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Framework for Android Controlled UAV for Navigation (Path – Pradarshak)

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ABSTRACT: Unmanned Aerial Vehicle (UAV) have been around for decades and have been used in a variety of roles in both military and commercial applications an UAV, commonly known as a drone is an aircraft without a human pilot aboard. Its flight is controlled either autonomously by onboard computers or by the remote control of a pilot on the ground or in another vehicle. UAVs used radio technology for guidance, allowing them to fly missions and return. They were constantly controlled by a human pilot, and were not capable of flying themselves. This made them much like todays RC model airplanes which many people fly as a hobby this paper is focusing on frame work for designing UAV.

Keywords: UAV, Drone, Sensors, Microcontroller

1. INTRODUCTION

The first UAV was manufactured by the Americans Lawrence and Sperry in. This is known as the beginning of ―attitude control, which came to be used for the automatic steering of an aircraft. They called their device the ―aviation torpedo‖ and Lawrence and Sperry flew it a distance that exceeded 30 miles. The development of UAVs began in earnest at the end of the 1950s, taking advantage of the Vietnam War or the cold war, with full-scale research and development continuing into the 1970s. UAV called Fire bee. After the Vietnam War, the U.S. and Israel began to develop smaller and cheaper UAVs. These were small aircraft that adopted small engines such as those used in motorcycles or snow mobiles. They carried video cameras and transmitted images to the operator‘s location. It seems that the prototype of the present UAV can be found in this period. The U.S. put UAVs into practical use in the Gulf War in 1991.Unmanned Aircraft system (UAS) has been used recently a lot in military applications as well as in civilian. Its importance and advantages in the search and rescue, real-time surveillance, reconnaissance operations, traffic monitoring, hazardous site inspection and range extension, recently it also used agriculture field. Moreover, UAS is suited for situations that are too dangerous and hazardous where direct monitoring of humanly not possible [1, 2]

2. UAV SYSTEM

An unmanned aircraft system is a system comprised of three main features: the aircraft, the Ground Control Station and the operator. UAV 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 and can carry a lethal or non-lethal payload (These payloads can be high and low resolution cameras/video cameras, day and night reconnaissance equipment, warfare machinery weapons and generally any equipment required for the mission the UAV is designed for [3].

3. CLASSIFICATION OF UAV

A powered vehicle that does not carry a human operator, can be operated autonomously or remotely, can be expendable or recoverable, and can carry a lethal or nonlethal payload Significant efforts have been devoted to increasing the flight endurance and payload of UA, resulting in various UA configurations with different sizes, endurance levels, and capabilities. Here, classify UA according to their characteristics (aerodynamic configuration, size, etc.)[4]. UA platforms typically fall into one of the following four categories:

3.1 Fixed-wing UA

Which refer to unmanned airplanes (with wings) that require a runway to take-off and land, or catapult launching these generally have long endurance and can fly at high cruising speeds.

3.2 Rotary-wing UA

It is also called rotorcraft UAVs or vertical take-off and landing (VTOL) UAVs, which have the advantages of hovering capability and high maneuverability. These capabilities are useful for many robotic missions, especially in civilian applications.

3.3 Flapping-wing UA

Which have flexible and/or morphing small wings inspired by birds and flying insects. There are also some other hybrid configurations or convertible configurations, which can take-off vertically and tilt their rotors or body and fly like airplanes

4. UAV ARCHITECTURE

A UAV is composed of various electromechanical parts and sensors which are used to govern the flight and working of UAV here the architecture of UAV is shown in Figure 1[5].

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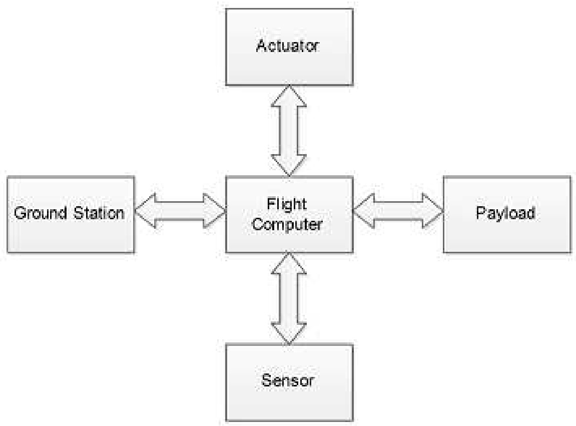

Figure 1. Architecture of UAV

4.1 Flight Computer/ aircraft control system

Used to fly the UAV. Either a two-way data link (radio) for remote control or an onboard computer (generally with GPS navigation) connected to the aircraft control system. Flight control and operating system which includes the control station(s), communication links, data terminal(s), launch and recovery systems.

4.2 Actuators

Actuators are devices of great importance in the control of Unmanned Aerial Vehicles (UAV), where they are used to command the control surfaces of the aircraft. The performance and the stability of the vehicle depend on the adequate modeling of its performance, as well as of the experimental identification of its physical parameters.

4.3 Payload

Payloads can be high and low resolution cameras/video cameras, day and night reconnaissance equipment, high-power radar, gyro-stabilized, electro-optical

4.4 Sensors

Sensor is used to provide basic functionality which is the ability to maintain flight without human input, radar, photo or video camera, IR scanners or ELINT are most common. Sensors may include a (laser) target designator to provide guidance for stand-off guided missiles and shells

4.5 Navigation sensors and microprocessors

Sensors now represent one of the single largest cost items in an unmanned aircraft and are necessary for navigation and mission achievement. Processors allow UAVs to fly entire missions autonomously with little or no human intervention.

4.6 Aircraft onboard intelligence

The intelligence that can be ―packed‖ into a UA is directly related to how complicated a task that it can handle, and inversely related to the amount of oversight required by human operators.

5. COMMUNICATION IN UAV

The principal issues of communication technologies are flexibility, adaptability, security, and cognitive controllability of the bandwidth, frequency, and information/data flows. A UAS data link typically consists of an RF transmitter and a receiver, an antenna, and modems to ink these parts with the sensor systems [6]. For UAS, data links serve three important functions:

(i) Uplinks from the ground station and/or a satellite to send control data to the UAV

(ii) Downlinks from the UAV to send data from the onboard sensors and telemetry system to the ground station

(iii) A means for allowing measurement of the azimuth and range from the ground station and satellite to the UAV to maintain good communications between them. There are three forms of control that an operator may exert over the aircraft

5.1 Ground control

Ground-controlled UA also called Remotely Piloted Vehicles (―RPVs‖), require constant input from the operator.

5.2 Semi-autonomous

The operator must assume full control of the aircraft during pre-flight, take-off, landing, and when operating near base, but once airborne an autopilot function can be engaged and the aircraft will follow a set of preprogrammed waypoints. The operator is responsible for the UA throughout the operation, however, and can assume control at any time.

5.3 Fully autonomous

Fully autonomous capability lies at the other end of the spectrum. In theory, autonomous flight requires no human input to carry out an objective following the decision to take-off. An autonomous UA can monitor and assess its health, status and configuration; and command and control assets onboard the vehicle within its programmed limitations. ―A sophisticated autopilot, allowing it to ―fly itself‖ on

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programmed flight paths without [human] interference for almost all the mission‖. ―Without an operator doing anything more than monitoring its systems‖.

6. FREQUENCY BANDS FOR UAS

- Ku band: this band has been historically used for high speed links. Due to its short wavelengths and high frequency, this band suffers from more propagation losses. Yet it is also able to trespass most obstacles thus conveying great deals of data.
- K band: possesses a large frequency range which conveys large amounts of data. As a main drawback, it should be mentioned that it requires powerful transmitters and it is sensitive to environmental interferences.
- S, L bands: they do not allow data links with transmission speeds above 500 kbps. Their large wavelength signals can penetrate into terrestrial infrastructures and the transmitter require less power than in K band.
- C band: it requires a relatively large transmission and reception antenna.
- X band: reserved for military use.

Table 1. Frequency Band

Band	Frequency
HF	3-30 MHz
VHF	30-300 MHz
UHF	300-1000 MHz
L	1-2 GHz
S	2-4 GHz
C	4-8 GHz
X	8-12 GHz
Ku	12-18 GHz
K	18-26.5 GHz
Ka	26.5-40 GHz

7. OPERATING SYSTEM AND SOFTWARE CONSIDERATIONS

The Operating System (OS) Application Programming Interface (API) is a very important consideration, not only from the point of view of execution, but also in the ease of system development. Due to the time, critical nature of flight control, high reliability and real-time execution is mandatory. The Portable Operating System Interface (POSIX) IEEE 1003.1 is the preferred operating system interface standard since it is widely supported, and allows easy porting of applications[7][8][9].

8. APPLICATION OF UAV

Currently, the main UAV applications are defense related and the main investments are driven by future military scenarios. Most military unmanned aircraft systems are primarily used for Intelligence, Surveillance and Reconnaissance (ISR) patrols and strikes. It also used for Chemical, Biological, Radiological and Nuclear (CBRN) detection, or simply those tasks considered too dangerous or politically challenging for manned aircraft to undertake [10].

Military Applications:

- Reconnaissance Surveillance and Target Acquisition
- Battle Damage Assessment (BDA).
- Radio and data relay
- Decoying missiles by the emission of artificial signatures
- Surveillance of enemy activity
- Monitoring of nuclear, biological or chemical (NBC) contamination
- Radar system jamming and destruction

Civil Applications: Today, the civilian markets for UAVs are still emerging. However, the expectations for the market growth of civil and commercial UAVs are very high

- Policing duties
- Traffic spotting
- Fisheries protection
- Pipeline survey
- Sports events film coverage
- Agricultural operations
- Power line survey
- Aerial photography
- Border patrol
- Surveillance of coastal borders, road traffic, etc.
- Disaster and crisis management search and rescue.
- Environmental monitoring.
- Firefighting.
- Mosquito collection

9. DEVELOPMENT

We are exploring two distinct development ways of UAV technology: a quadcopter's capability to autonomously sense and understand its surroundings, and its ability to interface and act with individuals. These parallel aims steered the event of Path-Pradarshak tour-guide system, leading to a platform that may with efficiency find, communicate with, and guide guests around university field, specifically on planned routes or towards user-determined destinations.

A custom Path-Pradarshak app will be developed for human/UAV interface, sanctioning the traveler to create

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specific requests, and therefore the UAV to each find and wirelessly communicate with them. Once the user presses the 'call' button, Path-Pradarshak outright accesses the GPS location of the visitor's phone and relays abstraction coordinates to the closest on the market UAV.

The quadcopter itself utilities aboard autopilot and GPS navigation systems with measuring instrument sensors and LAN property (via a ground station), sanctioning it to fly autonomously and communicate with the user via the Path-Pradarshak app. The UAV additionally integrates associate aboard camera as each associate military operation system (relaying pictures to a 'base' location upon encountering the user), likewise as a manually-controlled camera, accessible to the visitor-come-tourist once more via the Path-Pradarshak app.

10. CONCLUSION

Path-Pradarshak is Phase I of a bigger development program that's presently afoot at university, with the broader aim of exploring novel, positive uses of UAV technology within the urban context. This project offers a case study, we can have many application of this project like navigation, surveillance, monitoring the growth and diseases in plants and crops, sowing of seeds in remote areas like forests and bare lands, firefighting, 3D-Mapping, medical emergency and many more.

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