

Unmanned Aerial Vehicle for Video Surveillance Using Raspberry Pi

Priyanga .M, Raja ramanan .V

Dept of Information Technology, Anna University, Velammal College of Engineering and Technology, Madurai, India.

Dept of Information Technology, Velammal College of Information Technology, Madurai, India.

Abstract— Unmanned Aerial vehicles (UAVs) provide their efficient use in case of situational awareness by the surveillance process in the disaster places. The real time video surveillance using a system equipped for sensor support data is being developed to provide situational in the target of interest [3]. UAVs provide a safe means of video surveillance in the target place using raspberry pi. In this paper the target of interest is described is the riverbed. The objective of this project is to provide control measure over stealing tons of soil in the riverbed by some unauthorized groups. The system provides the surveillance process for the defined perimeters by fixing via points and the UAV follows the target through via points which are predefined [4]. Global Positioning System (GPS) is provided in the vehicle to locate the exact position of the UAV. This paper also describes the data link between cameras onboard an unmanned aerial vehicle and the monitoring terminal.

Keywords— unmanned aerial vehicle, video surveillance, raspberry pi, global positioning system.

significant application, real time video telemetry for controlling sand mining. For this process of video Surveillance opencv, an open source computer vision library is used.

For using opencv program, which can be integrated only with the micro controller kit known as raspberry pi which uses ARM 11 board the core frequency is set to 700MHz. It has the ability to boot from the SD card. It uses GPIO where its header consists of 17 pins. These pins could be connected to simple LED drivers, relay modules through driver transistors, or even stepper motor or servo motor drivers. The use of microcontroller board, raspberry pi is only possible only when the provided operating system is linux either ubuntu or some linux based operating system where ubuntu13.3 raring ringtail is considerably suitable for this application.

Opencv is a set of libraries targeted for real time computer vision applications such as human computer interaction; object identification, segmentation and recognition; face recognition, gesture recognition; Motion

I.INTRODUCTION

Unmanned aerial vehicle have a tremendous growth in many fields, specifically in the field of military and civilian applications [5]. For example UAV navigation [6], UAV controller design [7], multi-UAV position estimation [8], and cooperative air and ground surveillance [9]. UAVs are also used for various purposes which includes volcano monitoring, real estate photography, coastal zone studies, anti-piracy operations,

Tracking, Motion Understanding and Structure From Motion (SFM). **CMake**, the cross-platform, open-source build system. CMake is a family of tools designed to build, test and package software. CMake is used to control the software compilation process using simple platform and compiler independent configuration files. It also serves as a graphical user interface for compilation of opencv programs.

Opencv supports several languages including c, visual c ++, python etc. in our paper we use python, is an agile programming language. Python is an open source object-oriented programming language that offers two to ten folds programmer productivity increases over languages like C, C++, Java, C#, Visual Basic (VB), and Perl. Opencv, which is user friendly and most of the programs are available in internet as an open source.

PuTTY is a free and open-source terminal emulator, serial console and is mainly used in network file transfer applications. PuTTY is a program for Microsoft Windows that allows you to control a computer running a Linux or Unix-based operating system via SSH using a command-line interface. PuTTY's Key Generator is broken into three main functions: generating, importing, and exporting keys. If you will be receiving a key from another source, you will import the key into the PuTTY Key Generator and then export a PuTTY key for use with the PuTTY applications. If you will be creating your own key, you will be generating a key and then exporting to the key type needed by the recipient. If the key will be supplied for you, the key will need to be imported and a PuTTY key will need to be exported.

II. IMPLEMENTATION METHOD

We implemented our architecture with an unmanned aerial vehicle situated with three major components like onboard camera, voltage sensor and a GPS receiver. The real time video and all other sensor data's are displayed in the webpage which can be viewed from anywhere in the world by setting a specific internet address.

A.Architecture

Architecture of the surveillance system is shown in the figure 2.1. The unmanned aerial vehicle consists of voltage sensor, GPS receiver, camera, Wi-Fi-interface etc. All the sensor data's are controlled using raspberry pi. Those data's are sent to the webpage using Wi-Fi-

interface and the real time video is also sent along with sensor related data. The video is taken only when the particular template matching is verified. For template matching and real time video we use opencv.

```
*The mini-http server listens to this port for Requests
(default: 0 = disabled)
webcam_port 8081
```

*Quality of the jpeg (in percent) images produced
(default: 50)
webcam_quality 50

*Output frames at 1 fps when no motion is detected and increase to the rate given by webcam_maxrate when motion is detected (default: off)
webcam motion off

*Maximum framerate for webcam streams (default: 1)
webcam maxrate 1

```
*Restrict webcam connections to localhost only (default:
on)
webcam localhost on
```

*Limits the number of images per connection Number can be defined by multiplying actual webcam rate by desired number of seconds

*Actual webcam rate is the smallest of the numbers
framerate and webcam maxrate

```
*webcam limit 0
```

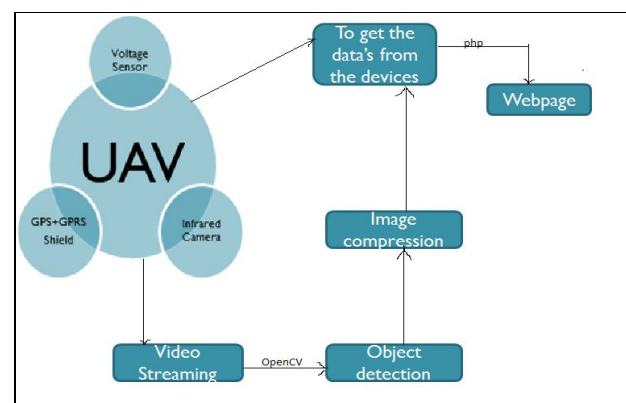


Fig. 2.1. Architectural model

B. Raspberry pi

Raspberry pi is a micro-controller kit with in-built ARM11 board provided with internet/Ethernet connectivity, dual usb connector, 512MB memory and works in linux operating system. The naked view of raspberry pi is shown in the fig (2.2). The main use of raspberry pi is to convert conventional television to smart tv. The board provides both the audio and video output as well the onboard storage of the micro-controller kit supports SD, MMC, SDIO card slot. Raspberry pi can be used for several applications including image capturing, media streaming, home automation, to control robots, internet radios etc. The major requirements of raspberry pi are a bootable SD card with linux, USB power adapter with support for 700 mA and USB Wi-Fi adapter for internet connectivity.

Web-based surveillance using raspberry pi

To update the software we use the commands as follows

```
sudo apt-get update && sudo apt-get upgrade
sudo apt-get install motion
```

To enable motion

```
sudo nano /etc/default/motion
```

The default settings for the “live webcam server” are the following

For security purposes the software access the port 8081 as default for motion that uses stream images. Image for webcam should be accessible at specific internet address. To generate the port number, host name and key we use PuTTY key generator. The port number in the PuTTY is default port 22. The PuTTY configuration is determined and open the specified session that is built by using database. Set the router gateway to access the network remotely.



Fig 2.2. Raspberry pi

C. WiFi Adapters

Wi-Fi adapters provide wireless connectivity to the local area network (LAN) in the home or office. Typically used to add Wi-Fi to desktop computers, they can also retrofit older laptops that never came with Wi-Fi. The adapter will retrieve the real time video from raspberry pi within the coverage range and provides safety means of video surveillance without complex wired network between the unmanned aerial vehicle and the system that provides the video.

D. Voltage sensor

The NCP/NCV302 and NCP/NCV303 series are second generation ultra-low current voltage detectors that contain a programmable time delay generator. This sensor is used to indicate in case of low battery it gives a beep sound with red light indication.



Fig 2.3 voltage sensor

E. Global positioning System (GPS)

The Global Positioning System (GPS) is a satellite based navigation system that sends and receives radio signals. A GPS receiver can acquire these signals and provide information. Using GPS technology we can determine location, velocity 7 time 24 hours a day in any weather conditions anywhere in the world. We need to interface raspberry pi with GPS receiver [10]. We use Trimble Studio software that is embedded into the raspberry pi and GPS module to view the current location of GPS receiver. The trimble studio usage can be viewed by the figure (2.4) given below. We can make use of available parameters like latitude, longitude speed etc from the given options in the software[11].

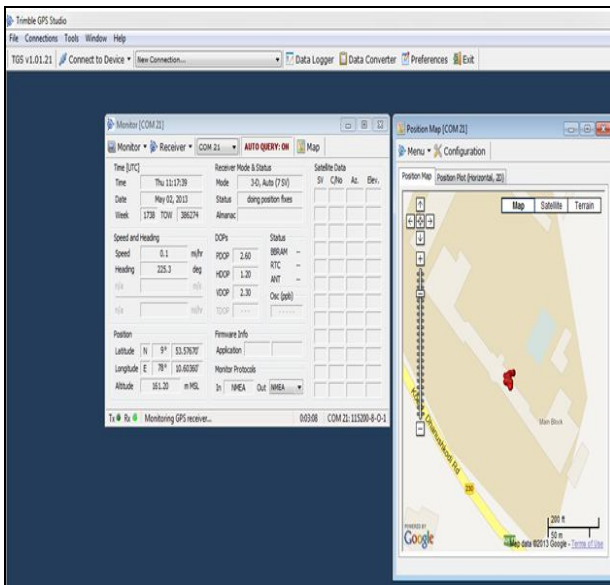


Fig. 2.4. Location of GPS receiver is viewed in Trimble Studio.

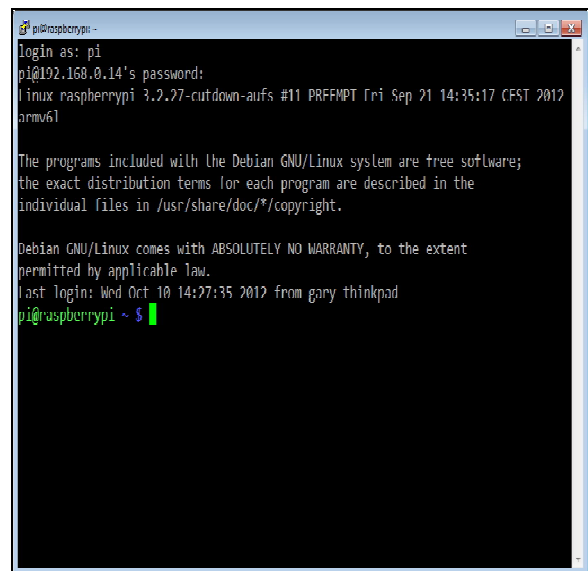


Fig 2.5. Connection of putty

III. OVERVIEW

The GPS receiver is fixed to the UAV that files over the riverbed. The location details are given in terms of latitude, longitude and the speed of the vehicle. Those details can be viewed from the webpage provided with specific internet address.

F. PuTTY

PuTTY is a free and open-source terminal emulator, serial console and network file transfer application. It supports several network protocols, including SCP, SSH, Telnet and rlogin, is a free implementation of Telnet and SSH for Windows and Unix platforms, along with an xterm terminal emulator. PuTTY's Key Generator is broken into three main functions: generating, importing, and exporting keys. The figure (2.5) shows the connection of PuTTY with raspberry pi. PuTTY generator known as PuTTYGen will automatically generates a key and provide the key pair for future file transfer.

To check the network connection of raspberry use the command prompt provide the following syntax followed by \$ping our specified ip address /t. if the reply is timed out or destination port unreachable then disconnect the network and provide the connection as before until the session time to live (TTL) is reached.

The real time video taken by the UAV, GPS data, voltage sensor intimation are viewed from the webpage with the given ip address. The overview of the project is shown in the figure 3.1. The figure explains the wired set up for the real time video surveillance. The video captured by the webcam is viewed in the webpage in the ip address with port 8081 configuration.



Fig 3.1. Wired setup of this project

IV. OUTPUT

The output window shows the video of truck that stealing soil from the riverbed also with the latitude, longitude and the speed of the UAV. After viewing the video the police will take the intended action to take control action over the sand theft. This work proposes the control measure over the sand mining in the riverbed, which is one of the best application using unmanned aerial vehicle. The port 8081 displays the real time video.

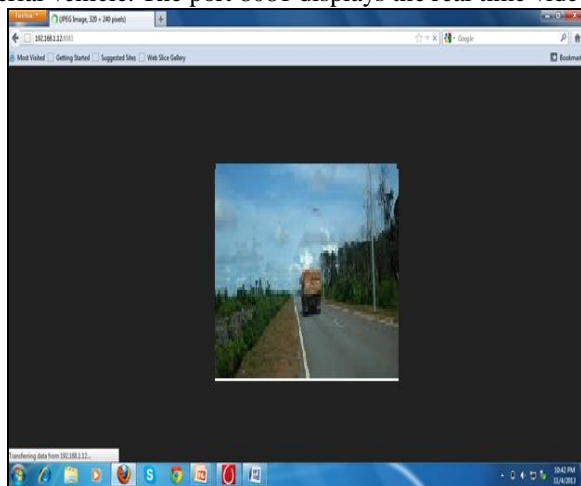


Fig 4.1. Video viewed in the webpage.

V. FUTURE WORK

This paper provides the real time video. In future we will pay more attention to reduce the storage capacity of the SD card it is wiser to take images when it matches the pre-defined template using opencv programs and compress those images and send those images to the web page through GPRS shield which helps in sending MMS through WiFi adapter.

VI. CONCLUSIONS

We have proposed a design that provides the real time video of the target/area of interest. The GPS receiver in the vehicle provides the latitude and longitude parameters in the webpage along with speed of the aerial vehicle. The battery range is provided by the use of voltage sensor. The aerial vehicle will provide its surveillance in the defined perimeter which is already defined by via points in the riverbed.

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