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Development of Unmanned Aerial Vehicle (Uav) For Surveillance System with Radio Frequency Control

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ABSTRACT: In the last few years, (Unmanned Aerial Vehicle) UAV systems have become relevant for applications in precision farming, military purposes, road and dam surveillance etc. The name UAV covers all vehicles, which are flying in the air whether it is a plane or a helicopter, etc., with no person on board to control the aircraft. This research gives an overview of UAV systems and their surveillance application. Since UAVs are costly systems and flexible, the aim is to develop a UAV system that is low in cost and its performance would be up to standard. Due to the advancement in satellite receiver tracking systems, an integrated system employing the latest tracking techniques using satellite Receiver in the form of GPS integrated with an aerospace vehicle can be used to get the pictures from the attached camera. The data of GPS is transferred to the base station with the help of a mobile phone, another mobile phone on the base station side receive that data and then it is stored in the Database. Radiofrequency transmitter controls the aerospace by integrating the above technique & it uses Global Positioning System (GPS) as a tracking tool.

I. INTRODUCTION

An unmanned aerial vehicle (UAV) is an aircraft with no onboard pilot. UAVs can be remote-controlled aircraft (e.g. flown by a pilot at a ground control station) or can fly autonomously based on pre-programmed flight plans or more complex dynamic automation systems. UAVs are currently used for several missions, including reconnaissance and attack roles. For this project, a UAV is defined as being capable of controlled, sustained level flight and powered by a jet or reciprocating engine. The acronym UAV has been expanded in some cases to UAVS (Unmanned Aircraft Vehicle System). The Federal Aviation Administration has adopted the acronym UAS (Unmanned Aircraft System) to reflect the fact that these complex systems include ground stations and other elements besides the actual air vehicles (Qayyum & Mazher, 2012).

The name UAV covers all vehicles, which are flying in the air with no person on board. They are mainly used for surveillance, reconnaissance and penetration of hostile territory without the deployment of human beings in areas of high risk. The term UAV is used commonly in the Engineering and artificial intelligence community, but terms like Remotely Piloted Vehicle (RPV), Remotely Operated Aircraft (ROA), Remote Controlled UAV (RCUAV), Unmanned Vehicle Systems (UVS) and model UAV are often used, too. The Remote Control (RC) and model UAVs are clearly defined by the Unmanned Vehicle Systems International Association as mini, close short and medium-range UAVs depending on their sizes, endurance, range and flying altitude. UAVs are mostly used in military applications for recognition, environmental observation, and maritime surveillance and mines removal activities. In any theatre of war, the key to success is information. Information on enemy defence lines such as; its capabilities to launch an attack can help the field commander to chalk out his strategy to counter the enemy's line of defence, for this purpose UAVs are used. UAVs can penetrate the enemy area without the involvement of human beings on board (without pilot) and it will be completely controlled by a person sitting in the base station. We can get all the necessary information without putting our pilot's life in danger. In the past, UAVs used in the Photogrammetric community was not defined precisely (Qayyum & Mazher, 2012).

Meanwhile, there is no threat of technology theft as all the work has been deployed on the base station side. There is a camera on the vehicle which has transmitted its video to the base station and a mobile phone which has transferred its data to the base station as well so there is nothing on the vehicle. If someone somehow got this vehicle he will not get any kind of information.

All the intended goals have been achieved successfully. The completion of this project has brought to light many problems concerning hardware and software and we also discovered ways to counter such problems. This paper is indeed a valuable contribution to the research on UAV systems. It will be extremely helpful to the engineering students as well.

This research was motivated by the need for long-range air-altitude surveillance of campus environment not frequently accessed by security personnel and the need to monitor biological or chemical contamination and check unauthorized gathering of students; there is a need to develop unmanned aerial vehicles. Furthermore, the relative cheapness of the UAVs, when compared with the risk to man, the scalability of the system to different shapes and sizes are the further motivation for the research. Thus, this paper presents an unmanned aerial vehicle for a campus surveillance system.

II. LITERATURE REVIEW

Due to the immense importance of unmanned aerial vehicles (UAV), considerable research has been done on developing UAV systems. Some research papers and websites were analyzed to find out the various methods implemented for UAVs, some of these would be mentioned. Information about the UAV system, how it is categorized and its different models is found in the work of Eisenbeiss (2004). It highlights different organizations which are associated with UAVs. Meanwhile, information about the features and workings of the special cameras in which UAVs are attached is discussed in (Helicam, 2016). Questions such as: what kind of camera we use, what is the resolution required for this purpose and how can we transfer that image or video to the base station? Moreover, a description of the different models of UAVs was given by (Unmanned Vehicle Systems, 2004).

Some UAV systems use RF link to sends live video, and also have the capability of determining the position, speed and time, of the vehicle (Everaerts, Lewyckyj, & Fransaer, 2004).

Some of the Vehicle systems were built using a Geographical Information Systems (GIS) mapping toolkit that can be purchased on the internet such as the work reported in (Shim, et al., 1998) and (Shim, et al., 2000). They are, however, very expensive and their use would eliminate the essence of learning through our research work. Therefore, the GPS coordinates will be obtained by the receiver, which will subsequently be used to design the mapping algorithm. The client-server model will be retained by defining a Vehicle Side Unit (VSU) and a control station. Also, a comparison and analysis of the cost of these UAV systems were done. This helped in defining the cost factors of the research such that it could afford. Further discussion on UAVs can be found in (Corban, et al., 1998).

Patrick, Nnadi& Ajaelu(2020) observed that the unavailability of construction data and records of incidents that have led to the loss of life, property damage, injuries and loss of materials in an average construction site is alarming. Therefore, the authorsexamined“how effective the use of a drone to monitor safety and security in Nigerian Building Construction site”. about two years earlier, Rakha& Gorodetsky(2018) reviewed UAVs applications in the built environment in terms of building inspection.

Finally, a comprehensive overview of drones was presented in Hassanalian& Abdelkefi (2017). The authors “identify a novel classification of flying drones that range from unmanned air vehicles to smart dust at both ends of this spectrum, with their new defined applications. The design and fabrication challenges of micro-drones, existing methods for increasing their endurance, and various navigation and control approaches are discussed in details. Limitations of the existing drones proposed solutions for the next generation of drones, and recommendations”were examined.

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III. METHODOLOGY

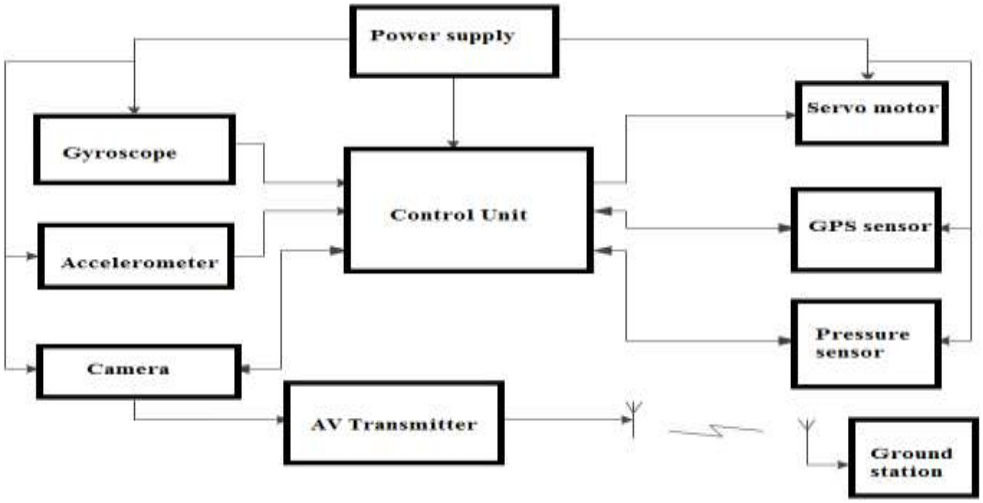

Figure 1: Block Diagram of Unmanned Aerial Vehicle

Design Features

The design features would include flight path programming, onboard GPS sensor (shown in figure 2), surveillance camera, ground station to receive captured data. The GPS sensor Keeps track of UAV location, determination of the point of interest Speed and distance measurement. The design will also incorporate a gyroscope (shown in figure 3), which is a spinning wheel or disc in which the axis of rotation is free to assume any orientation by itself. When rotating, the orientation of this axis is unaffected by tilting or rotation of the mounting, according to the conservation of angular momentum (Kabai, 2007). Also included in the design is an accelerometer, shown in figure 4. It measures the acceleration and vibration of the UAV and keeps track of the movement and orientation of the UAV.

Figure 2: GPS Sensor

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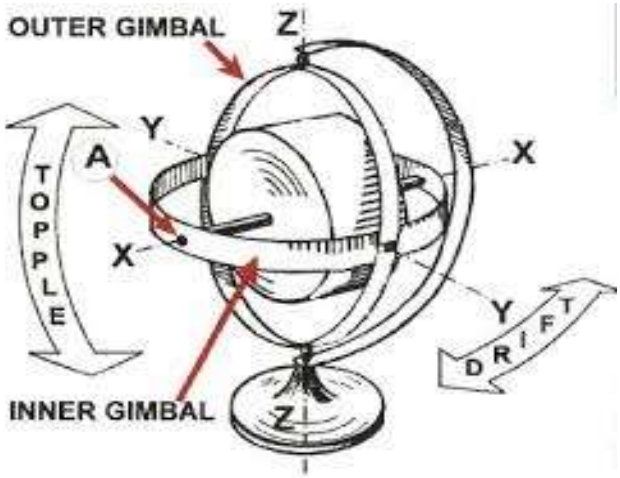

Figure 3: Gyroscope

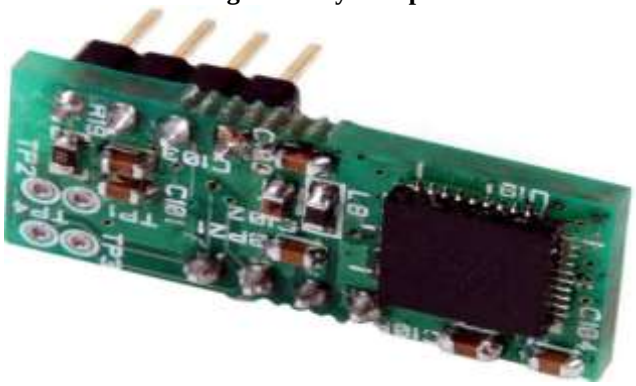

Figure 4: Accelerometer

Base Station Side

The base station side is also called the transmitting side when we are controlling the vehicle but in the case of camera and GPS, it is the receiving side. It is shown in figure 5. The air vehicle control station

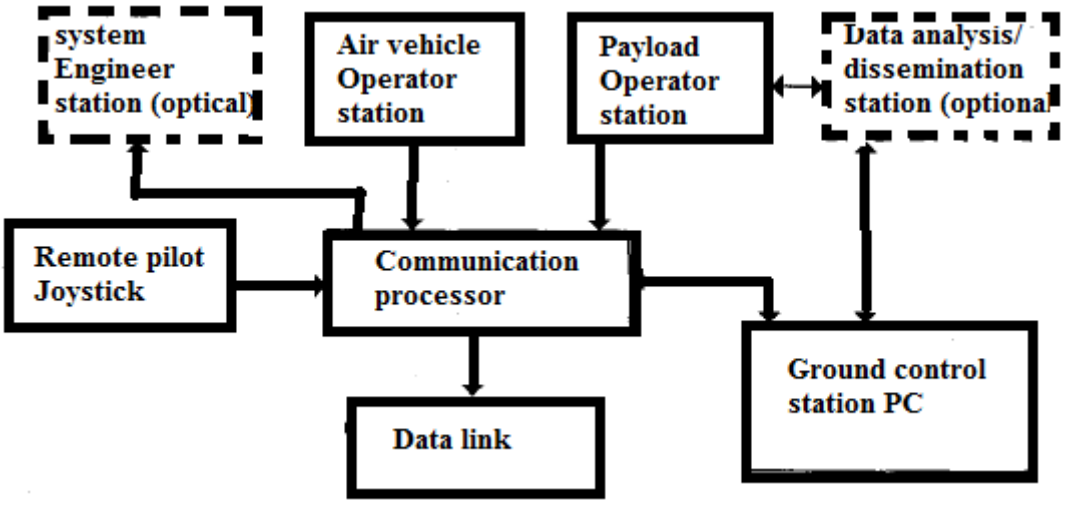

Figure 5: Block Diagram of Base Station with adaptation from (Nataranj, 2001)

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The provision of a man-machine interface to control and fly the UAV is made possible by the Air Vehicle Operator station. It comprises a console or joystick, UAV flight parameter and trajectory display. The data flow between the ground control station and the UAV is managed by a set of dedicated communication processor at either end. The PC contains software modules, graphic processor modules with video data acquisition capability to handle the needed display (Nataranj, 2001).

As the camera transmits the video from the vehicle by using RF (Radio Frequency) at 1.2 GHz, will have an RF receiver at the base station to receive video signals that would be displayed on the monitor. For this purpose, we will make a video player in VB and integrated it with our controlling software so that the vehicle can be controlled monitored.

The RF receiver receives the live video stream and then it decodes it and gives that video stream to the TV tuner card and by using it, we display it on the software player. The video can be saved in the 'avi' format according to will. Press the 'video capture' button on the programme and give it the path on the hard drive where the video will be saved. Furthermore, to stop, press the 'stop' button and the video will be automatically saved on the path on the hard drive which has been set. SMS messages from a mobile phone will be used to transfer the data of GPS to the base station. So a mobile phone, which supports SMS in text format will be attached to the PC on the serial port. The mobile phone receives the message from the vehicle side mobile which is sent after filtration. Then, this message is read from the mobile phone by using the AT commands and it is spitted into longitude, latitude, altitude and speed, then it is displayed on the VB based software. A database to store GPS data would also be created.

This work would be limited to developing an unmanned aerial vehicle for the Federal Polytechnic, Offa. Offa is a town located in Kwara State, North Central, Nigeria, with coordinates: longitudes 8^0 30' 05'' N and latitude 8^0 15' 55'' E. (Mustapha 2009).

IV. RESULT AND DISCUSSION

The UAV was developed following the block diagram shown in Figure 5. The finished work is as shown in Figure 6.

Figure 6: Image of the developed UAV

It was noticed that the UAV's performance is limited in harsh weather conditions, limited battery life and flight time, communication loss and privacy concern.

V. CONCLUSION

The effective use of unmanned aerial vehicles in Nigeria is encouraged because its images could be used for analyzing and evaluating students activities within the campus, especially in areas with no security personnel presence. The use

of drones will reduce illegal campus activities such as cultism, bullying, sexual harassment and so on. It will enhance the sense of safety of both students and staff. This research proposes the use of UAVs as a viable alternative to the traditional safety and security monitoring in the Nigerian campus environment.

However, the issue of privacy and the impact of motor vibration on image quality should be investigated further (Mark &Junshan, 2017, Rok et al., 2016).

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