

## Smart Home Automation and Live Streaming By Using Raspberry PI



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### *Abstract:*

*Raspberry Pi, an ARM11 based processor with 512MB of RAM and 8GB of SD Card is used as a main processor of this project. Pi Camera, USB Wi-Fi Dongle are connected to the Raspberry Pi at the USB ports for live streaming and to connect Internet. A web server is hosted in Raspberry Pi for live streaming (MOTION), and another web server is also hosted in Raspberry Pi for controlling the LOADS (FLASK). Both were created upon a boot, and a client smartphone is connected to the server for controlling the robot. Pi Camera will be on automatically upon a boot and it captures the frames and uploads them to the server. A simple LOAD controllers are created using Flask for controlling the LOADS. Pi camera is mounted on the Raspberry Pi for Live streaming. Whenever Load ON/OFF, we can see the LOADS ON/OFF through Pi camera.*

**Keyword** — *Raspberry Pi B+, Pi camera*

### **I. INTRODUCTION**

In the previous prototypes, the controlling of home appliances were done with the help of simple switches mounted to a board on a wall. There were many emerging trends in the field of Home Automation, and security. One among them is using CCTV Camera for monitoring the surroundings and the other is using

Android Smartphone for controlling the appliances in a room.

In the proposed solution, one can control the home appliance from anywhere around the globe and can see what's going on in a room from anywhere around the globe using Internet of Things Framework. A simple Pi Cam is interfaced to the processor for live streaming to see what's happening through Internet.

According to Gartner, Inc. (a technology research and advisory corporation), there will be nearly 26 billion devices on the Internet of Things by 2020. ABI Research estimates that more than 30 billion devices will be wirelessly connected to the Internet of Things (Internet of Everything) by 2020.

As per a recent survey and study done by Pew Research Internet Project, a large majority of the technology experts and engaged Internet users who responded—83 percent—agreed with the notion that the Internet/Cloud of Things, embedded and wearable computing (and the corresponding dynamic systems) will have widespread and beneficial effects by 2025. It is, as such; clear that the IoT will consist of a very large number of devices being connected to the Internet. In an active move to accommodate new and emerging technological innovation, the UK Government, in their 2015 budget, allocated

£40,000,000 towards research into the Internet of Things. The Chancellor, Rt Hon George Osborne, posited that the Internet of Things is the next stage of the information revolution and referenced the inter-connectivity of everything from urban transport to medical devices to household appliances.

The concept of the Internet of Things first became popular in 1999, through the Auto-ID Centre at MIT and related market-analysis publications. Radio-frequency identification (RFID) was seen as a prerequisite for the Internet of Things in the early days.

If all objects and people in daily life were equipped with identifiers, computers could manage and inventory them. Besides using RFID, the tagging of things may be achieved through such technologies as near field communication, barcodes, QR codes and digital watermarking.

Have to design a smart, low-cost and simple Internet of Things Controlled Robot which navigates in Coal Mines to detect hazardous gases.

The Internet of Things (IoT) is the network of physical objects or "things" embedded with electronics, software, sensors and connectivity to enable it to achieve greater value and service by exchanging data with the manufacturer, operator and/or other connected devices. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure.

## II.SYSTEM ARCHITECTURE

The system architecture of this proposed system is explained with the block diagram.

Each block represents way we are navigating the proposed project. It contains mainly seven blocks and master of all blocks is Raspberry Pi Processor. We have used Raspberry Pi B+ processor. We can use any flavour of Raspberry pi

For controlling the home appliance, I've interfaced TRIAC board which is connected to Raspberry pi and for live streaming I've interfaced Camera to the Raspberry Pi. For home appliance control I have designed framework using Internet of Things and to connect this Internet. I have connected WIFI dongle to the Raspberry Pi. Raspberry Pi works at 5V 1A for that I have used Power Bank.

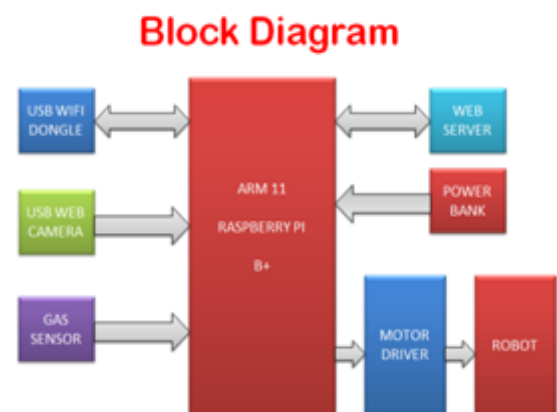


Figure – 1: Block Diagram

Above we have discussed what we have used in hardware now let's look in to the software, the processor Raspberry Pi is completely Linux based operating system. It is having its own Linux Operating System and the programming language is Python. Every motion of the system has done in Python itself. We have explained each block in depth in the next session.

## III.IMPLEMENTATION HARDWARE:

In hardware implementation, ARM11 processor (Raspberry Pi) plays a key role in monitoring and controlling the security system. Low-power consumption ARM11 processor (Raspberry Pi) operating at 3.3-5V, 50uA-1A is designed and mounted on a PCB along with Reset Circuit and a Clock Circuit. ARM11, a 32-bit microcontroller with advanced RISC architecture and having 40 GPIO lines with a program memory of 32KB and a data memory of 512Bytes.

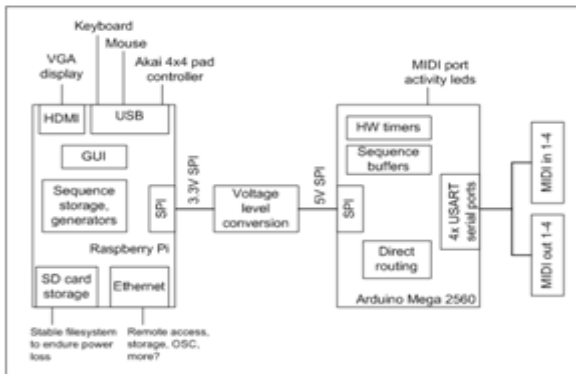


Figure – 2: ARM11 [Raspberry Pi] Overview

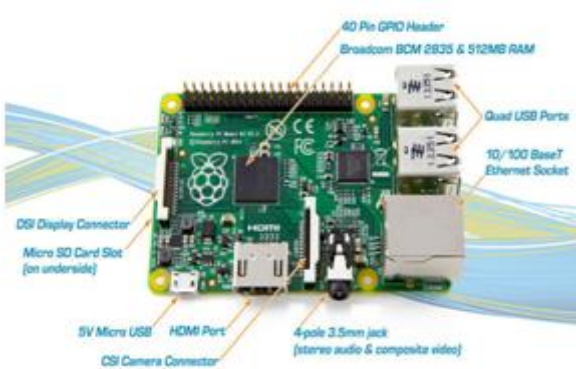


Figure – 3: Raspberry Pi Development Board

Here, in the above figure the 4 Quad USB Ports and 10/100 Base T Ethernet Socket, CSI Camera Connector, DSI Display Connector and 5V Micro USB and HDMI Port. We can see 40 GPIO Header and the processor in Raspberry pi is BCM 2835 and 512MB RAM. With the help of GPIO we can connect no of inputs and outputs and by using Quad USB we can connect the keyboard and mouse for software programming and also interface the USB Camera. The pin layout of Raspberry Pi is showed below

**GPIO Numbers**

Raspberry Pi B Rev 1 P1 GPIO Header		Raspberry Pi A/B Rev 2 P1 GPIO Header		Raspberry Pi B+ Rev 2 P1 GPIO Header	
Pin No.	Pin No.	Pin No.	Pin No.	Pin No.	Pin No.
3.3V	1	3.3V	1	3.3V	1
5V	2	5V	2	5V	2
GPIO0	3	GPIO0	3	GPIO0	3
GPIO1	4	GPIO1	4	GPIO1	4
GND	5	GND	5	GND	5
GPIO2	6	GPIO2	6	GPIO2	6
GPIO3	7	GPIO3	7	GPIO3	7
GPIO4	8	GPIO4	8	GPIO4	8
GPIO5	9	GPIO5	9	GPIO5	9
GPIO6	10	GPIO6	10	GPIO6	10
GPIO7	11	GPIO7	11	GPIO7	11
GPIO8	12	GPIO8	12	GPIO8	12
GPIO9	13	GPIO9	13	GPIO9	13
GPIO10	14	GPIO10	14	GPIO10	14
GPIO11	15	GPIO11	15	GPIO11	15
GPIO12	16	GPIO12	16	GPIO12	16
GPIO13	17	GPIO13	17	GPIO13	17
GPIO14	18	GPIO14	18	GPIO14	18
GPIO15	19	GPIO15	19	GPIO15	19
GPIO16	20	GPIO16	20	GPIO16	20
GPIO17	21	GPIO17	21	GPIO17	21
GPIO18	22	GPIO18	22	GPIO18	22
GPIO19	23	GPIO19	23	GPIO19	23
GPIO20	24	GPIO20	24	GPIO20	24
GPIO21	25	GPIO21	25	GPIO21	25
GPIO22	26	GPIO22	26	GPIO22	26
GPIO23	27	GPIO23	27	GPIO23	27
GPIO24	28	GPIO24	28	GPIO24	28
GPIO25	29	GPIO25	29	GPIO25	29
GPIO26	30	GPIO26	30	GPIO26	30
GPIO27	31	GPIO27	31	GPIO27	31
GPIO28	32	GPIO28	32	GPIO28	32
GPIO29	33	GPIO29	33	GPIO29	33
GPIO30	34	GPIO30	34	GPIO30	34
GPIO31	35	GPIO31	35	GPIO31	35
GPIO32	36	GPIO32	36	GPIO32	36
GPIO33	37	GPIO33	37	GPIO33	37
GPIO34	38	GPIO34	38	GPIO34	38
GPIO35	39	GPIO35	39	GPIO35	39
GPIO36	40	GPIO36	40	GPIO36	40

**Key:** Power = 3.3V, 5V; UART = SPI; FC = GPIO

Figure – 4: GPIO Pin out

Hardware implementation has divided into 3 major parts one is Motor Driver Implementation, second is Gas sensor Implementation and third Power circuitry.

### TRIAC Driver:

It is acting as a bridge between Raspberry Pi and AC Load. The TRIAC BT136's Terminal 1 and 2 are connected between AC Power and AC Load. The gate terminal of BT136 is connected to Optocoupler (MOC3021) where it is used for coupling the AC Load with AC Power when triggered by the Raspberry Pi. Following is the pin diagram for BT136 and MOC3021:

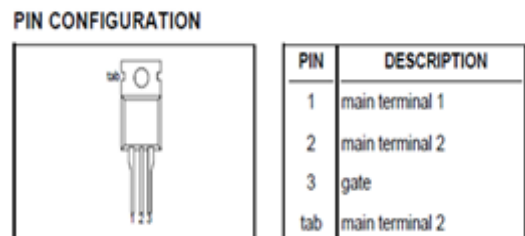


Figure – 5: L293D Pin Layout

TRIAC Board is interfaced to Raspberry Pi as shown below:

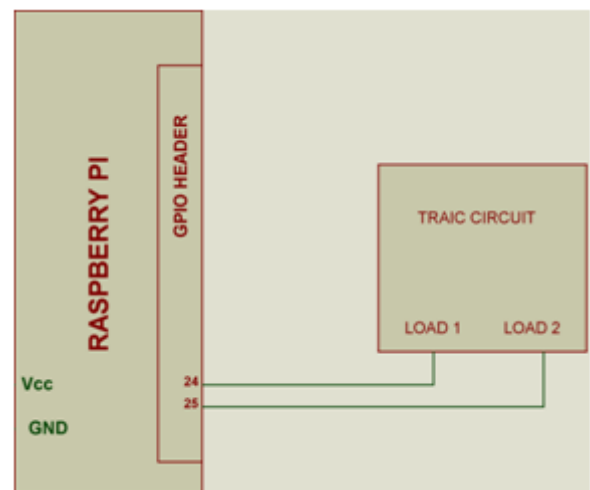


Figure – 6: L293D Interfacing with Raspberry Pi

Pi Camera: The Raspberry Pi Camera board contains a 5 MPixel sensor, and connects via a ribbon cable to the CSI connector on the Raspberry pi. Below I have shown Raspberry Pi camera.

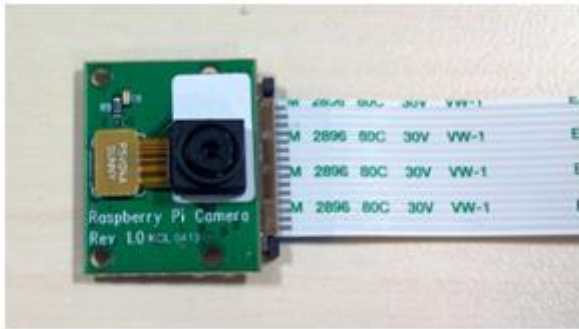


Figure – 7: Pi camera

**Power Circuitry:** Power circuit for Robot has showed below:

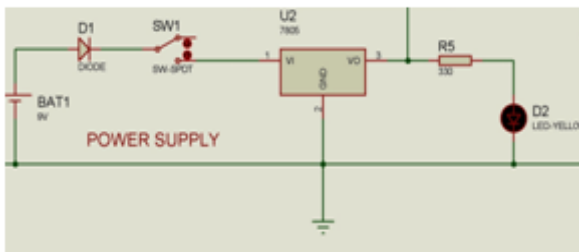


Figure – 8: Power circuitry

The final schematic diagram will be:

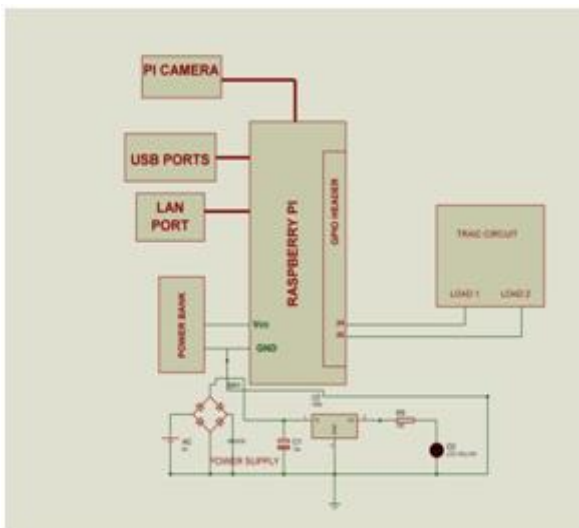


Figure – 9: Schematic Diagram

When we look into the schematic Loads are connected to GPIO of 24, 25 pins of Raspberry Pi B+ and Pi Camera is connected to Raspberry Pi B+. WIFI dongle connected using USB Ports and power bank is also connected to Raspberry Pi for power supply.

**SOFTWARE:**

Here, to program ARM11 [Raspberry Pi] processor, Python Idle interpreter was used, inbuilt we have all related drivers and softwares to build an application and Flask for web server design and camera server id done by motion.

**Pi Camera:**

Raspberry Pi camera should have to interface to the Raspberry Pi and Enable the Pi Camera by using Raspberry Pi configuration. Then download mjpg-streamerzip file on Raspberry Pi and extract zip file and install mjpg-streamer on to Raspberry Pi by using a simple Linux commands in a Linux Shell. After installing the mjpg-streamer run the camera by using simple commands in a linux prompt. Connections of Raspberry pi and Pi camera is:



Figure – 10: USB Camera

Installing Web server: Install Flask Web Server into Raspberry Pi Create a Python File to call home automation actions. Create a User Interface in HTML

**IV.ALGORITHM & FLOWCHART ALGORITHM:**

- Step – 1: Boot OS
- Step – 2: Open web server for Python and Camera
- Step – 3: Connect to the web server
- Step – 4: Press any action for controlling the light, and then the respective python code will be called

Step – 5: Camera and sensor status will be updated for every 4 seconds

Step – 6: Repeat step4 and step 5 until power goes off

**FLOWCHART:**

The flowchart of this paper is Showed Below

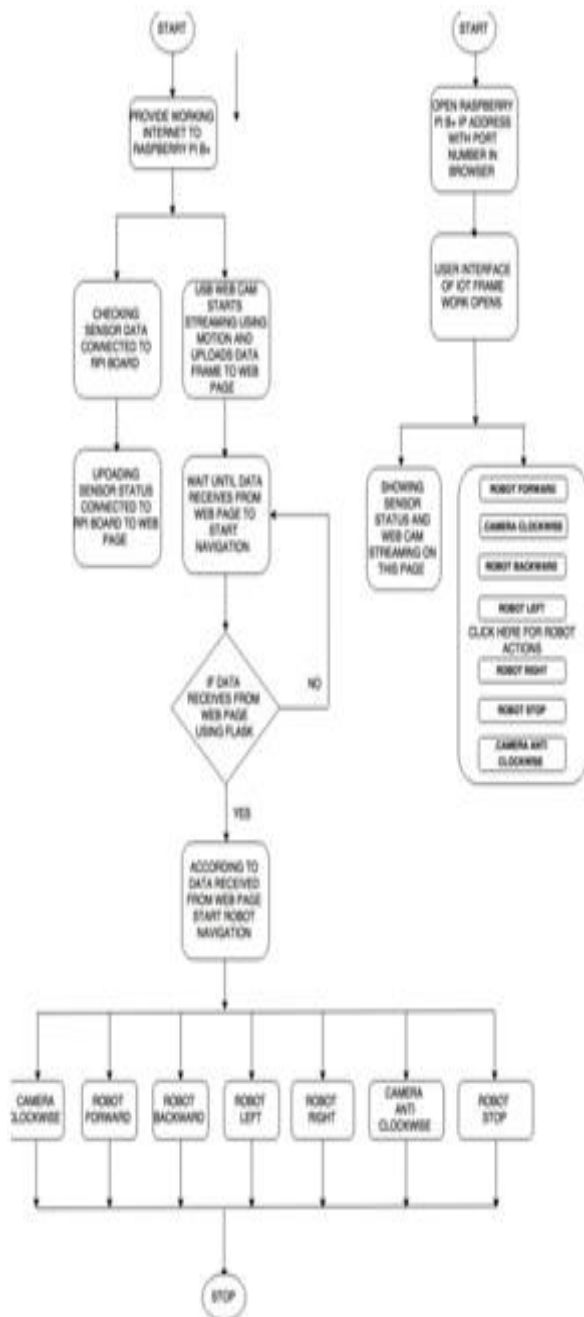


Figure – 12: Raspberry Pi Development Board

**V.RESULTS**



Figure – 13: Final Result Preview 1



Figure – 14: Final Result Preview 2



Figure – 15: Final Result Preview 3



Figure – 16: Final Result Preview 4



Figure – 17: Final Result Preview 5

## VI.CONCLUSION

Smart, Low-Cost, Simple and Secured IOT Device is designed on Raspberry Pi and Controlling the Home Appliances is done through web server along with streaming of camera

## ACKNOWLEDGEMENT

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