras

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