HOME SECURITY
(Prototype of a surveillance bot using Raspberry pi and Pi camera)

Thesis submitted in partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

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May 2017

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DECLARATION BY THE SCHOLAR

I hereby declare that the work reported in the B-Tech thesis entitled "**Title (14 bold)**" submitted at **Jaypee University of Information Technology,Waknaghat India,** is an authentic record of my work carried out under the supervision of **Dr. Rajiv Kumar.** I have not submitted this work elsewhere for any other degree or diploma.

(Signature of the Scholar)

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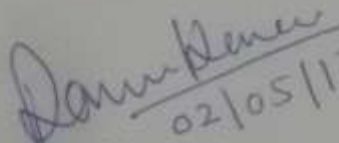
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SUPERVISOR'S CERTIFICATE

This is to certify that the work reported in the B-Tech. thesis entitled "HOME SECURITY", submitted by **Deepanshu Dhingra Kanika Saraswat and Priyadarshni** at **Jaypee University of Information Technology, Waknaghat , India,** is a bonafide record of his / her original work carried out under my supervision. This work has not been submitted elsewhere for any other degree or diploma.

02/05/17

(Signature of Supervisor)

Dr. Rajiv Kumar

Associate Professor (Senior Grade)

Date

ACKNOWLEDGEMENT

We have taken efforts in this project. However, it would not have been possible without the kind support and help of many individuals and organizations.

We would like to extend our sincere thanks to all of them. We are highly indebted to Dr Rajiv Kumar for their guidance and constant supervision as well as for providing necessary information regarding the project & also for his support in completing the project.

We would like to express our gratitude towards our parents & member of Jaypee University Of Information Technology for their kind co-operation and encouragement which helped us in working on this project.

We would like to express our special gratitude and thanks to industry persons for giving us such attention and time.

LIST OF ACRONYMS & ABBREVIATIONS

(Alphabetically)

AC   ALTERNATING CURRENT

API   APPLICATION PROGRAM INTERFACE

ARM   ADVANCED RISC MACHINES

CPU   CENTRAL PROCESSING UNIT.

CSI   CAMERA SERIAL INTERFACE

EN   ENABLE.

ESD: ELECTROSTATIC DISCHARGE

DPDT   DOUBLE POLE DOUBLE THROW

FPS   FRAMES PER SECOND

GPIO   GENERAL PURPOSE INPUT OUTPUT

HDMI   HIGH-DEFINITION MULTIMEDIA INTERFACE

I/O: INPUT/OUTPUT

IOT   INTERNET OF THINGS

MJPG   MOTION-JOINT PHOTOGRAPHIC EXPERTS GROUP.

PC   PERSONAL COMPUTER

RAM   RANDOM ACCESS MEMORY.

RISC   REDUCED INSTRUCTION SET COMPUTER

RPM   REVOLUTIONS PER MINUTE.

SD: SECURE DIGITAL

SDHC   SECURE DIGITAL HIGH CAPACITY

SOC   SYSTEM-ON –A-CHIP

SPDT   SINGLE POLE DOUBLE THROW

TTL: TRANSISTOR-TRANSISTOR LOGIC

VCC: VOLTAGE IN A COMMON NPN CIRCUIT.

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ABSTRACT

This venture endeavours to address the requirement for an independent home security framework. As of now, home security frameworks require numerous expensive segments and a confounded establishment prepare. Two fundamental sorts of frameworks are at present accessible. The first is a wired framework. One disadvantage is that establishment of a wired framework can take a considerable measure of time what's more, cash. Another downside is that it is a changeless piece of the home. On the off chance that the proprietor moves, the security framework must remain. The second sort of framework is a remote one. The parts for this are additionally exorbitant. Remote frameworks are more versatile, however they require batteries which must be changed from time to time. The reason for the proposed framework will be to dispense with the disadvantages of both wired and remote frameworks. The proposed framework will comprise of a solitary unit, which will screen the home for different risky conditions and give video criticism by means of a web interface.

CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

It might appear that the wonder of robots has come into existence just as of late with every one of the complexities and progression confronted in its making. At the point when in all actuality such gadgets have roots dating as long back as old Greece and Chinese administrations in its initial days. Robots had been first portrayed in first century. These gadgets are known as machines, from the Greek word robots, or "acting of one's own will".

Robots are for all intents and purposes ubiquitous as we approach our lives. Business and different establishments are in wonderment of them. They finish an excursion of right around 3000 years of making.

With the approach of Internet of things, these robots have jumped into our homes for such a large number of purposes. Security, simplicity of work, and so on.. However while the expansion of remote network has conveyed a similarity of knowledge to our indoor regulators and lights, by transforming our cell phones into remote controls for the "web of things", introducing, utilizing and dealing with all these new gadgets remains a work of quirky love.

1.2 SECURITY

When you take a gander at your family, and your home, you know you need them to be protected, constantly out of damage's way. When you leave for work, you hope to return to a grinning family, and to a home that is secure. The developing wrongdoing rates crosswise over urban areas mirror the biting reality. Many individuals neglect, overlook, and belittle the need of taking fitting home safety efforts.

To adapt up to this request we have made one little stride ahead through this venture.

Home security is a prime issue of concern since it's not just about your money related or fiscal wellbeing but rather a great deal more than that. Everybody need the joy and security of their dear ones. Nobody can see their relatives in peril or in risky circumstance. This is the key motivation behind why Home security is critical.

1.3 IMPLEMENTATION

Implementation of Home Security can be carried out using Embedded System. In this project we have used Raspberry Pi to facilitate the purpose of providing the hardware and software platform to for implementation. Pi camera is connected to the Raspberry Pi which is clicking pictures at a delay of 5 fps.

1.4 WHY HOME SECURITY

Introducing, outfitting, incapacitating, paying month to month expenses, and managing false alerts are all things that are attached to observed security frameworks which may make you think about whether home security frameworks are justified regardless of the characteristic bother. This is a decent thing to ask as you consider how you can best secure your valuables and your friends and family.

There are a considerable measure of components to consider with regards to home security frameworks and that incorporates how the security framework could profit you and your family. Here are a couple reasons how that is valid.

1. Ensures Valuables

This is, obviously, the advantage a great many people instantly consider. We likely all know somebody who has lost hardware, gems, or other high-esteem things because of a home attack. The catastrophe is intensified when the thing is a basic family legacy. A home security framework has an alert that alarms off many would-be robbers and can tell the nearby experts in the event that somebody attempts a break-in.

2. Dissuades Crime

Recent reports found that, as the quantity of home security frameworks expanded in a region, the quantity of private burglaries diminished here, notwithstanding for individuals who didn't have their own security framework. Having a security framework ensures you, as well as helps your neighborhood be a more secure place for everybody.

3. Enables Remote Access to Your Home

Present day security frameworks now enable you to remotely screen what's going on in your home when you're not there. Contingent upon your supplier, you can screen what happens by means of cameras introduced all through your home, and control the indoor regulator, entryway locks, lights, and different gadgets in your home.

4. <u>Brings down Homeowner's Insurance</u>

Yes, you might pay a month to month expense for your security framework, however having the framework in your home can bring down your mortgage holder's protection by up to 20%. That, consolidated with alternate advantages, makes an alert framework a really decent arrangement.

5. <u>Informs You of Fire or Gas Problems</u>

You can select to get warnings if your smoke or carbon monoxide alerts go off when you're far from home. Contingent upon the supplier, you can even set it up so specialists are in a split second told of these crises.

6. <u>Watches Kids</u>

This is another awesome part of home computerization. In case you're grinding away, you can utilize your supplier's portable application to watch what's going on in your home by means of cameras, so you'll know who your teenagers are welcoming over when you're away. On the off chance that you have programmed entryway locks, you can even remotely open them to give the children access after school, so they don't need to stress over conveying (and conceivably losing) a key to the house.

7. <u>Enhances Electricity Management</u>

Numerous security frameworks offer brilliant indoor regulators and outlets. In the event that you've neglected to change your indoor regulator before leaving on an excursion, these contraptions enable you to control the indoor regulator on any web-empowered gadget. Similarly, on the off chance that you think you exited you're hair curler connected to, you can turn it off appropriate from any of your gadgets. This fills in as an incredible apparatus to turn lights on and off while you're on an excursion to help give the home the appearance that somebody is there.

8. <u>Prepares for Peace of Mind</u>

The feeling that all is well with the world and peace you pick up with a caution framework is maybe the best advantage of all. Beside being sheltered, the certainty of feeling safe will help you be a more gainful, sound, and centered individual.

Adding a security framework to your home gives you an additional layer of barrier against any potential interlopers. Regardless of whether you lease or claim, you can appreciate the advantages that accompanied having a security framework.

1.5 MARKETING REQUIREMENTS

1. The robot should be relatively inexpensive.
2. The robot should be able to navigate across various types of floors seen in modern homes.
3. The robot should be intuitive and easy to use for the average homeowner.
4. The robot should include safety mechanisms.
5. The robot should require minimum amount of setup for basic use.
6. The robot should move autonomously.
7. The robot should be configurable by the user.
8. The robot should be able to sense multiple hazards such as motion, sound, and some common hazardous gas.
9. The robot should be capable of backing up data.
10. The robot should be expandable for increased coverage and security.
11. The robot should be capable of transmitting real-time data over some medium

CHAPTER 2

THE BOT

2.1 INTRODUCTION

A bot is a reprogrammable, multifunctional gadget created to give help and make everyday life simpler for client. We have attempted to build up a bot that could help the client keep check over his/her possessions or home when the client is away. The motivation behind outlining such a bot is to help the client to keep mind different spots or a specific element.

2.2 DESCRIPTION

The bot is made on metal stage called the metallic body which has an apparatus box connected to it. 200RPM 12V apparatus engines which are anything but difficult to utilize and accessible in standard sizes. It has 6 mm shaft measurement that has inward gap. Nuts and strings on the pole helps it effectively interface and inner strung shaft helps it effortlessly associate with the wheel.

Figure 2.1: DC motor

2.2.1 AC ADAPTER

An AC connector is a kind of outer power supply. An AC connector is utilized with electrical gadgets that require control yet don't contain inside parts to infer the required voltage and power from mains control. Outside AC connector has its own leverage:

•   Safety - It liberates item creators from agonizing over the wellbeing issues. A lot of this style of hardware uses just voltages sufficiently low to be a security issue inside. The gear does not should be composed with worry for inward voltage dangers.

•   Heat Reduction - Heat lessens unwavering quality and life span of electronic segments, and can make touchy circuits glitch. A different power supply expels a wellspring of warmth from the gear.

•   Electrical Noise Reduction - Since transmitted electrical commotion tumbles off with the square of the separation, it is to the producer's leeway to change over possibly uproarious AC line energy to clean power lie.

•   Weight and Size Reduction - Removing power segments and the mains associating plug from gear fueled by rechargeable batteries lessens the weight and size which must be conveyed.

2.2.2 Double Pole Double Throw (DPDT) Switch

A DPDT switch has a pair of inputs and four outputs, every input has a pair of corresponding outputs that it will hook up with.
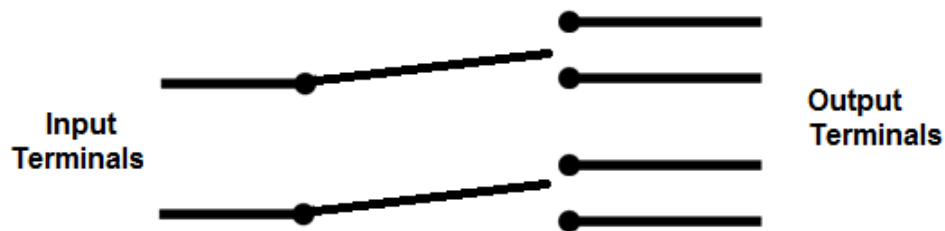

Figure 2.2 - input output configuration of DPDT

A Double Pole Double Throw electric switch acts specifically like 2 separate SPDT switches connected to constant switch bat. It's 2 separate common terminals and every of these is connected to at least one or the opposite of the opposite 2 terminals on constant aspect of the switch.
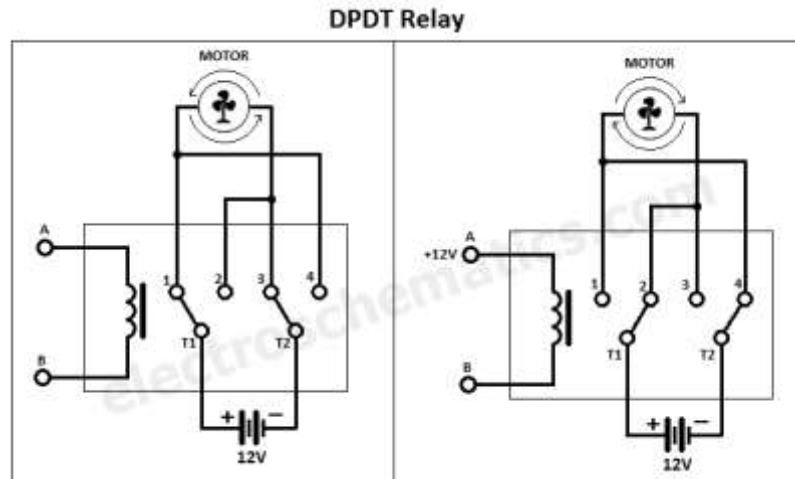
Figure 2.3 - DPDT Relay

As we will see within the schematic the 12V battery is connected with the positive at terminal T1 and negative at terminal T2. The contact one and four ar connected along as a pair of and three ar too.

Without voltage applied to the coil the positive of battery is connected to contact one (and 4) and negative to three (and 2) thus the motor is popping in one direction. once voltage is applied to the coil then the relay switches and currently T1 (positive) is connected to contact a pair of (and 3) and T2 (negative) is connected to four (and 1) thus the motor is dynamic the direction of rotation.

CHAPTER 3

INTERFACE PLATFORM

3.1 OVERVIEW

To provide the user interface for the bot we have staged our bot over raspberry pi. Raspberry pi is a microcontroller that helps provide the platform to user friendly interface to connect the camera and motor drivers to control the bot and act as eyes for the user.

3.2 RASPBERRY PI

3.2.1 OVERVIEW

Raspberry Pi is a progression of little single-board PCs initially created to advance instructing of fundamental software engineering in schools. A few eras of Raspberry Pi's have been discharged.

A "process module" was discharged in for implanted applications, with littler size and lessened information/yield (I/O) and broadly useful information/yield (GPIO) capacities.

All models highlight a Broadcom framework on a chip (SOC), which incorporates an ARM perfect focal preparing unit (CPU) and an on-chip representation handling unit . CPU speed ranges from 700 MHz to one.2 GHz for the Pi three and on board memory go from a pair of56 MB to one GB RAM. Secure Digital (SD) cards area unit used to store the operating framework and program memory in either the SDHC or small SDHC sizes. Most sheets have within the locality of 1 and 4 USB openings, HDMI and composite video yield, and a 3.5 millimetre jack for sound. Bring down level yield is given by varied GPIO pins that bolster basic conventions like I²C. The B-models have a 8P8C LAN port and therefore the Pi three and Pi Zero W wear board Wi-Fi 802.11n and Bluetooth.

The Foundation furnishes Raspberry pi with working framework RASPBIAN, a Debian-based Linux dispersion, and in addition outsider UBUNTU, WINDOWS 10 IOT CORE, RISC OS. It advances Python and Scratch as fundamental programming dialect, mind support of other programming dialects as well.
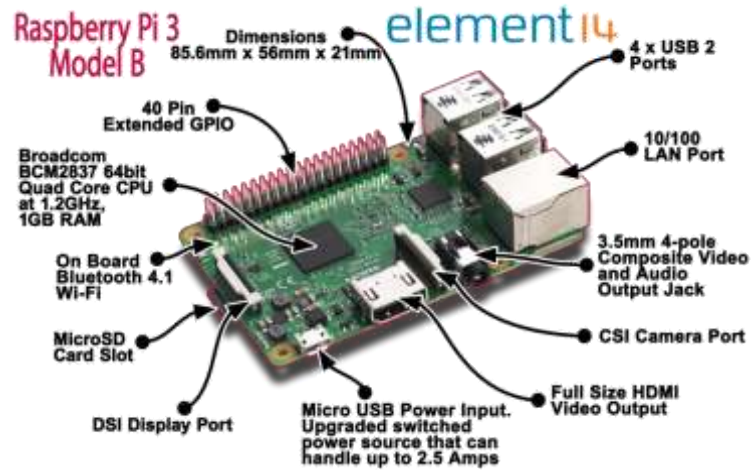
Figure 3.1 - Raspberry pi

3.2.2 HARDWARE

The Raspberry pi hardware has evolved through several versions that features variations in memory and peripheral-device support for better use.

3.2.2.1 PROCESSOR

The Broadcom BCM2835 SOC utilized as a part of first era of raspberry pi is to some degree like first era cell phones which incorporates 700 MHz ARM1176JZF-S processor, VideoCore IV representation handling unit (GPU), and RAM. It has a level 1 reserve of 16 KB and a level 2 store of 128 KB which is basically utilized by GPU.

Raspberry pi 3 has BROADCOM BCM2837 SOC with a 1.2 GHz 64-bit quadcore ARM Cortex-A53 processor, with 512 KB shared level 2 store.

3.2.2.1.1 PERFORMANCE

Raspberry pi 3, with a quad-center Cortex-A53 processor, which is 10 times the execution of Raspberry Pi 1. Benchmarks demonstrate that Pi 3 is roughly 80% quicker than Pi 1 in parallelized undertakings.

3.2.2.1.2 OVERCLOCKING

The CPU chips of the first and second era loads up did not require cooling unless the chip was overclocked. Be that as it may, in Pi 3 the SOC needs cooling thus it has warm sink. This is finished by observing the center temperature of the chip, the CPU stack, and progressively modifying clock speeds and the center voltage.

3.2.2.2 POWER SOURCE

Pi expends 700mA or 3W of energy which is fueled by MicroUSB or GPIO header.

3.2.2.3 SD CARD

The Raspberry Pi does not have any installed stockpiling accessible. The working framework is stacked on a SD card which is embedded on the SD card space on the Raspberry Pi. The working framework can be stacked on the card utilizing a card peruser on any PC.

3.2.2.4 GPIO

GPIO – General Purpose Input Output is a nonexclusive stick on an incorporated circuit whose conduct, including whether it is an info or yield stick, can be controlled by the client at run time.

Figure 3.2 - Pin configuration of Pi

3.2.2.5 ETHERNET

The Pi has an Ethernet port controlled by Microchip LAN9512 controller chip.

3.2.2.6 CSI CONNECTOR

Camera Serial Interface is designed to aim at interfacing digital cameras with mobile processors.

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3.3 SOFTWARE

3.3.1 OPERATING SYSTEM

The Raspberry Pi principally utilizes Linux bit based working frameworks. The installer supervisor of for Raspberry Pi is NOOBs. The OS included with it are as per the following:

• Archlinux ARM

• OpenELEC

• Pidora (Fedora Remix)

• Raspbmc and the XBMC open source advanced media focus

• RISC OS – The working arrangement of the principal ARM-based PC

• Raspbian

3.3.2 THE NOOBs INSTALLER

The working framework is first stacked on a SD card from a PC and after that the SD card is embedded in Pi which turns into the essential boot gadget.

The NOOBS installer can be downloaded from it's authentic site. The client just needs to associate a SD card with the PC and run the setup record to introduce NOOBS on the SD card. Next, embed the card on the Raspberry Pi. On booting, first the NOOBS interface is stacked and after that the client can choose from a rundown of working frameworks to introduce or introduce the coveted OS specifically. It is much simple to introduce the working framework thusly. Likewise once the working framework is introduced on the card with the NOOBS installer, each time the Pi boots, a recuperation mode given by the NOOBS is gotten to by holding the move scratch amid boot. It additionally permits altering of the config.txt petition for the working framework .

3.3 PI CAMERA

The Raspberry Pi Camera module is utilized to take still photos of the place. It is anything but difficult to utilize and has a lot of elements, for example, time-slip by, moderate movement and other video impacts.

The Pi camera has five megapixel settled concentration camera that backings 1080p30, 720p60 and VGA90 video modes and in addition stills catch. It joins through a 15 cm strip link to the CSI port on the Raspberry Pi.
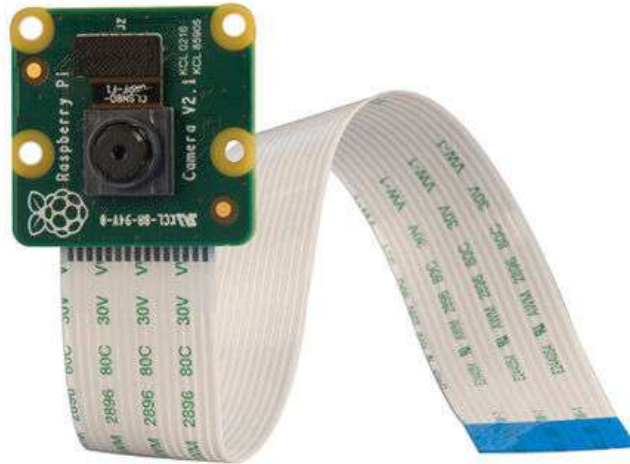

Figure 3.3 - Pi camera

	CAMERA MODULE 1	CAMERA MODULE 2
Size	Around $25 \times 24 \times 9$ mm	
Weight	3g	3g
Still resolution	5 Megapixels	8 Megapixels
Video modes	1080p30, 720p60 and $640 \times$ 480p60/90	1080p30, 720p60 and $640 \times$ 480p60/90
Linux integration	V4L2 driver available	V4L2 driver available
C programming API	Open MAX IL and others available	Open MAX IL and others available
Sensor	Omni Vision OV5647	Sony IMX219
Sensor resolution	2592×1944 pixels	3280×2464 pixels
Sensor image area	3.76×2.74 mm	3.68 x 2.76 mm (4.6 mm diagonal)
Pixel size	1.4 μm $\times$ 1.4 μm	1.12 μm x 1.12 μm
Optical size	1/4"	1/4"

Table 3.1 - Specifications of Pi camera

3.4 L293D

3.4.1 FEATURES

- Wide Supply-Voltage Range: 4.5 V to 36V
- Separate Input-Logic Supply
- Internal ESD protection
- Output current 600mA per channel
- Peak output current of 1.2A per channel
- Output clamp diodes for Inductive Transient Suppression

3.4.2 DESCRIPTION

The L293D is a fourfold high-flow half-H driver. The L293D is intended to give bidirectional drive streams of up to 600-mA at voltages from 4.5 V to 36 V. It is reasonable to drive little DC-Geared engines, bipolar stepper engine. L293D is intended to drive inductive loads, for example, transfers, solenoids, dc and bipolar venturing engines, and in addition high present or voltage stacks in positive-supply applications.

All information sources are TTL perfect. Each yield is a total chain of command drive circuit, with a Darlington transistor sink and a pseudo Darlington source. Drivers are empowered in sets, with drivers 1 and 2 empowered by 1,2EN and drivers 3 and 4 empowered by 3,4EN. At the point when an empower information is high, the related drivers are empowered, and their yields are dynamic and in stage with their data sources. At the point when the empower info is low, those drivers are debilitated, and their yields are off and in the high-impedance state. With the best possible information inputs, each combine of drivers structures a full-H (or scaffold) reversible drive reasonable for solenoid or engine applications.
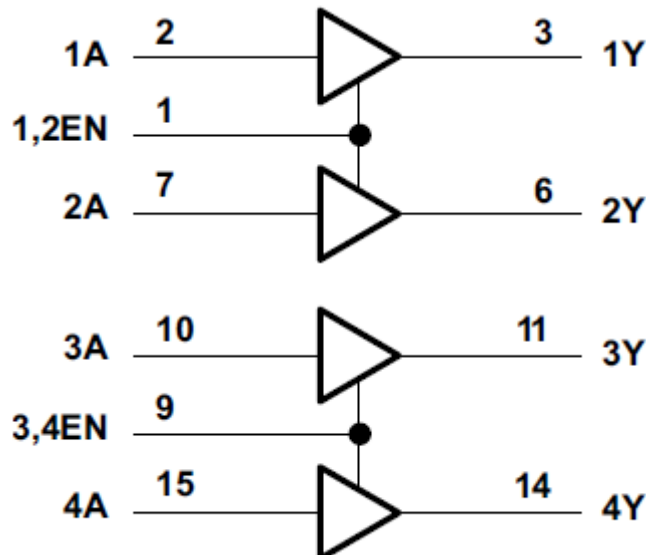

Figure 3.4 - Logic diagram of L293D
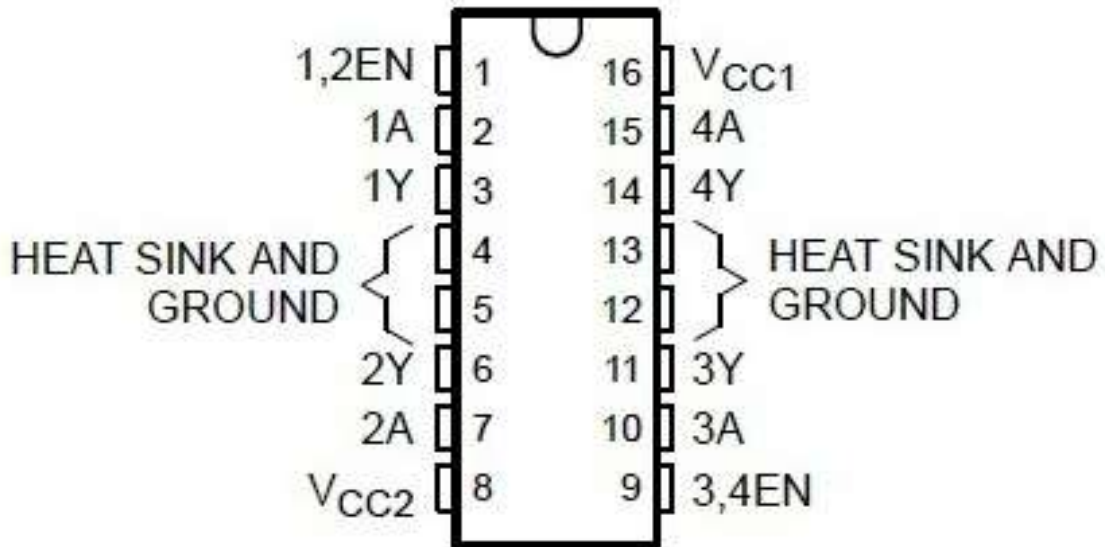
3.4.3 PIN CONFIGURATION AND FUNCTIONS

Figure 3.5 - Pin configuration of L293D

PIN		TYPE	DESCRIPTION
NAME	**NO.**		
1,2 EN	1	I	Enable driver channels 1 and 2 (active high input)
<1:4> A	2,7,10,15	I	Driver inputs, non-inverting
<1:4> Y	3,6,11,14	o	Driver outputs
3,4EN	9	L	Enable driver channels 3 and 4(active high)
GROUND	4,5,12,13	-	Device ground and heat sink pin. Connect to printed-circuit-board ground plane with multiple solid vias
VCC1	16	-	5-V supply for internal logic translation
VCC2	8	-	Power VCC for drivers 4.5 to 36 V

Table 3.2 - Pin functions of L293D
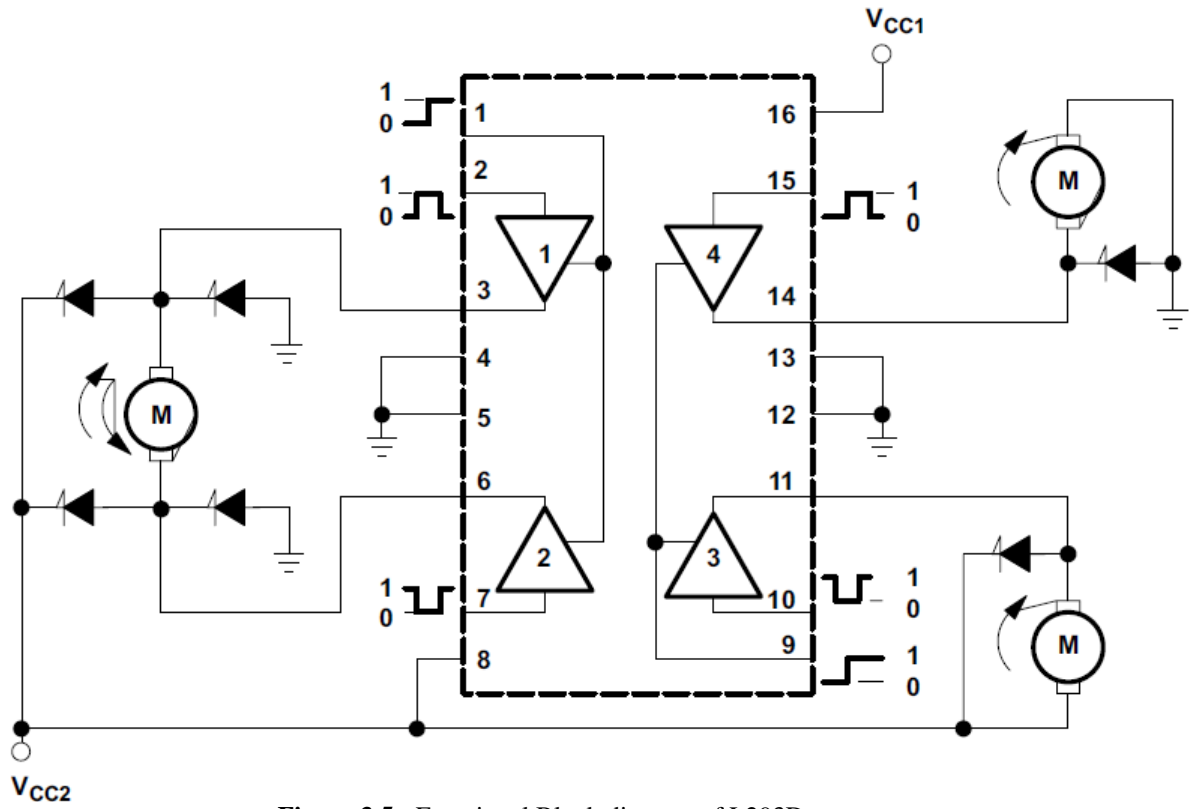
3.4.4 FUNCTIONAL BLOCK DIAGRAM

Figure 3.5 - Functional Block diagram of L293D

CHAPTER 4

RUNNING PI CAMERA

4.1 INTRODUCE FABRICATE CONDITIONS

The accompanying summon introduces the three libraries that MJPG-Streamer employs:

```
$ sudo apt-get install libjpeg8-dev imagemagick libv4l-dev
```

4.2 Include missing videodev.h

The videodev.h header record that MJPG-Streamer needs has been supplanted with a videodev2.h. To fulfill MJPG-Streamer you need to make a typical connection:

```
$ sudo ln -s /usr/include/linux/videodev2.h /usr/include/linux/videodev.h
```

4.3 Download MJPG-Streamer

The source code for MJPG-Streamer is accessible at sourceforge.net, however it is precarious to locate the direct download interface:

```
$         wget         http://sourceforge.net/code-snapshots/svn/m/mj/mjpg-
streamer/code/mjpg-streamer-code-182.zip
```

Take note of that occasionally the connection above neglects to work. On the off chance that that is the situation, you can likewise download from your web program by opening this page: http://sourceforge.net/p/mjpg-streamer/code/HEAD/tarball.

4.4. Unfasten the MJPG-Streamer source code

The source code download is a compacted compress document. Put the record in your home index (or a transitory organizer, on the off chance that you incline toward) and run the accompanying to remove the documents:

```
$ unzip mjpg-streamer-code-182.zip
```

4.5 Construct MJPG-Streamer

MJPG-Streamer accompanies a few modules, yet just a few them are expected to stream video as per the strategy I clarified in my past article. The charge beneath just forms what's required:

```
$ cd mjpg-streamer-code-182/mjpg-streamer
$ make mjpg_streamer input_file.so output_http.so
```

4.6 Introduce MJPG-Streamer

We didn't talk about establishment in the past article, and that befuddled numerous perusers. The accompanying orders duplicate all the required records into framework catalogs:

```
$ sudo cp mjpg_streamer /usr/local/bin
$ sudo cp output_http.so input_file.so /usr/local/lib/
$ sudo cp -R www /usr/local/www
```

4.7 Begin the camera

We are nearly there. Presently the time has come to begin the camera module:

```
$ mkdir /tmp/stream
$ raspistill --nopreview -w 640 -h 480 -q 5 -o /tmp/stream/pic.jpg -tl 100 -t
9999999 -th 0:0:0 &
```

Obviously, we can utilize distinctive choices to raspistill on the off chance that you like.

4.8 Begin MJPG-Streamer

The camera is currently composing pictures, so all that is left is to begin MJPG-Streamer:

```
LD_LIBRARY_PATH=/usr/local/lib mjpg_streamer -i "input_file.so -f /tmp/stream
-n pic.jpg" -o "output_http.so -w /usr/local/www"
```

4.9 Watch the Stream!

 Presently you can associate with your web program for appreciating the live stream. On the off chance that you need to watch from inside a similar Raspberry Pi you can enter http://localhost:8080 in the program's address bar. On the off chance that you need to watch from another PC in your system utilize http://<IP-address>:8080.

4.10 Cleanup

After you check that everything is working you can evacuate the source code:

```
$ cd ../../
$ rm -rf mjpg-streamer-182
```
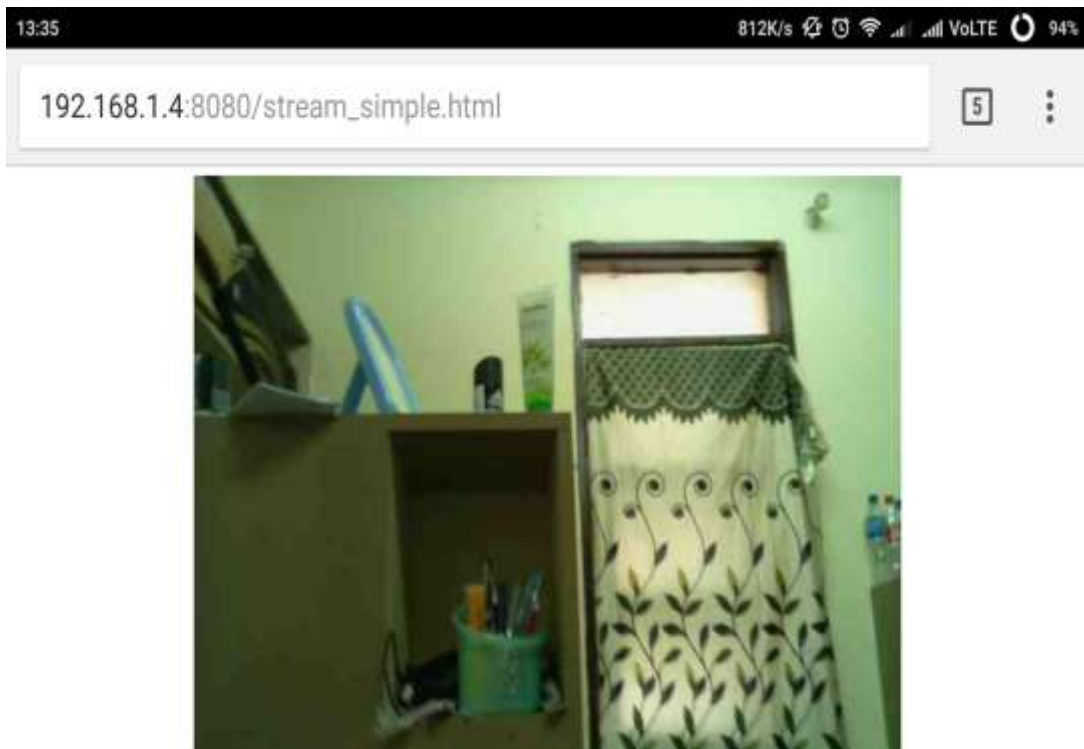
CHAPTER 5
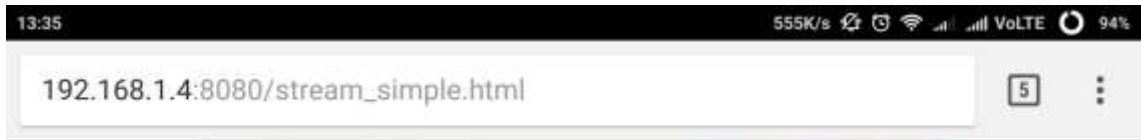
RESULTS

Figure 5.1- Result 1

Figure 5.2- Result 2

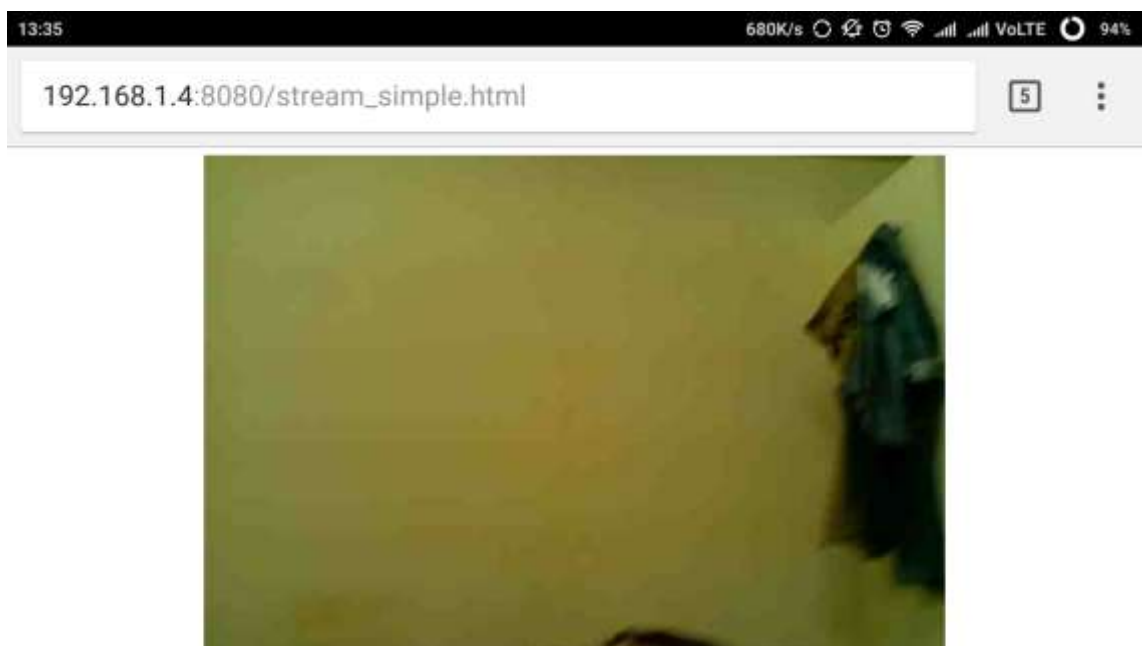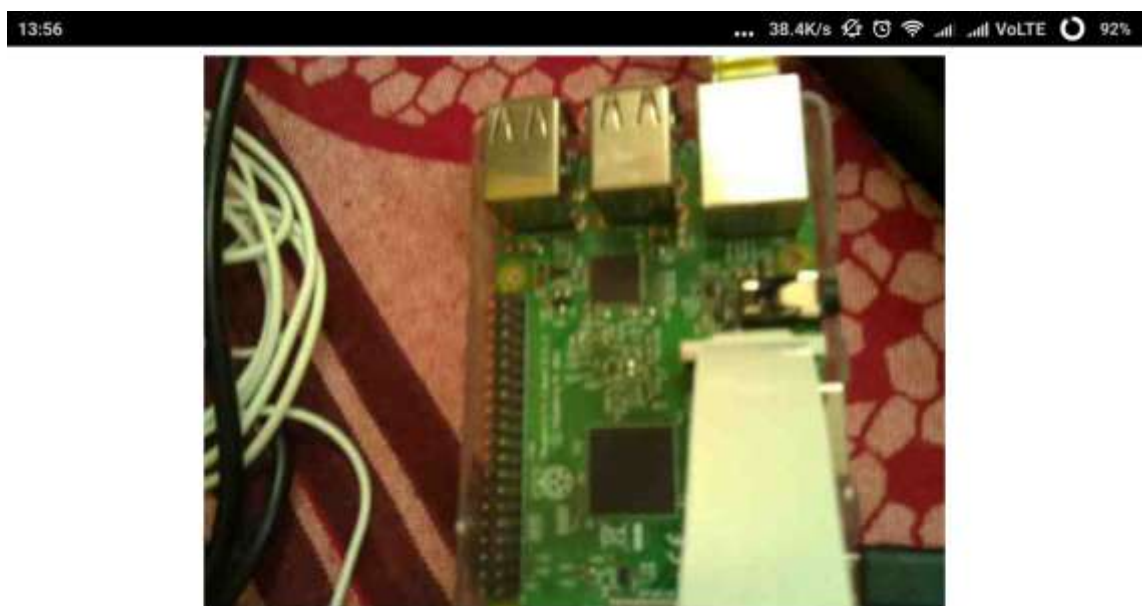**Figure 5.3**- Result 3

Figure 5.4- Result 4

Figure 5.5- Result 5

Figure 5.6- Result 6

CONCLUSIONS AND FUTUREWORKS

To conclude, we have implemented camera interface with the help of Pi camera mounted on Raspberry Pi. The setup is supported by a metallic bot that gives it the platform to move. The drawback of this prototype is that it is wired and hence is not yet supporting much freedom of space and connectivity from far places.

As future work we are planning to make the bot wireless so that the user can access the pictures of the desired location from any place they wish to.

Also we are planning to try and stream live video instead of pictures of the environment so that the user has a better look of the surveillance.

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