Remote Live Surveillance device

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1st Yashodeep Kacholiya Entc dept. Government college of engineering, Aurangabad (B.A.M.U.)
Aurangabad, India
yrk9421@gmail.com

2nd Ajinkya Agnihotri entc dept. Government college of engineering, Aurangabad (B.A.M.U.)
Aurangabad, India
ajinkyaagnihoti105@gmail.com

3rd Varun Kulkarni entc dept.
Government college of enng., aurangabad
Aurangabad, India
varun.kulkarni111@gmail.com

4th Aniket Kulkarni CSE dept.
GECA, Aurangabad
Aurangabad, India

5th Divyakanth Trivedi
Mechanical Dept.
Geca, Aurangabad
Aurangabad, India

6th Sayali nagarkar CSE dept.
GECA
Aurangabad, India

7th Abhishek chopde
Entc dept. Geca , urangabad
Aurangabad, India

Abstract - Although drones are very much in the news at the moment, aerostats are one family of aerial systems which have much to commend them. Certainly the ability to deliver a persistent overview of areas, for days or even weeks at a time, from thousands of feet above the surrounding landscape makes such lighter-than-air systems stand out from the crowd as surveillance platforms, there are many places where continuous human presence is not practically possible. Areas such as remote forests, wild life sanctuaries, disaster areas, construction sites, mining areas, riot areas needs an human eye. Engaging a human for that specific work is not a feasible solution.

Index Terms—component, formatting, style, styling, insert

I. Introduction

This is a project in which, an area can be surveillance for 2-3 days remotely. The idea is to improve the capabilities of a surveillance device unlike drones which can be used just for some hours. We have used a microcontroller and a camera is interfaced with it and the live stream of the captured footage is hosted to a website which can be accessed globally. The microcontroller system is interfaced with a wifi module. The whole system works as a web server which host the video frame by frame to a globally hosted website. The camera is interfaced using camera serial interface which provides the frames for hosting. Thus the live footage of the area surveillance is made remotely available. The whole electronics system is attached to the tethered balloon. Which is them made stable at a required height for area surveillance.

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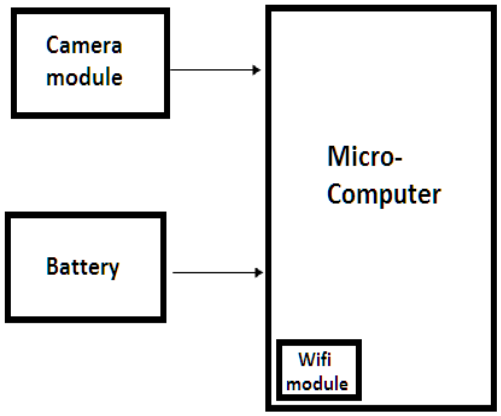
II.Literature Survey

The first aerostats were assigned to the United States Air Force in December 1980 at Cudjoe Key, Fla. During the 1980s, the U.S. Customs Service operated a network of aerostats to help counter illegal drug trafficking. Their first site was built at High Rock, Grand Bahamas Island, in 1984. The second site was built at Fort Huachuca, Ariz., in 1986. Before 1992, three agencies operated the TARS network: the Air Force, U.S. Customs Service and U.S. Coast Guard. Congress in 1992 transferred management of the system to the Defense Department, with the Air Force as executive agent. During the 1990 Invasion of Kuwait, the first indication of the Iraqi ground advance was from a radar-equipped tethered balloon that detected Iraqi armor and air assets moving south. Tethered surveillance balloons were used in the 2004 American occupation of Iraq. They utilized a high-tech optics system to detect and observe enemies from miles away. They have been used to over watch foot patrols and convoys in Baghdad, Afghanistan, and are permanently installed above US military bases in Kabul and Bagram. The U.S. Army has developed a tethered aerostat to perform operational testing at Aberdeen Proving Ground beginning in 2015.

III. Hardware

A. Hardware Architecture

The implemented system consists of raspberry pi B+ as a microcomputer. Which is used to interface pi camera with it by using camera serial interface. Raspberry pi B+ also acts as a web server.



B. Hardware components

Raspberry pi B+ -

- Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit SoC @ 1.4GHz
- 1GB LPDDR2 SDRAM
- 2.4GHz and 5GHz IEEE 802.11.b/g/n/ac wireless LAN, Bluetooth 4.2, BLE
- Gigabit Ethernet over USB 2.0 (maximum throughput 300 Mbps)
- Extended 40-pin GPIO header
- Full-size HDMI
- 4 USB 2.0 ports
- CSI camera port
- DSI display port
- 4-pole stereo output and composite video port
- Micro SD port for loading your operating system and storing data
- 5V/2.5A DC power input

Pi Camera

- Resolution: 5 MP
- Interface Type: CSI(Camera Serial Interface)
- Dimensions: 25x23x8 (LxWxH) mm
- Supported Video Formats: 1080p @ 30fps, 720p @ 60fps and 640x480p 60/90 video

Battery

- Lithium Polymer battery
- 10000 mah capacity
- 5V/2.5A DC power output

IV. Software

A. CSI(Camera Serial Interface)

The Camera Serial Interface (CSI) is a specification of the Mobile Industry Processor Interface (MIPI) Alliance. It defines an interface between a camera and a host processor. The MIPI CSI-2 v1.0 specification was released in 2005. It uses either D-PHY or C-PHY (Both standards are set by the MIPI Alliance) as a physical layer option. The protocol is divided into the following layers:

- Physical Layer (C-PHY/D-PHY)

- Lane Merger Layer.
- Low Level Protocol Layer.
- Pixel to Byte Conversion Layer
- Application Layer

B. Raspbian

Raspbian is a Debian-based computer operating system for Raspberry Pi. Raspbian was created by Mike Thompson and Peter Green as an independent project. There are several versions of Raspbian including Raspbian Stretch and Raspbian Jessie. Since 2015 it has been officially provided by the Raspberry Pi Foundation as the primary operating system for the family of Raspberry Pi single-board computers. Raspbian is highly optimized for the Raspberry Pi line's low-performance ARM CPUs.

C. Tethered Balloon

Tethered balloon is a balloon which is attached with more than one tethers to restrict the free floating motion in air. Such, balloon stays at a same altitude with less motion which makes them perfect for the surveillance use. The balloon is made up of fiber material filled with helium or hydrogen (Lighter gas). The balloon used is spherical in shape which can be of varying diameter. As the diameter increases the load lifting capacity of the balloon increases. Typically, a 6 feet diameter balloon has a load lifting capacity of about 2kg. The payload used weighs about 500gms only, thus a 6 feet diameter balloon is good enough to be used. The balloon takes up a height of about 15 to 20 feet above sea level. Thus a larger area can be made under observation.

V. System Information

Pi Camera (5 MP) is interfaced with the raspberry pi 3 B+ microcomputer using Camera Serial Interface (CSI). A power supply is provided using a Lithium polymer battery. The capacity of the battery is 10,000 mAh. The output of the battery is 5 V/2.5 A. Raspberry pi needs a DC supply of 5 V/2.5 A which is provided by the battery. Tethered balloon is filled with helium gas which is attached with more than one tethers to restrict the free floating motion in air. A 6 feet diameter balloon is used with a load lifting capacity of about 2kg. The payload used weighs about 500gms. The balloon takes up a height of about 15 to 20 feet which covers a required area. Raspberry pi acts as a web server, the web server is created using python scripting language. Python has some inbuilt libraries like Flask which makes it possible to turn a raspberry pi into a web server. We can use external libraries like motion. The pi camera captures the video frames and sends to the locally created web server. The frame rate and the resolution of the video frame can be changed using camera settings. A website is coded with the help of HTML, CSS and Java Script which is capable of reading the video frame from the local web server. The website is then hosted on the internet. The website is featured with the functions such as zoom in, zoom out, capture and record which makes it an ideal device for surveillance.

VI. Future Scope

The system can be modified by interfacing sensors and the application range of such system widen up, like

- Research
- Force Protection
- Beyond Line of Sight (BLOS) Communication Relays
- Rapid Acquisition
- Monitoring Air Quality & Atmospheric Conditions

VII. Application

The system can be used under various condition and finds various applications like,

- Reconnaissance
- Critical Infrastructure Security
- Intelligence Gathering
- Border/Port Security
- Situational Awareness

VIII. Conclusion

Surveillance devices are one of the key features for the security purposes. Remote live surveillance device promises to extend the features of existing surveillance devices. By adding the features like global access, zoom in, zoom out, capture and record. The hardware component used are very cost effective and reliable making the whole system cost less than the other surveillance devices.

IX. References

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