

# A Smart Home Automation Technique with Raspberry Pi using IoT

Vamsikrishna Patchava<sup>1</sup>, Hari Babu Kandala<sup>2</sup>, P Ravi Babu<sup>3</sup>

Department of ECE<sup>1</sup>, Department ofEEE<sup>2</sup>, Centre for Advanced Studies in Electronics Science & Technology<sup>3</sup>

RGUKT-Nuzvid<sup>1</sup>, MVSREC<sup>2</sup>, University of Hyderabad<sup>3</sup>

Andhra Pradesh<sup>1</sup>, Hyderabad- Telangana<sup>2,3</sup>

vamsi.patchava@gmail.com<sup>1</sup>, kandhala.hari94@gmail.com<sup>2</sup>, perakalapudi@gmail.com<sup>3</sup>

**Abstract** - In this paper, we are presenting a proposed system for Smart Home Automation technique with Raspberry Pi using IoT and it is done by integrating cameras and motion sensors into a web application. To design this system, we are using a Raspberry Pi module with Computer Vision techniques. Using this, we can control home appliances connected through a monitor based internet. Raspberry Pi operates and controls motion sensors and video cameras for sensing and surveillance. For instance, it captures intruder's identity and detects its presence using simple Computer Vision Technique (CVT). Whenever motion is detected, the cameras will start recording and Raspberry Pi device alerts the owner through an SMS and alarm call.

**Keywords** - Raspberry Pi, IoT, Computer Vision, Simple CVT, M- JPG Streamer.

## I. INTRODUCTION

Now a days, automation plays a crucial role in all work places and living homes. Presently automation [2, 4] techniques are implemented either using microcontroller or computer. Microcontroller cannot run multiple programs at a time. With the use of Microcontroller it is difficult to control both the appliances and surveillance at a time i.e., it is very complex to perform the multiple functions simultaneously. We can achieve this with the computer, but using the computer is very expensive for this purpose and consumes more power. The Raspberry Pi [1, 5] is a single board computer and it can be used to overcome these problems. Simply, the Raspberry Pi system functions like a computer with small setup as shown in Fig- 2.1. It contains GPIO and USB ports. Using these ports we can control the appliances with the sensors as well as interface the camera for surveillance. Raspberry Pi can be used for multiple purposes based on our requirement.

The rest of the paper is structured as follows. Section II explains the functional description of all the components. Section III explains the system design. Section IV, deals with algorithm of the proposed system. Section V shows the results. Section VI discusses the conclusion and future work.

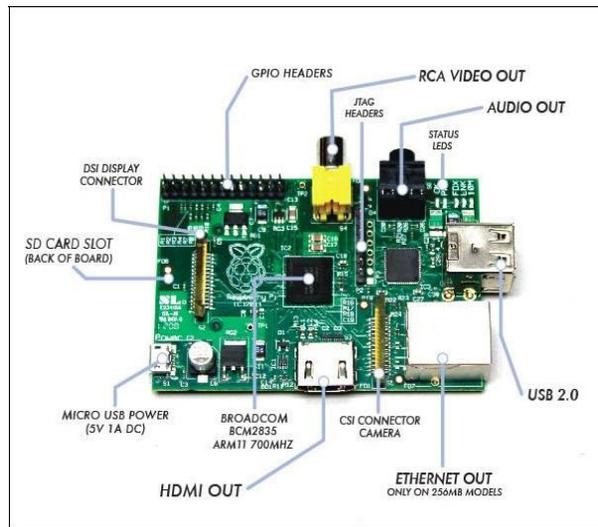


FIG2.1: RASPBERRY PI B+ BOARD

## II. FUNCTIONAL DESCRIPTION

The functions of the various working components are given below:

### A. Raspberry Pi:

Raspberry Pi is using the Advanced Reduced Instruction Set Computing Machine (ARM) technology. ARM technology is used on the board which reduces cost, heat and power consumption. It is energy effective multi core CPU implemented as System-On-Chip (SoC) weighing 50gm and operates on 5V, 700mA power rating. This board is available in three models named A, B, B+. The B+ Raspberry Pi board is the latest version among them, and it runs on ARM11 processor with 512MB RAM operating at 700 MHz frequency. It has SD card slot, which is used for booting the operating systems like Raspbian, Pidora, Raspbm. It has four USB2.0 ports to connect to the peripherals like mouse, keyboard and Wi-Fi adapter etc,

making it as a full sized portable pocket computer. It also has an Ethernet port to connect to the network. GPIO ports are used to interface and control the LED's, switches, sensors and other devices. With the help of HDMI port, all kinds of monitors like LCD screens, projectors, TVs can be connected. In this board, some additional features like camera connector is available to interface camera and an audio jack. With all these features, Raspberry Pi is not just limited to single use, it can be used in many applications.

### B. Simple Computer Vision Technique(CVT):

Simple Computer Vision Technique has a wide range of applications on face detection, robotics, video phone systems, intelligent human machine interface, biometrics, diagnosis of skin cancer and so on. We utilize Simple computer vision based system that allows users to interact with the virtual world by means of augmented reality along with movement recognition in the specified zone. Simple CV is an open source system for building PC vision applications and it allows the users to get more personal with their devices. It gathers the libraries for programming and that can be utilized to create vision applications. It gives the possibility to work with the images or feature streams that originate from USB & IP cameras, webcams, kinects, firewire and cell phones. Simple CV is composed in Python and it runs on Mac, Windows, and Ubuntu Linux.

### C. M-JPG Streamer:

There are couple of cutting edge gushing conventions for web programs like HLS for Apple items, Fragmented MP4 and so forth. Divided MP4 is supported by Adobe and Microsoft, however obliges program plugins from these organizations on the player PC. The windows and Mac PCs can do it, but not versatile with the Linux based systems.

MJPEG-streamer is a command line tool to stream JPEG files over an IP-based network from the webcam to a viewer like Firefox, Video LAN or even to a Windows Mobile gadget using the TCPMP-Player. MJPG-streamer relies on input-and output-plug-in, e.g. an input-plug-in to copy JPEG images to a globally accessible memory location, while an output-plug-in, like output http//, processes the images. For example serve a single JPEG file (provided by the input plug-in), or streams it converts existing MPEG standards. MJPG-streamer summons up a line application that duplicates JPG-outline from a solitary information module to different yield module. MJPG Streamer is a simple and straight forward video streamer, but it is faster than most streamers, so this makes it ideal for remote control projects in which real-time video feed is crucial for navigation and orientation purposes.

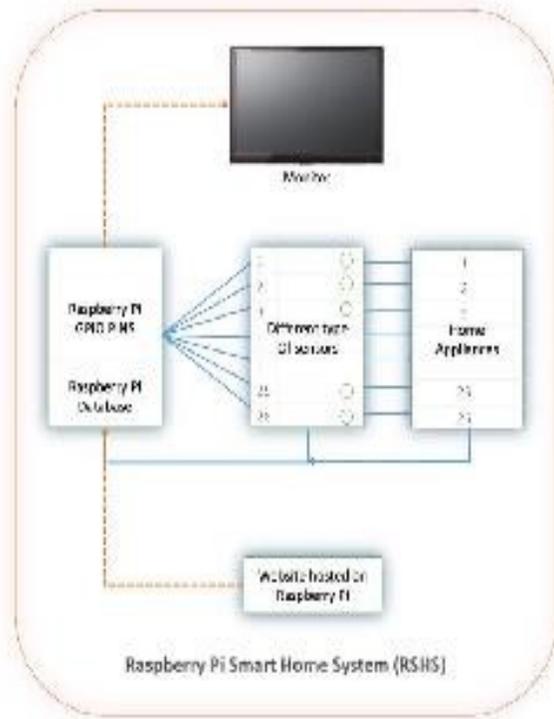


FIG3.1: SYSTEM DESIGN FOR SURVEILLANCE SYSTEM

## III. IMPLEMENTATION

### System Design:

The main aim of the system design is that the user can control the home appliances through mobile or laptop having internet facility using Raspberry Pi. A program is written to control home appliances and to get the current status (i.e, OFF or ON) of the appliances and to get the live streaming from camera connected to Raspberry Pi. It uses this program to get the status of appliances and to store the status on the database of website and it displays the current status of appliances and live streaming on monitor connected through HDMI port.

It is also used to stream video online i.e, we can see the live streaming anywhere through internet. We can connect it to several monitors at a time using HDMI extension switch. Thus Raspberry Pi will act as the central authority for controlling the home appliances and website database as well. Refer fig 3.1.

## IV. ALGORITHM

In Raspberry Pi, Raspian operating system [7] is installed. This Operating System is a Linux based one and it supports all programming languages like Python, C, C++etc.

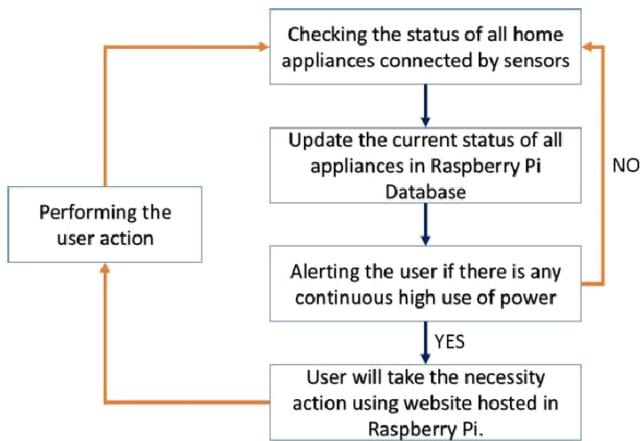


FIG4.1: ALGORITHM FOR SURVEILLANCE SYSTEM

Out of those, Python programming language is used in this system to communicate with General Purpose Input Output Ports and simple connection is made with databases using MYSQLDB [6] and Simple CV [8] modules. Refer the flowchart (Fig 4.1). For sending SMS to alert the user Serial module is used.

The proposed system can be demonstrated with the help of following steps:

- Import all the required modules i.e, Simple CV, MYSQLDB, Serial Module;
- Check the status (ON/OFF) of all home appliances connected to Raspberry Pi;
- Update the website database of appliances with the current status;
- Check whether the Raspberry Pi captures the surroundings using the camera;
- Using Simple CV, find whether the motion is present;
- If there is motion alert the user about the motion through SMS using GSM connected Raspberry Pi;
- If there is no motion Surveillance, check it continues the process from the beginning;

Whenever there is change in status of appliances then the changes are updated in website database.

## V. RESULTS

The system allows the user to control the appliances from anywhere in the world using an internet connection. The proposed home automation system is practically implemented and thus the results are obtained.

Results of the proposed automation system are as follows:

Fig 5.1 shows the website containing the status of all the home appliances and live status from the camera connected to Raspberry Pi.

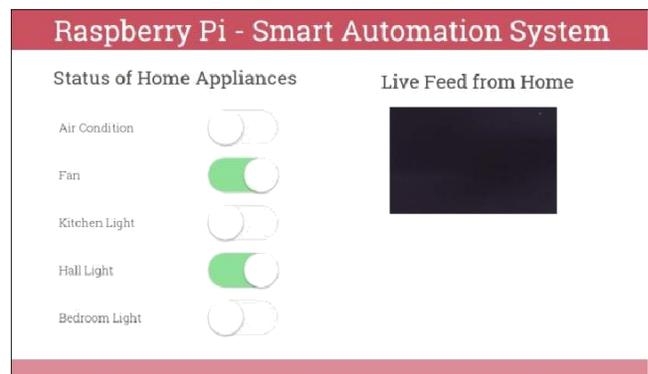


FIG5.1: WEBSITE SHOWING THE STATUS OF APPLIANCES AND LIVE STATUS FROM CAMERA

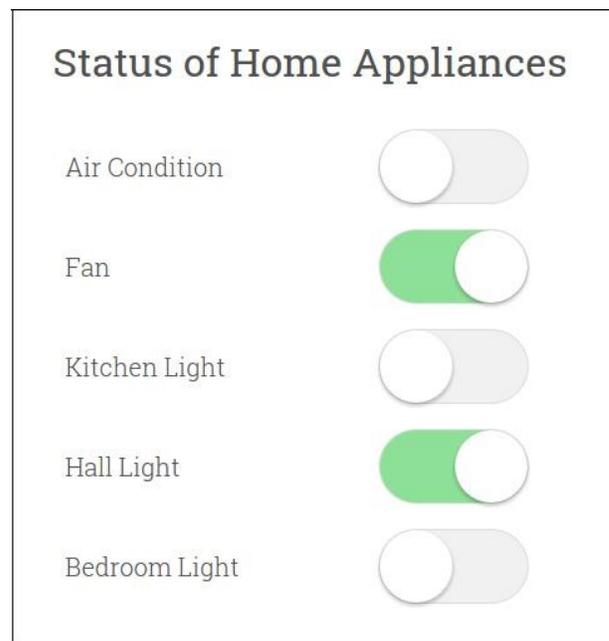


FIG5.1.1: STATUS OF HOME APPLIANCES



FIG5.1.2: LIVE STATUS FROM CAMERA

After detecting the motion Fig 5.2, Shows the process of cautioning the user.

```
pi@raspberrypi ~/Desktop $ python Project.py
VIDIOC_QUERYMENU: Invalid argument
VIDIOC_QUERYMENU: Invalid argument
VIDIOC_QUERYMENU: Invalid argument
VIDIOC_QUERYMENU: Invalid argument
<<< Updating the current statuses of Appliances >>>
DONE

<<< Finding the motion >>>
Motion Detected!!!
Sending Message to User...
AT+CMGS='+919492319493'
Message: Someone is in your area
Message Sent

<<< Finding the motion >>>
```

FIG5.2: RASPBERRY PI TERMINAL SHOWING THE RESULTS

## VI. CONCLUSION AND FUTURE WORK

In this paper, we are designing an advanced automation system which has surveillance system and which in turn reduces most of the human interactions, by supporting this system using Internet of Things (IoT). Finally, it is absolutely an affordable system. It can be associated with various other options like energy monitoring systems etc., soon, as an extension to this project a system may be developed which warns the user about the excess usage of energy.

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