Design and Development of Monitoring System

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Abstract - Using airborne vehicles to support security-focused monitoring and surveillance operations is known as aerial security. These kinds of operations imply that human officers (police, security, etc.) could plan and assess their operations by remotely monitoring and viewing data and video collected from drones. Drones can be used for a wide range of security-related tasks, such as scouting and reporting emergencies, keeping an eye on crimes and accidents, monitoring a specific area of the landscape, operating in areas with high pedestrian traffic and tracking pedestrians from above, and more. Because a drone will be used, the project will act as a bridge to connect actual events that are occurring in areas that are difficult for corporate institution security personnel to navigate.
Key word: Aluminium alloy, Composite materials, RSM, ANOVA

I. INTRODUCTION

Monitoring someone's actions, behaviour, or other changing data—usually pertaining to people—with the intention of controlling, managing, guiding, or safeguarding them is known as surveillance. This can involve using electronic equipment (like CCTV cameras) to observe from a distance or intercept electronically transmitted data (like phone calls or Internet traffic); it can also involve using low-tech or no-tech methods like human intelligence agents, aerial surveillance using drones to gather the necessary data, and interception. For those inside the cars, visibility is frequently reduced, making it challenging to see all potential hazards to the front, rear, and sides. Insurgent danger increases significantly when visibility is limited. Even with expensive bomb-sniffing dogs, explosive detectors, and law enforcement, there is still no guarantee of total safety on travel routes that can stretch hundreds of miles. Increasing the visibility of the people inside the cars can help reduce these outside dangers. The prototype can be used as a bridge to record events in space and provide a realistic scenario with the least amount of human intervention. The following is ths objective is To perform a literature review on the existing similar systems in order to gain some knowledge that will be applied in implementing this project, to design and construct a Quadcopter that can successfully take off, the quadcopter should fly unaided and smoothly, carry out tests on the designed quadcopter for maximum flight time, maximum height it can fly and the total range of laterally distance it can fly, to implement the actual quadcopter and that will completely carry out instructions and commands given.

II. LITERATURE REVIEW

Large unmanned and manned aircraft of the same type typically share physically identifiable components, with the cockpit and environmental control system or life support systems being the primary exceptions. Certain UAVs are equipped with payloads, like cameras, that facilitate the capture of images and videos. Due to the lack of life-critical systems, small civilian UAVs can be constructed using less robustly tested electronic control systems and lighter, less sturdy materials and shapes. The quadcopter design has gained popularity for small UAVs, but manned aircraft rarely use this configuration. Additionally, miniaturisation opens the door to the use of less potent propulsion technologies—like tiny electric motors and batteries—that are impractical for manned aircraft.
UAV control systems frequently differ from those of manned aircraft. The windows in the cockpit are almost always replaced with a camera and video link for remote human control; radio commands are received in place of actual cockpit controls. Sophisticated autopilot software can be found in both manned and unmanned aircraft; however, the features required for autonomous drone operation are frequently different from those found in large aircraft, such as commercial passenger airlines. A UAV's general physical composition is depicted in fig. 2.1 below (Unmanned Aerial Vehicle 2016a).

III. EXPERIMENTAL DETAILS

The hardware design focuses on identification of the system‟s physical components and their interrelationships. Also determines how these components fit into the system architecture. It also discusses the requirements specification of actual hardware and circuit construction.
The tasks involved in design and development of hardware:

- Design considerations.
- Draw the block diagram
- Identify most suitable flight board controller.
- Identify required motors and how to design them.
- Draw the overall circuit diagram

The first thing was to do a design consideration where analysis of the various parts was analysed and the choice for the different components to use are decided.

PARTS	Number	SPECIFICATION	WEIGHT
Frame	1	HJ model	300g
Motors (19g each)	4	Model Number – A2212 13T 1000KV	76g
Propellers	4	10x45	15g
ESC(13g each)	4	30A SimonK model	52g
Battery	1	LIPO	200g
Flight Controller	1	Hobby king KK2.1	55g
Connectors	20 pieces	Deans Ultra Plugs Gold Bullet Connectors	30g
Total			728g

Table 3.1 Parts and components

In the design of the circuit hardware, the main blocks of the overall system and drawing it as shown in figure below.

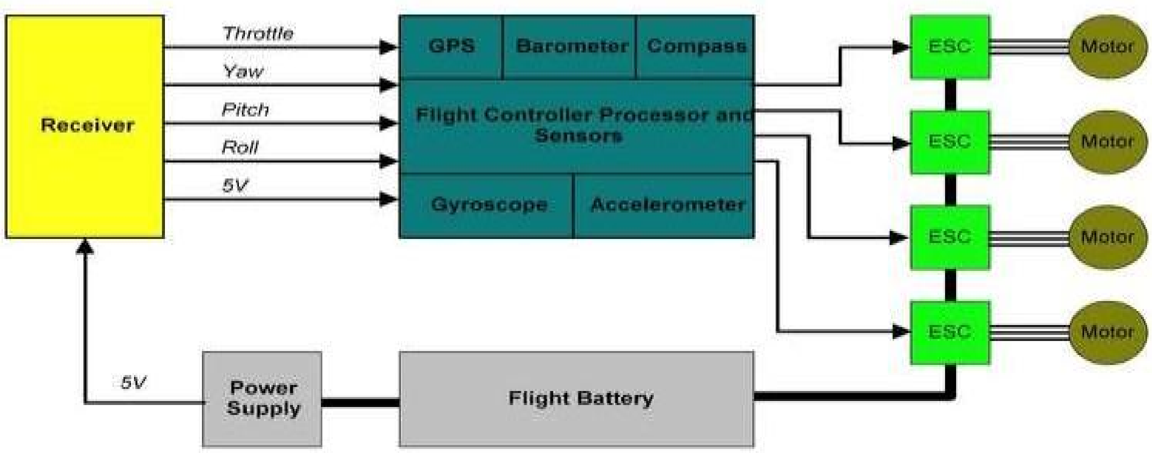

Figure System block diagram (“QuadcopterBlockDiagram.png (PNG Image, 1026 × 998 Pixels) - Scaled (69%)” 2016)

The third step in the design was to choose a microcontroller suitable for the project implementation. To do this first determine the required hardware interfaces e.g. Flight controllers‟ module, motors actuators and sensors.

The choice of microcontroller depends either on digital or analogue functions. For serial to parallel conversion and vice versa these features are best delivered by the Atmega 644pa in the KK2.1 flight board microcontroller.

IV. Hardware design procedure

Here the design is discussed showing all activities involved in framing and implementing the hardware part of the Aerial security surveillance system.

The tasks that will be discussed in this part are:

- Assignment of each motor in the Flight control board and actuators and finally designing the power distribution board the quadcopter.
- Connection of Electronic speed controllers.
- Pairing the radio transmitter to the receiver section to be attached in the Quadcopter.
- Fabrication of the housing to the electronic components and selecting suitable shock- absorbing material.
- Working principles and general assembly of the quadcopter.

Circuit Programming

For the quadcopter to work correctly it should be intelligent to take the commands and execute them as guided from the base station which could be miles away from the physical location of the drone. Hence circuit programming is paramount and the heart of the prototype, the flight controller board has four customized buttons and a liquid crystal display screen which aid in the programming. Using Arduino IDE functions which is a higher level programming language is meant for hardware programming.

Component requirement

Component required are divided into two parts that are hardware and software. Flight controller is applied as auto balance controller of Quadcopter based on input signal from MPU 6050 sensor. The signal produced by KK2.1 Flight controller to control four brushless motor of Quadcopter through Electronic Speed Controller. The Quadcopter body must be rigid and light weight in order to minimize the Quadcopter weigh. For software part, ARDUINO IDE is used to design GUI as interface between control base and Quadcopter.

Flight Controller

A flight controller is used to interpret RC controls, provide telemetry data to the base station, as well as provide dynamic control feedback to keep the Quadcopter stable during flight. The flight controller shall support GPS navigation. The flight controller shall use software that can be manipulated by the user. That is, having access to the flight controller code and modifies it per project needs. I applied KK2.1 flight control board.

Working

A permanent magnet rotor and wire-wound stator poles make up a brushless motor. The permanent magnet rotor and the rotating magnetic field created by the wound stator poles attract each other magnetically, converting electrical energy to mechanical energy. A common point connects the three electromagnetic circuits. The permanent magnet rotor is able to move in the centre of the induced magnetic field because each electromagnetic circuit is split in the middle. The majority of BLDC motors use a star connection three-phase winding topology. This topology motor is powered by energising two phases simultaneously. Since the suggested magnetic alignment is simple to visualise, it is only used as an illustration. In actuality, the greatest torque is attained when The rotor of the permanent magnet is 90 degrees out of alignment with the magnetic field of the stator.

V. CONCLUSION

There is still work to be done; with more time and funding, many design modifications would have been made. Sonar and an optical flow sensor, among other sensors, could have been added to enhance flight performance. These actions would improve the quadcopter's stability, tracking accuracy, and wind-related flying performance. Additionally, a camera could be mounted on the quadcopter to transmit images and video to a base station, which would process the data and make the appropriate decisions. Obstacle sensors are required for the quadcopter's full autonomy; one such feature could be a sonar sensor in front of the vehicle; this would be an easy and quick addition to stop the quadcopter from flying off. an object, an additional option would be to employ one or more cameras along with computer vision to identify the object and figure out the best path around it. The addition of obstacle avoidance would significantly improve this prototype's utility and readiness for the market. Finally, the person learning to fly a quadcopter should get the appropriate advice from the Civil Aviation Department, an organisation responsible for pilot certification, training, and licencing.

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