# VISVESVARAYA TECHNOLOGICAL UNIVERSITY

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**A**
**BE MINI-PROJECT (19EC6DCMPR) REPORT**
on

# Wide Angle Coverage Live Video Streaming Using Raspberry Pi

*Submitted in partial fulfillment of the requirement for the degree of*

**Bachelor of Engineering**
*in*
**Electronics & Communications Engineering - ECE**
*by*


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**2021-22**

# Certificate

Certified that the mini-project work **(19EC6DCMPR)** entitled "**Wide Angle Video Coverage Live Video Streaming using Raspberry Pi"** carried out by **Konkala Sourabh** (USN-1DS19EC063), **Mangala Shashank**(USN-1DS19EC074), **Mo Imran** (USN-1DS19EC080), **Nalliboyina Yuva Raja Phani Kumar** (USN-1DS19EC085) are bonafide students of the ECE Dept. of Dayananda Sagar College of Engineering, Bangalore, Karnataka, India in partial fulfillment for the award of Bachelor of Engineering in Electronics & Communication Engineering of the Visvesvaraya Technological University, Belagavi, Karnataka for the VI Semester course during the academic year 2021-22. It is certified that all corrections / suggestions indicated for the mini-project work have been incorporated in the mini-report submitted to the ECE department. This Mini-Project report has been approved as it satisfies the academic requirement in respect of mini-project work prescribed for the said degree.

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Name of the mini-project examiners (int & ext) with date:

1 : Signature : _____

2 : Signature : _____

# Declaration

Certified that the mini-project work entitled, " **Wide Angle Coverage Live VideoStreaming Using Raspberry Pi** " with the course code **19EC6DCMPR**(2 Credits, 100 Marks, CIE & SEE 50 marks each) is a bonafide work that was carried out by ourselves in partial fulfillment for the award of degree of Bachelor of Engineering in Electronics & Communication Engg. of the Visvesvaraya Technological University, Belagavi, Karnataka during the academic year 2021-22for the VI Semester Autonomous Course. We, the students of the mini-project group/batch B-03 do hereby declare that the entire mini-project has been done on our own & we have not copied or duplicated any other's work. The results embedded in this mini-project report has not been submitted elsewhere for the award of any type of degree.

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# Abstract

In today's world, surveillance systems like CCTV are extremely popular but they require high cost for installation and they are not much flexible and scalable. Live Video Broadcasting like Television is also a far complex and high cost process for video streaming. On the other hand, our proposed system of live video streaming using raspberry pi through cloud is far more simple and low cost with high level of accessibility through internet. This report provide the design and implementation of the technology called Live video streaming using Raspberry Pi, with a single board computer which computes the written in python as programming environment. The live steaming can be viewed from any web browser or even from mobile in the real time. The design of a reliable real-time (Live) video streaming and surveillance system is proposed, which can be broadcasted over an Internet connection with remote access. Raspberry Pi's IP address is fetched and VNC server or Putty is setup to create virtual desktop on host device for remote user. Host device is a Personal Computer/Smartphone connected to same LAN/ WLAN on which Raspberry Pi is connected. Previously, live video surveillance meant massive machinery, restricted to larger spaces and usually involved huge costs. For the effective implementation of the design, Raspberry Pi 3 Model B along with a Raspberry Pi camera V2 module has been used and web browser acts as the streaming medium for the live video broadcast, initiated by the code written in Python. VNC viewer, Putty, Remote.it, are the applications used for remote connections over the Network.

**Keywords:** *Live Video Streaming, low cost, Raspberry Pi, Wide angle coverage, Stepper Motor, Putty, and Remote.it.*

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# Nomenclature and Acronyms

**Abbreviations (Alphabetical Order):**

| | |
|---|---|
| DSCE | Dayananda Sagar College of Engineering |
| ECE | Electronics & Communication Engineering |
| HTTP | Hyper Text Transfer Protocol |
| HTTPS | HTTP streaming |
| IEEE | Institute of Electrical & Electronics Engineers |
| IP | Internet Protocol |
| SSH | Secured Shell |
| VNC | Virtual Network Computing |

# Chapter-1

# Introduction

## 1.1 Overview

- Introduction
- Methodology adopted
- Hardware & Software Tools used
- Results & Discussions
- Applications,
- Advantages
- Outcomes
- Limitations
- Conclusion
- Future Work

## 1.2 Literature Survey

**[1] Sruthy S; Sudhish N George, "Wi-Fi enabled home security surveillance system using Raspberry Pi and IoT module", IEEE International Conference on Signal Processing, Informatics, Communication and Energy Systems (SPICES) ,IEEE,2017.**

In this paper, designing and developing a real time surveillance system using IoT module and Raspberry Pi was performed. It is an active surveillance system which will alert the user when the event happens. Live video streaming is an additional advantage of the system. Web servers which helps the user to view the sensor status and the live video were created. The use of NodeMCU makes the system cost effective, portable and compact. Most of the existing surveillance systems are costly and common people may not spend a lot for such systems. This system is designed with an aim that it can be used for all kind of people since security of every one's home should not be left behind.

**[2] Zaixi Shang , Joshua Peter Ebenezer, Yongjun Wu, Hai Wei, Sriram Sethuraman, and Alan C. Bovik, "Study of the Subjective and Objective Quality of High Motion Live Streaming Videos", IEEE, 2021**

In this paper, a large scale video quality database targeting high motion, live streaming scenarios was created. The new resource includes 45 source sequences from 33 original contents and 6 different distortion types. The new database can be used to create, test, and compare both NR and FR VQA models. Making a new LIVE Live stream database publicly available. Future steps include developing new NR VQA models using the proposed database.

**[3] Ayushi Gupta, Dr.Gandhi Charu, Vartika Katara, Stuti Brar, "- Real-time video monitoring of vehicular traffic and adaptive signal change using Raspberry Pi", IEEE Students Conference on Engineering & Systems (SCES), IEEE, 2020.**

The way of life of individuals in metro urban areas with huge volumes of the populace is similarly influenced by different applications and administration frameworks. In this way, as of now, a large portion of the urban areas are changing into savvy urban areas by receiving mechanized frameworks in every single imaginable division. This proposed framework lessens the chance of congested driving conditions, brought about by high red

light deferrals, to a degree and effectively. Here a framework has been planned with the reason to clear the traffic as per the vehicular density.

**[4]. Dr. G. G Sivasankari, Prerana G Joshi, "Live Video Streaming using Raspberry Pi in IOT Devices", International Journal of Engineering Research & Technology (IJERT) , 2017.**

In this paper, an approach for the video survelliance monitoring system with the Motion Detection algorithm to decrease the cost as well as the storage using a raspberry pi as single board computer was proposed.

**[5]. Akshat Jain, Shraddha Basantwani, Owais Kazi , Yogita Bang ," Smart surveillance monitoring system" , International Conference on Data Management, Analytics and Innovation (ICDMAI) ,IEEE, 2017.**

In this paper, a Smart Monitoring System which smartly monitors the workplaces and homes with least human interference was developed. Here, the Streamer on motion detection starts the video streaming and stores it for future playback. On commencement of streaming, the red alert zone is checked for suspicious activity using Image Processing. The stored video is encrypted using Blowfish Algorithm, to be transmitted securely over the network. The system senses for an intruder router and sends the encrypted data to the client without any leakage using Shortest Path Algorithm. By using this system, manual monitoring and power consumption is reduced as well as cyber security is enhanced.

**[6]. Sungmin Cho, Jongmin Lee, Kyungmo Park, "Low delayed Mobile Live Streaming method and its implementation", IEEE International Conference on Multimedia & Expo Workshops (ICMEW) ,IEEE, 2015.**

In this paper, the low delayed mobile live streaming system (=TRLMS) and its implementation cases through MMT technologies was introduced. Based on market demands for true real time services for media consumption, some prominent use cases were derived. The prototype of TRMLS to prove the concept, especially with respect to the low latency was implemented. Through the implementation, it is observed that latency reduction of media streaming and media synchronization is achieved.

## 1.3 Objectives / Scope / Aim of the mini-project work

- The objective of the proposed mini-project is to capture the video of any particular real time scenario through the Raspberry pi camera v2 module and make it stream with any supportive web server acting as the streaming medium of the live video broadcast.
- A live video of appreciable resolution and wide coverage to be displayed on the user's screen.
- To be able to stream the video and interface it to the internet so that the user can have the remote access to the streaming.
- To achieve a wide range of coverage, stepper motor has to be configured to the raspberry pi system which facilitates the camera's rotation.

## 1.4 Motivation & Problem Statement

Through the available Video Streaming technologies specially for live incidents, clients are facing many issues. Among them few predominant ones are:

- Cost.
- The range of broad casting.
- The wide coverage of a particular scenario.

Previously, live video surveillance meant massive machinery, restricted to larger spaces. The technological advancements, ease of access and usability in Latter-day gadgets brought forth easier connectivity, bridging the gap between virtual and the real worlds. This makes dealing with indispensable concepts like security and surveillance much convenient, even for a remote user. Keeping in mind all these concepts, an effective; simple yet powerful design for a live video streaming is proposed which solves the above mentioned issues.

## 1.5 Existing & Proposed (Developed) Mini-Project module

It is well known that there are gadgets available which are involved in the domain of Video Streaming and Surveillance Systems. But when the cost and range of the broadcast taken into consideration, there are some contrasts developed between the end user and

the device specifications and applications like huge costs and restricted area of streaming etc.,

Considering the existing problems, the Mini - Project module is developed in such a way that it is available at a minimal cost compared to the existing devices. In addition to that. a coverage of more than 270 degrees of any required scenario to be streamed is achieved with the help of a stepper motor interfaced to the camera module.

Not all the devices, but some of the already existing devices cannot be accessed in remote location. *But the developed Mini-Project module facilitates remote access and hassle free streaming experience to the end user.*

## 1.6 Proposed Methodology

- The interfacing of Raspberry pi camera module and the stepper motor to the raspberry pi board is to be done with the help of necessary connecting wires . Now the raspberry pi is switched on.
- The required softwares and applications has to be pre installed in the raspberry pi
- Upon completion of proper python programming for both the camera and stepper motor, the moduleis almost set to achieve the required outcomes.
- Making use of Putty and Remote it and Putty applications, the Raspberry Pi can be accessed and hence the video streaming can be viewed via an URL generated by remote it application.
- The URL generated here can be used over any network and at any place so that the user can have the remote access to streaming.

# 1.7 Organization of the mini-project report

The mini-project work undertaken is organized in the following sequence as follows. A brief introduction to the mini-project work was presented in the introductory chapter in chapter-1. Block diagram and working principle of mini-project work undertaken by us is presented in the chapter – 2. Hardware/ Software tools /Description/Interfacing employed in our mini-project work is depicted in the chapter – 3. Results and Discussions are presented in chapter – 4. Applications , Advantages Outcomes and Limitations are explained in chapter – 5. Finally, the mini-project report concludes with conclusion & future work in chapter –6.

# Chapter-2

## Block diagram, Circuit Diagrams and Working principle, Algorithms, Flow-Charts & DFDs

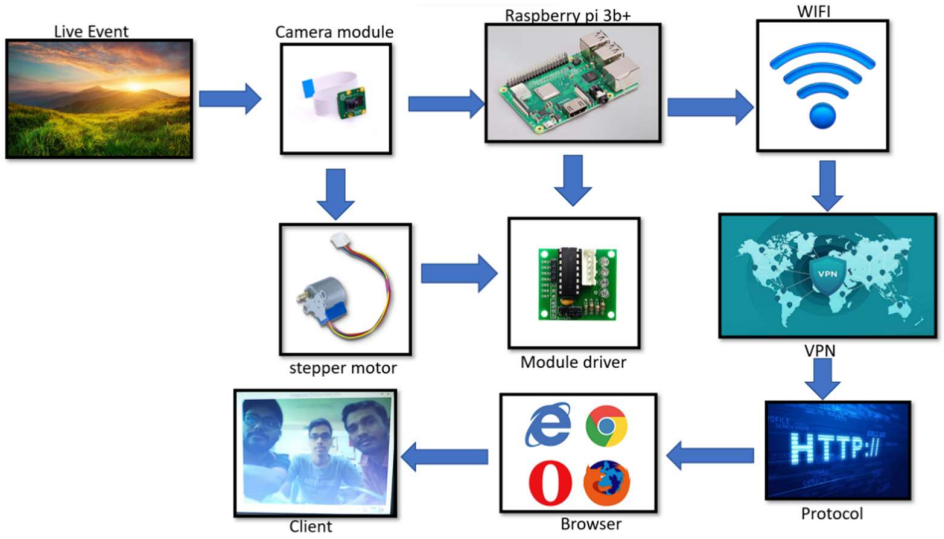


Fig.1: Block-diagram of the proposed methodology

The overall block diagram of the proposed methodology is shown in the Fig 1 above.

The block diagram gives the information about entire procedure employed to do the Mini-Project. It is briefly explained as follows:

- Firstly the live event is captured using camera module which in turn is connected to raspberry pi.
- Raspberry pi has a Wi-Fi module through which the video is surfaced over the internet.
- Stepper motor interfaced to camera module is used to expand the coverage of video through rotation and the module driver is helpful in supplying required voltage to the stepper motor.
- Making use of VPN application (remote.it) and HTTP protocol, an URL link is generated which when searched in the web browser displays the video being streamed.

# Working Principle

- For establishing communication in any network, 5 parameters are very important.
  1. Reliability
  2. Delay
  3. Efficiency
  4. Jitter
  5. Bandwidth
- So, with the proper coordination among all the above mentioned parameters and the user interface technology, a communication (data transfer) becomes successful.
- And coming to connectivity, the Principle involved behind the video getting streamed is that, from the source till server, there should be a connecting factor, which was served by the Wi-Fi (or any LAN) in this case.
- Also, for remotely connecting to the Raspberry Pi i.e., other than the home network a network other than the local LAN was necessary and this purpose was served by the Virtual Private Network (VPN) in this case.
- So, the integration of all the above mentioned parameters made the project "Wide Angle Coverage of Live Video Streaming" possible.

# Chapter-3

# Hardware / Software tools / Description / Interfacing /Working of the complete mini-project module

## Hardware tools used are:

1. Raspberry pi
2. Stepper motor
3. Camera module
4. Module driver
5. Jumper wires

## 1.Raspberry Pi and its specifications

- Quad Core 1.2GHz Broadcom BCM2837 64bit CPU
- 1GB RAM
- BCM43438 wireless LAN and Bluetooth Low Energy (BLE) on board
- 100 Base Ethernet
- 40-pin extended GPIO
- 4 USB 2 ports
- 4 Pole stereo output and composite video port
- Full size HDMI
- CSI camera port for connecting a Raspberry Pi camera
- DSI display port for connecting a Raspberry Pi touchscreen display
- Micro SD port for loading your operating system and storing data
- Upgraded switched Micro USB power source up to 2.5A

Fig. 2: Raspberry Pi 3 Model B

# 2. Raspberry pi camera module

Technical Specifications of the Raspberry Pi Camera Board are

Camera Module: 5 Megapixel Omni-vision 5647 Camera Module.

Size: 25mm x 23mm x 8mm.

Weight: 3 grams.

Camera Serial Interface: 15-pin MIPI (Plugs Directly into the Raspberry Pi Board).

Compatibility: Raspberry Pi Model A, Model B and Model B + Raspberry Pi.

The Raspberry Pi Camera v2 is a high quality 8 mega pixel Sony IMX219 image sensor custom designed add-on board for Raspberry Pi, featuring a fixed focus.

Video Capture Resolution: 1080p..

Lens Type: Prime.

Optical Zoom: 1 x

Minimum Focal Length: 28 Millimeters.

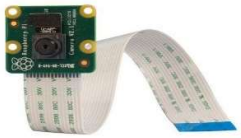

Fig. 3: Raspberry Pi Camera

# 3.Stepper motor

The intension in using Stepper motor in this Mini-project is to make the camera rotate by 360 degrees (more than 270 degrees). So that the area of video coverage is increased.

Features: Gear Stepper Motor for DC 5V 4 Phase Step Motor Reduction Step Motor Brand new and high quality.

Diameter: 27mm.

Voltage: 5V.

Step angle: 5.625 x 1/64.

Reduction ratio: 1/64.

5 lines cable 4 phase stepper motor can be driven by ULN2003 chip. It also can be connected as 2 phase to use.

Specification: Original box..

Size: 31*27*19mm.

Net weight: 35g Package.

Weight: 50g.

Fig. 4: Stepper motor

# 4.Module Driver

## Features:

- On-board ULN2003A chipset.
- 5-12V **power supply.**
- On-board 4-way indicator light.
- On-board XH-5P socket.
- Compatible with Arduino.
- Stepper Motor Driver Test and DIY.
- A, B, C, D LEDs indicate the shape of the four-phase stepper motor.
- It is equipped with a standard interface for stepper motors and can be inserted directly during use.
- **Dimensions:** 31 × 35mm.

## Specifications:

- The diagram to the left shows the 5 wires connected to the motor. Plug the motor into the driver board.
- The Arduino should be connected to the ULN2003 driver board as shown below:
- 5V+ connect to +5V.
- 5V- connect to 0V (Ground).


Fig.5: Module Driver

# 5. Jumper Wires

- The conductor shall consist of a solid, wire of commercially pure annealed Copper, smoothly drawn, circular in section, uniform in quality, free from defects, uniformly coated with pure tin. The nominal conductor diameter shall be 0.6mm with a tolerance of +0.01mm.
- Insulation Each conductor shall be uniformly covered with fire-resistive PVC insulation. The tensile strength of the material shall at least be 120 Kg/cm2 and its elongation, minimum 100%. The nominal thickness of the PVC insulation shall be 0.25mm. Over all Insulated Conductor Diameter = 1.10 mm with a tolerance of +0.01mm. The insulation shall neither be loose around the wire nor adhere to it.
- Electrical Requirement Reference Temperature: 200 C Loop Resistance of twisted pairs: max132 Ohms/Km (66 Ohms/km for Single wire). Insulation Resistance: min. 200 Meg Ohms. Km Test Voltage: 500 V .rms. for 2 minutes.

Fig. 6: Jumper Wires

## Software tools used

The software tools used in the Mini-project are listed below:

1. Raspberry Pi OS downloaded and installed from the internet.

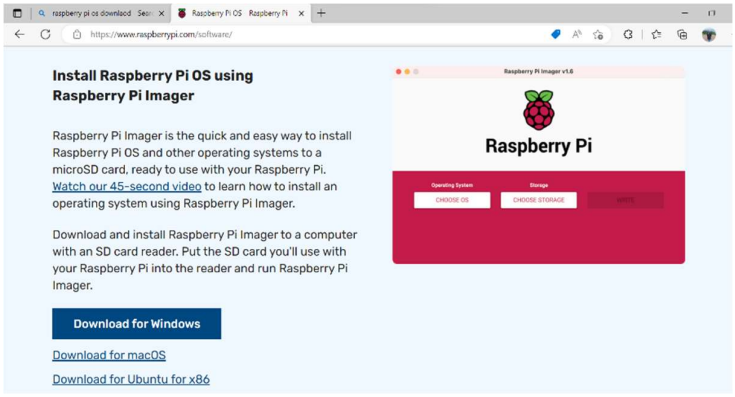


Fig .7 : Downloading Raspberry pi OS

2. Putty and VNC viewer applications are used as SSH clients.


Fig. 8: Putty logo

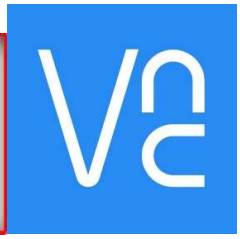

Fig. 9: VNC logo

3. Remote it application acts as aVPN here.


Fig.10 : Remote it logo

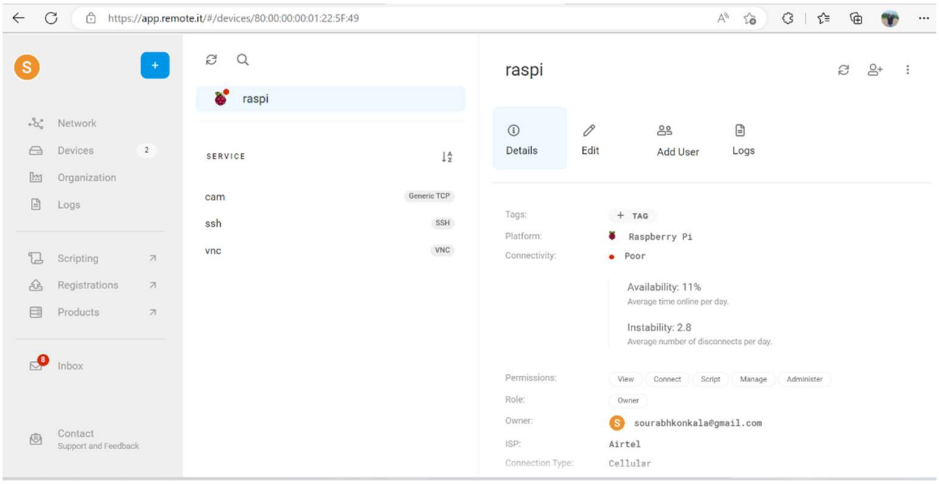


Fig .11 :Remote it page showing the raspi acknowledgement

4. Python3 is installed for doing python programming.

# Working of the complete mini-project module

- First and fore most thing to do is, to get a Raspberry pi 3b model from the market and install the Raspberry Pi OS. It is an open source software and can be easily downloaded and installed from any browser.
- An SD card is required to download and install the Raspbian OS which is inserted into the specific port given in the raspberry pi later on.
- Now the Raspberry pi is given a power supply of 2amp and 5V. The current and threshold values should not exceed the above mentioned values.
- Initially a desktop and a screen are needed to find the unique Raspberry pi IP address and to enable the Camera, SSH, Wi-Fi module, VNC. To proceed further it is very much necessary to know the IP address of raspberry pi.
- The raspberry pi will have default Id and password, which can be changed as per the user's wish.
- Now using the credentials of raspberry pi, one can access the Pi through laptop or mobile phone.
- After successful installation of required python libraries, programming for the video streaming and rotation of the stepper motor is to be done.
- Once the coding is done using the ribbon cable, the camera module has to be configured and using the connecting wires stepper motor should be connected to module driver which in turn is connected to the specific pins provided in the raspberry pi. This completes the manual setup of the Mini-Project module.
- Make sure the Raspberry pi is switched on and all the hardware components are working properly.
- Register an account in the remote it application and configure it to the raspberry pi using necessary commands.
- Once the raspi gets connected to the vpn (Remote.it), it means that the Raspberry Pi is successfully accessed remotely.
- So, after giving couple of commands for live-video streaming, the user can access the video at any place irrespective of where the module is located.

# Chapter 4

## Results and Discussions

The proposed model was designed and the quoted outcomes for achieved successfully.

As mentioned earlier a ubiquitous live streaming of a particular scenario along with a wide area coverage of more than 270˚ is achieved.

And the working is shown below.


Fig. 12 : Proposed model.

# Chapter-5

# Applications, Advantages, Outcome and Limitations

## Applications

- Video streaming can be viewed through any browser by capturing video through raspberry pi and transferring it to cloud server and then user browser.
- **Face detection can also be applied to capture videos for further applications like identification, surveillance, etc.**
- The module can be further developed and a smart class room can be build where in the attendance of the students is taken by the face detection.
- Its application is also found in Smart Vehicle Parking system.

## Advantages

- Video streaming can be accessed from any remote location and with any network connection irrespective of the network to which the raspberry pi is connected.
- An increased angle of coverage of the scenario to be streamed is witnessed.
- The video streaming is made ubiquitous.
- It is user friendly and comes with less complexity.
- Most importantly the module is made with minimal cost.

## Outcomes

- A wide angle coverage of more than 270 degrees (as proposed) of any real time situation is achieved.
- A decent resolution of 480 × 640 pixels is achieved.
- Multiple users can have the hassle free access to the live video streaming at the same time simultaneously.
- The video streaming is made available on the internet so that it can be accessed from any location.

# Limitations

- Though multiple users are able to login, only the main user can have the access to control the video streaming.
- Once the streaming is stopped and made to start again, the stepper motor starts to rotate again from the instance where it was previously stopped. This makes the Ribbon cable to have repeated twists hence obstructing the rotation of the camera.
- There is a delay of around 5 seconds.
- Running the module for longer time intervals heats up the stepper motor and the raspberry pi as well. The components may worn out due to overheating.

# Chapter-6

## Conclusion and Future Work

In this Mini Project we have designed and developed a real time live video streaming module using IoT and Raspberry Pi 3 Model B. As proposed,an appreciable wide angle coverage live video streaming using raspberry pi is achieved and made the streaming a ubiquitous one.

We have used HTTP protocol, and socket servers while programming for the live video streaming. Through this whatever maybe the video need to be streamed is displayed in a web page. And as discussed earlier, streaming can be accessed from any location provided that the user has to know the Remote it application credentials and should have Remote it app, either Putty or VNC viewer pre-installed.

But there are some drawbacks of the Mini project such as the delay of around 5 seconds, twisting of the ribbon cable and the multiple users though they are able to access the video streaming, they are not able to control it. Resolving these issues, the module can be further developed into many applications such as Face detection, Surveillance systems, smart vehicle parking systems etc. If the delay is reduced to a negligible amount and if an authentication system is developed, the module undoubtedly becomes the one of its kind surveillance system when compared to the existing models.

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