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A Review on Unmanned Aerial Vehicle (U.A.V.)

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Abstract- UAV-Unmanned Aerial Vehicle commonly known as Drones are extensively being used these years. Today drones are used in various applications like Military, Commercial Cargo Transport, and 3-D Mapping etc. For supporting the weight of the plane, and shock absorption functions, landing gear design is highly essential. Unmanned aerial vehicles (UAV) are the logical successors to modern aircraft and advancements in automated technology. The current generation of UAV's is focused on wartime capabilities and reconnaissance, leaving an existing market untapped by UAV technology: the commercial field. There are hundreds of applications for UAV technology in the civilian market, from emergency response applications and media outlets to communication technicians and horticulturalists. The vehicle can even act as a path guider in normal case and as a fire extinguisher in emergency.

Keywords: UAV, Tx/Rx, module, Delta, mixing, bed.

1. INTRODUCTION

An unmanned aerial vehicle (UAV), called a drone, is an aircraft without a human pilot on board. Its flight is controlled either autonomously by computers in the vehicle or under the remote control of a pilot on the ground or in another vehicle. UAV has many applications besides the military applications with which "drones" became most associated. Numerous civil aviation uses have been developed, including aerial surveying of crops, acrobatic aerial footage in filmmaking, search and rescue operations, inspecting power lines and pipelines, and counting wildlife, business advertisements etc. A small scale UAV can be designed using EPP foam, 2.4 GHz Transmitter & Receiver (Tx/Rx), brushless motor, servos, Electronic Speed Controller (ESC). The UAV makes use of eleven (delta) mixing which reduces

the hardware requirements and complexity in designing the model. The small scale UAV can be used for commercial aerial surveillance, remote sensing, scientific research, etc. There are many applications for UAV technology in the military and civilian market, from emergency response applications and media outlets to communication technicians and horticulturalists. It is a fact, though a very simplistic fact, that unmanned aerial vehicles (UAVs) are little aircraft, more or less. This means that the UAVs follow the laws of thermodynamics and the laws of physics. UAVs are even more varied in their physical characteristics than are manned aircraft. Their size widely varies with wingspans ranging from 7 inches to 13 ft.Mini-UAVs in the current field have wingspans ranging from 21 inches to 10 ft. These UAVs can be remotely controlled or can fly autonomously based on pre-programmed flight plans. They carry a variety of payloads including infrared cameras, television cameras and jamming electronics. UAVs are of growing interest to military operations, but they can also be used in a variety of civilian applications. Potential military applications for mini-UAVs include local reconnaissance, target identification, post-strike battle damage assessment, electronic warfare (including radar jamming) and combat search and rescue. Potential civilian applications include monitoring traffic, inspection of oil pipelines or power-lines, border surveillance, killing harmful insects, surveying wildlife, real estate photography, monitoring concentrations in chemical spills and more.

2. REQUIRED HARDWARE

List of hardware

- 2.4 GHz Tx/Rx (Mode 2-Throttle on the left) with delta mixing.
- 24x36 sheet of 30mm EPP Foam.
- Two Micro Metal Gear 9g servos.
- 2200kV brushless out-runner motor
- 2200mA 3S1P 30C Lithium polymer (LiPo) battery.

- 40A ESC with inbuilt battery eliminator circuit(BEC)
- Propeller with diameter 6 inch and pitch 4 inch (6x4).
- Balsa Wood.

3. COMPONENTS DESCRIPTION

3.1 Brushless Out-runner Motor

It is a synchronous motor that is powered by a DC electric source via an integrated switching power supply, which produces an AC electric signal to drive the motor.

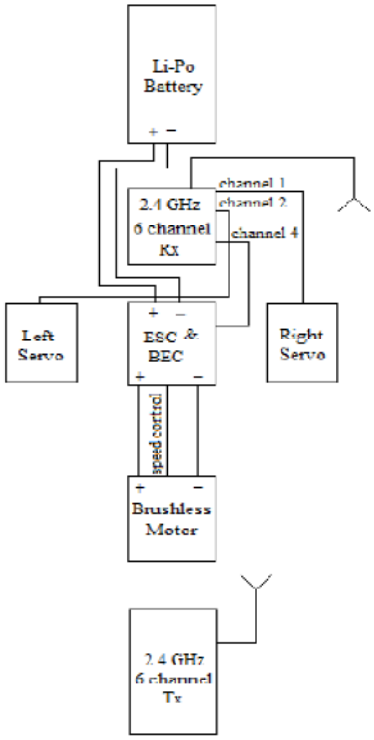

Fig 1 Block Diagram

3.2 Electronic Speed Controller with Battery Eliminator Circuit (ESC)

It is an electronic circuit with the purpose to vary an electric motor's speed, its direction and possibly also to act as a dynamic brake. The ESCs with built in BEC are engineered so that the current to power the radio system in the UAV is drawn from the Li-Po battery (that also powers the brushless motor). This saves weight as no separate battery is required to be installed to power the radio.

3.3 Lithium Polymer battery

Lithium-ion polymer battery is a rechargeable (secondary cell) battery. It is usually composed of several identical secondary cells in parallel to increase the discharge current capability, and is often available in series configuration to increase the total available voltage.

3.4 Servo

A servo is a specific type of motor and rotary encoder combination that forms a servo mechanism. The encoder provides position and usually speed feedback, which by the use of a PID controller allow more precise control of position and thus faster achievement of a position.

3.5 GHz 4 Channel Tx/Rx

It performs the function of transmitting and receiving communication signals used to control any system. It has a range of 1 kilometer radius and comes with 4 channels which are used to control different components connected to the receiver (eg . servos, speed controller, etc.).

4. SYSTEM DESCRIPTION

4.1 Airframe and Power Plant

A COTS Radio controlled model airplane kit is used as the airframe/test platform. The airframe chosen for this a Hangar 9, 1/4th scale Piper J3 Cub. See Figure 1(a). The kit is available in Almost Ready-To-Fly condition, an hence minimized assembly time. The scaled down model of a popularly studied general aviation aircraft, such as the Piper Cub, also simplexes dynamic modeling of the platform. The Hangar 9 Piper Cub is equipped with individually actuated control surfaces that are used to simulate situations such as aircraft damage and un modeled dynamics such as a change in the moment coincident, Cm0 , due to lowering of both ailerons simultaneously, thus acting as apes. These capabilities make the UAV a good test platform for adaptive control research. The power plant chosen for this project is a Fuji Imvac BT43EI gasoline/oil engine(Figure 2(b)

(a) Hangar 9 25% Piper J3 Cub

(b) Fuji Imvac BT43-EI

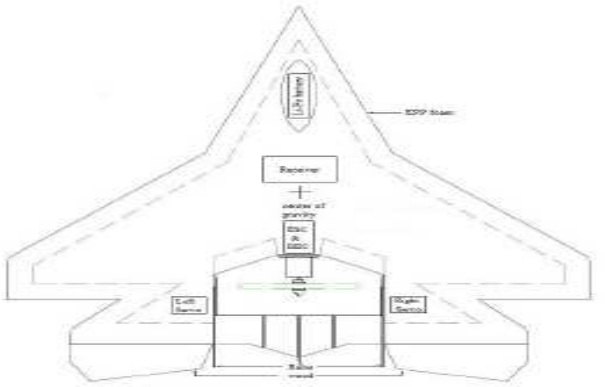

Figure 2:top view chassis frame

4.2 Flight Computer

The light computer used is a FitPC2 minicomputer. The FitPC2 is finless Intel Atom based Single board computer. This computer was chosen due to its light and small form factor and rugged construction. The Intel based architecture enables the use of commercially used operating systems such as Windows Embedded and VX Works. The computer has six external USB ports, an HDMI display port and uses a solid state memory (CF card) for data storage. This makes the light computer less susceptible to damage due to vibration. Power to the light computer is provided Lithium Polymer batteries, capable of delivering a charge of up to 2450 mAh at 14.8 volts. A power board comprising of two voltage regulators, to step down the voltage from 14.8 volts to 12 volts was built.

4.3 Avionics/Sensor Suite

The UAV will uses a Micro strain 3DM-GX3 Attitude Heading Reference System for orientation, angular and linear inertial force measurements. The Micro strain 3DM-GX3 combines a tri-axial accelerometer, tri-axial gyro, tri-axial magnetometer, temperature sensors, and an on-board processor running a sophisticated sensor fusion algorithm to provide static and dynamic orientation and inertial measurements.

4.4 Software

Microsoft Windows XP Embedded will be used as the onboard operating system. The Embedded version of Windows provides real time operating system capabilities, ensuring stable running of the control system programs. The current configuration of the UAV is running Windows XP Professional, for ease of development .The UAV is developed around a central Plug-and-Play software infrastructure, the Reaction Architecture.

5. USES OF U.A.V.

5.1. Professional aerial surveying

UAS technologies are used worldwide as aerial photogrammetric and LiDAR platforms.

5.2. Commercial and motion picture filmmaking

In the United States, FAA regulations generally permit hobbyist drone use when they are flown below 400 feet, and within the UAV operator's line of sight. For commercial drone camerawork inside the United States, industry sources state that usage is largely at the de facto consent – or benign neglect – of local law enforcement. Use of UAVs for filmmaking is generally easier on large private lots or in rural and exurban areas with fewer space concerns. In certain localities such as Los Angeles and New York, authorities have actively interceded to shut down drone filmmaking efforts due to concerns driven by safety or terrorism.Drones were used in the 2014 Winter Olympics in Sochi for filming skiing and snowboarding events. Some advantages of using unmanned aerial vehicles in sports are that they allow video to get closer to the athletes, and they are more flexible than cable-suspended camera systems

5.3. Search and rescue

UAVs were used in search and rescue after hurricanes struck Louisiana and Texas in 2008. Predators, operating between 18,000 and 29,000 feet above sea level, performed search and rescue and damage assessment. Payloads carried were an optical sensor and a synthetic aperture radar. The latter can provide images through clouds, rain, or fog, and in daytime or nighttime conditions, all in real time. Photos taken before and after the storm are compared, and a computer highlights areas of damage. Micro UAVs, such as the Aeryon Scout, have been used to perform search and rescue activities on a smaller scale, such as

the search for missing persons UAVs have been tested as airborne lifeguards, locating distressed swimmers using thermal cameras and dropping life preservers to swimmers.

Figure 3:uas 3.1 octocopter

5.4. Demining

The Space Assets for Demining Assistance program from the European Space Agency aims to improve the socioeconomic impact of land release activities in mine actionIt is developing and has tested UAV technology for demining in Bosnia-Herzegovina.

5.5. Scientific research

Unmanned aircraft are especially useful in penetrating areas that may be too dangerous for manned aircraft. The U.S. National Oceanic and Atmospheric Administration began using the Aerosonde unmanned aircraft system in 2006 as a hurricane hunter. The 35-pound system can fly into a hurricane and communicate near-real-time data directly to the National Hurricane Center. Beyond the standard barometric pressure and temperature data typically culled from manned hurricane hunters, the Aerosonde system provides measurements from closer to the water's surface than previously captured. NASA later began using the Northrop Grumman RQ-4 Global Hawk for extended hurricane measurements.

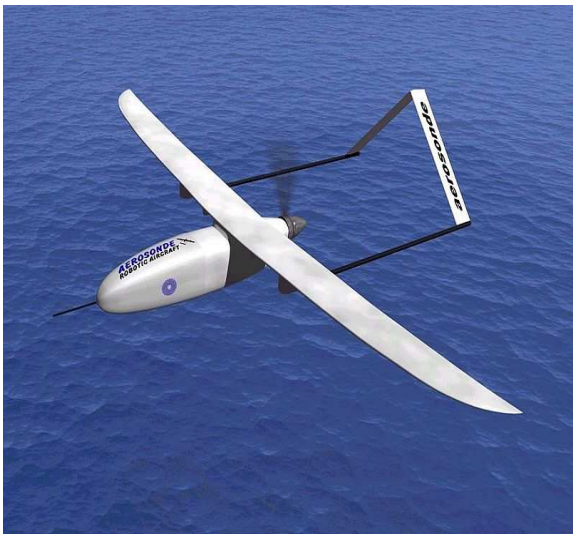

Figure 4: AAI corporation aerosonde

5.6. APPLICATIONS

- Remote sensing
- Commercial aerial surveillance
- Domestic policing and patrolling
- Oil, gas and mineral exploration and production
- Transport of goods
- Scientific research
- Search and rescue operation
- Forest fire detection

6. FUTURE SCOPE

Future work on the autopilot system would be to include the GPS module for better position data. The IMU and GPS could be fused together using an estimator based approach, to get accurate position data. Future versions of the autopilot will also have the ability to transmit light data to a ground based computer for monitoring and analysis. This will be done by including the 900 MHz radio modem, in the autopilot loop.

7. CONCLUSION

In this paper the procedure to built UAV has been perspicuously stated. The small scale UAV is cost effective and has many applications in various fields like military etc. This brief look at the UCAV and other emerging technologies merely scratched the surface of employing UAVs in a strike role. Further research should focus on control of **CAS** UAVs at the tactical level. Additionally, further study must determine the proper manned unmanned force mix to meet future battle field requirements, as well as doctrinal and

operational considerations for employing UAVs in civil airspace and in concert with Air Expeditionary Forces.

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