

# Reality of Aerial Solution

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## ABSTRACT

With no doubt robotics are providing the biggest technology leap from past years and will bring changes in every business practices and everyday life. Small unmanned aircraft systems (drone) are rapidly developed for various applications. A potential helping application is live streaming. The aim is to use drones and virtual reality to provide remarkable visual experience. This paper proposes a system to integrate virtual reality (VR) with a low cost unmanned semi-autonomous quad copter for live streaming with the help of Wi-Fi. It presents the software component that is the streamer used for streaming video. The proposed system enable the user to move the quad copter to remote areas with video streaming to required PC/Mobile with effective visualization using virtual reality (VR). Raspberry pi model is used in building the system which is most appropriate as a portable device. Open source Linux based operating system is used in this project to keep the cost low. The system is very practical and portable in the actual operating environment.

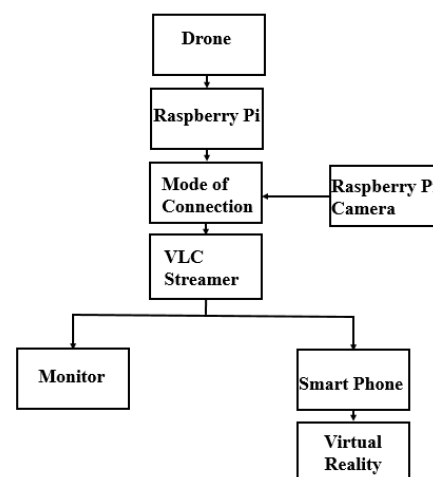
**Keywords :** Drone, Raspberry Pi, Streamer, Virtual Reality

## I. INTRODUCTION

With the continuous development of the internet technology and network bandwidth, real time streaming media transmission technology has become a trending research topic in recent years. The popularity of Wi-Fi technology and the rapid increase of mobile handheld device performance promote mobility of the real time streaming. Streaming media technology is the product of internet technology developed. Transmission of streaming media requires appropriate protocol such as Real time streaming protocol (RTSP) .On the other hand Radio controlled (RC) flying devices have an explosive expansion in the past few years [1]. An Aerial Surveillance System is a flying machine that can be controlled remotely with capabilities to transmit real time data to PC/Mobile.

Raspberry Pi a series of small single-board computers along with a camera module is easily portable,

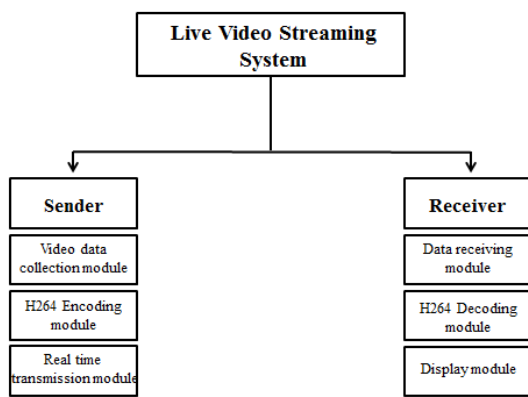
lightweight and easy to mount. So, it makes sense that this can be used for streaming the video. A Linux based open source operating system is used. This paper explores the potential to develop a VR enabled drone that will be an assistive technology to support social engagement for people. The block diagram is shown in figure 1.0.



**Figure 1.** Block diagram

## II. SYSTEM MODULES

The system is divided into two subsystems each divided into several functional modules. Subsystems include sender and receiver [1]. The structure of the system module is as shown in the figure 2.0 Firstly the sender, drone mounted with raspberry pi and its camera module acts as the video data collection module. Encoding technique used here is H264 encoding technique. Real time transmission occurs with the help of streaming protocol RTSP. The playback client of the system is PC/Mobile that uses streaming media player VLC.



**Figure 2.** Structure of the system module

### A. Drone

As drones continue to grow in popularity, the amount of innovative drone projects being created continue to soar. Drones are being used for film and photographic purposes.

#### A. Construction of the drone

The drone is build using a kit model that is controlled remotely with an RC controller. There are essentially two configurations for a Quad-copter “+” frame and the “X” frame. Here we have chosen an “X” frame so that onboard camera can have a clear forward view. And is shown in figure 2.1.0.

- The electronic speed controller is used to deliver the power to the motor with the information’s of KK2.0.
- Battery is required to supply power to the motors.

- Power distribution board is used to connect ESC’s to the battery.
- Because the motors create lot of vibrations mounting pad is used to reduce them.
- Four motors are required for construction a Quad-copter.
- A Quad-copter with some motors but without propellers isn’t a Quad-copter .Hence propellers have to be chosen according to the frame. Propellers has to be clockwise and Anti-clockwise on equal numbers and alternatively.
- KK2.0 multi-rotor control board is used for flight control [8].



**Figure 3.** Drone

### B. KK2.0 microcontroller Setup steps

- Factory reset – to set default values.
- Acc calibration – calibration of Gyro.
- Mode setting- converting self-level to AUX (switch).
- Load motor layout – to see motor direction.
- Receiver test- check direction of each channel.
- PI editor- set the values for gains and limits.
- Self-level settings- set the gain values.
- Esc throttle calibration-make sure all motors start at same time.

### B. Raspberry Pi

The proposed system uses raspberry pi 3 model B. It is cost effective, credit card sized computer that connects to a computer monitor or a TV and uses a

standard mouse and keyboard. Raspberry pi 3 is the third generation Raspberry pi which replaced raspberry pi to model B [9].

Features offered by it includes:

- Broadcom BCM2837 64bit ARMv8 quad core processor
- 1.2 GHz speed
- BCN4314 WIFI with IEEE 802.11 b/c \n support.
- Bluetooth
- RAM 1 GB
- 40 pin extended GPIO.

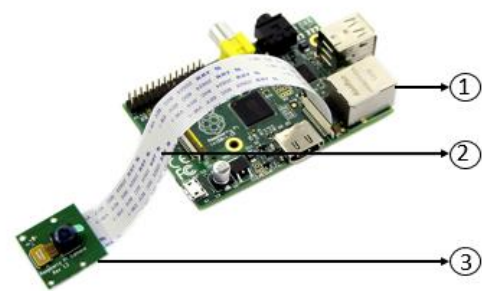
Raspberry Pi is initially plugged onto the monitor for the first boot and then its IP address is configured, which is later used for establishing connection. Raspberry Pi runs on Raspbian OS.

#### **A. Interfacing the camera module with Raspberry-Pi**

Raspberry pi Noir camera v2 module is used for video broadcasting. It is connected to the Raspberry Pi's camera port through a CSI bus which is the camera serial interface. And is shown in the figure 2.2.1.

Its features includes:

- Fixed focus lens for high quality imaging.
- 8mp native resolution.
- Sensor capable of 3280x2464 pixel static images.
- Supports 1080p 30, 720p 60 and 640X480p 90.
- Video the Pi camera is connected to the Raspberry Pi 3 board and power up. It is then enabled on Raspberry Pi GUI.



1. Raspberry Pi 3 Model B
2. CSI bus
3. Raspberry pi Noir camera v2

**Figure 4.** Noir camera module mounted on Raspberry Pi

#### **C. Streamer**

Live video streaming is to transmit or receive real time audio or video coverage over the internet. There are various streamers available like Gstreamer (connects sequence of processing elements through a pipeline). The proposed system uses VLC media player, it serves as a source or medium for live streaming from the Raspberry Pi. A code is written using bash script for broadcasting live video stream on the VLC media player on the host machine. Raspberry Pi's IP address is fed into VLC's network stream bar to initiate the stream.

RTSP (Real Time Streaming Protocol) is used. This protocol is mainly used for establishing and controlling media sessions between end points. RTSP is very similar in structure and syntax to HTTP. Both use same URL structure to describe an object.

#### **D. Virtual Reality**

Virtual reality is an artificial environment that is created with software. On computer/mobile virtual reality is primarily experienced through two of the five senses site and sound. Scientific and engineering data visualization has benefited for years from virtual reality through recent innovation in display technology has generated interest in everything from molecular visualization to architecture to weather models [14].

This paper explore potential to develop a system including drone and VR that will be an assitive technology to support people. VR is most widely adopted technology in the field of entertainment and gaming communities where physical presence in real or imagined worlds can be simulated.

### III. WORKING

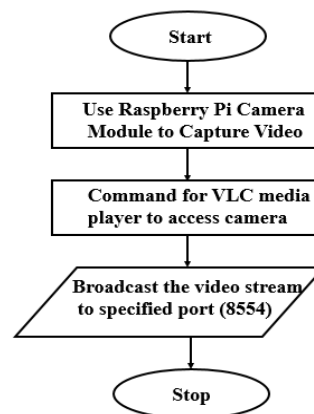
The proposed system uses Raspberry Pi 3 board along with its camera v2 module. Raspberry Pi uses Raspbian operating system and is programmed using bash scripting language. The process begins by initially booting up the Raspberry Pi. A 16 GB micro SD card is given a proper format using SD formatter and setup with latest Raspbian OS. To do so, the Raspbian OS is downloaded from Raspberry Pi's official website in zip file format. The downloaded file are then extracted to the micro SD card, after which it is inserted to the SD card slot of Raspberry Pi. The Raspberry Pi is plugged into a monitor via HDMI adaptor cable. Once the Raspbian OS is installed, the initial boot completes. The Raspberry Pi is then connected to the internet and Pi's IP address is fetched. Now, VLC media player which is the streaming medium for the live video broadcasted over the network. The host device can be any PC or smart phone connected to the same network on which Raspberry Pi is connected. For the camera to start the live streaming and broadcast it over the network on a VLC media player, the equivalent code needs to be run on the Pi. The code for design execution is implemented in bash script and this script is added to the bootstrap file of Raspbian OS so that it starts automatically and need not be connected to monitor instead LCD display can be used for this purpose [4]. The code run on the terminal of Raspbian OS is as shown in the figure 3.0.



**Figure 5.** Code running on the terminal of Raspberry Pi

On the other hand in VLC media player user has to provide the details in the format `rtsp://192.168.43.38:8554/` in the open network stream which initializes the video.

To get better visualization system employs virtual reality box. In case of smart phones, capturing image or recording video in VLC media player is not possible. Hence android app like Touchshot can be used for this purpose, and is adaptable to functions of virtual reality remote. Functional flow chart is represented in the figure 3.1.



**Figure 6.** Functional flow chart

### IV. RESULT

The raspberry pi board is interfaced with the camera module, powered up using a battery pack is set in the location for remote surveillance over Wi-Fi. The code required to initiate the camera is run on raspberry pi side. Once the code is run, Raspberry Pi's 'vid' command start the camera for video capture, following which the captured image is flipped

vertically with a width of 800 pixels with 20fps i.e. 20 consecutive images are captured per second. Then the output is sent to the VLC media player commanding it to start streaming the data coming in, into the port specified on Raspberry Pi's IP address. Encoding is done in H264, which is a format used for high definition video files.

VLC media player is opened on the host device and the raspberry pi's IP address along with rtsp protocol is fed into the network stream bar; then hitting play starts the live stream. The streaming is shown in the figure 7.



**Figure 7.** Video streaming in PC and Mobile

To increase the visual participation virtual reality is used and is controlled using hardware controller and in mobile using android app like Touchshot for capturing image and recording video [4].

## V. APPLICATIONS AND FUTURE SCOPE

The proposed system includes various technologies brought together under a common platform. The system can be deployed in various departments (applications) like:

- Physically challenged  
Drones for live streaming of visuals for people with limited mobility to have realistic view.
- Disaster Management  
Fire accidents or natural calamities, to know the extent of disaster occurred in various locations where human intervention is difficult.
- Tourism and photography

To explore the place and capture picture with realistic experience using VR and discovering more places.

- Military  
To patrol unsafe areas.
- Wildlife  
For animal population census.

This system can be future improved by,

- Include sensory abilities to drone like sensing the weather conditions so that virtual environment similar to the reality can be created using sensory smart IOT devices to desired location to enhance the experience.
- Adding gyroscopic features to both camera module and VR box along with rotations.
- Include professional camera feature and stabilization for camera module.
- Developing a specific streamer having features that can be compatible with microcontrollers, ability to capture image and video and which is adaptable to VR controller.
- Development of Boomerang drones.
- Drone adaptability towards obstacles.

## VI. CONCLUSION

This paper illustrates the design and implementation of simple yet powerful aerial system that deploys modules from various technologies like Raspberry Pi along with its camera module which acts as the primary module for capturing and broadcasting the video, drone an unmanned vehicle as a medium on which Raspberry pi and camera module is mounted, bash scripting for programming which is efficient and virtual reality for increasing the visual experience. Bringing together various technological components under common platform led to the development of this system, improving this system can lead to a product that can have reverberation in the market.

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