IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Design and Control of Drone Using Raspberry PI model and APM 2.8 Flight Controller

Shivtej Bhor, Sanika Patade, Shraddha Gaikwad, Ankita Ashtekar, Prof.N.S. Bagal

Department of Computer Engineering PVPIT, PUNE-411021

ABSTRACT:

Unmanned Aerial Vehicle (UAV) is commonly known as Drone. It is extensively being used these years. Nowadays drones are used in various Military applications, Commercial Cargo Transport, and 3-D Mapping etc. For supporting the weight of the plane, and shock absorption functions, landing gear design is highly needed. Unmanned aerial vehicles (UAV) are the logical successors to modern aircraft and advancements in automated technology. The current generation of UAVs is focused on wartime capabilities and reconnaissance, leaving an existing market untapped by UAV technology: the commercial field. There are thousands of applications for UAV technology in the civilian market, from quick response applications and media outlets to communication technicians and horticulturalists. Drones represent a compelling subject of inquiry, prompting an exploration into their intricate mechanics, constituent elements, and their expansive array of applications that profoundly shape their future prospects. Integrating principles from electronics, mechanical engineering, and particularly aviation, drones epitomize a convergence of diverse disciplines. These aerial vehicles manifest in various forms, categorized by distinct configurations such as bicopters, tricopters, quadcopters, hexcopters, octocopters, and more.

INDEX TERM:

Unmanned Aerial Vehicle, Artificial intelligence, Random Access Memory, integrated development environment , Visual Studio.

Introduction :

As we know we have a drone for spying and combat (in development) but I think it is not enough for army and other forces. Consider the following conditions : 1. Surgical strike (we have a drone but only for spying and track the movement of terrorist) 2. Neutralizing militants in JK 3. At the time of Terrorist attack (drone just see the movement and notify to force) 4. Naxalite attacks or keep tracking of their movement We mean we don't have a quick reaction drone which can fire missile similar to Pike 40mm (Length:16.8 Inch , maximum firing length: 2000m) .

Due to increasing interest, Drones are being commercially launched in the market today in various size and forms. Quadcopter or quad rotor is a special kind of Drone that consists of four rotors and is being actively applied in the field or research and development in recent years. The major technological advantage of Quadcopter over other species of its kind is its stability, simpler design and maneuverability. In helicopters tail rotor is provided to control yaw motion. Unlike helicopter, Quadcopter has four rotors where a pair of rotor move in clockwise direction and a pair rotate in anticlockwise direction.

RELATED WORK :

1)Socket Programming:

A socket is a type of medium that provides a connection between two devices. The socket can be either a phone charger that provides the connection between the socket and the phone or the phone and that laptop. With the help of a socket, different applications are attached to the local network with different ports. Every time when the socket is created, the server specifies the program, and that program specifies the socket and the domain address. The socket is a type of mechanism that is used to exchange data between different processes. Here these processes are either present in different devices or the same device which are connected over a network. Once the connection for the socket is created, then the data can be sent in both directions and continues until one of the endpoints closes the connection. There are some procedures that we have to follow to establish client-server communication.

2) Live Streaming:

Live streaming from a Raspberry Pi to a computer involves the implementation of an efficient streaming algorithm to encode, compress, and transmit video data in real-time. The algorithm typically follows these steps:

Video Capture: The Raspberry Pi captures video frames using the Raspberry Camera Module V2. This involves configuring the camera settings such as resolution, frame rate, and exposure as per the project requirements.

METHODOLOGY:

Hardware Setup: Connected the APM 2.8 flight controller to the quadcopter according to manufacturer specifications. Configured the Raspberry Pi with necessary peripherals for communication and interfacing with the APM 2.8.

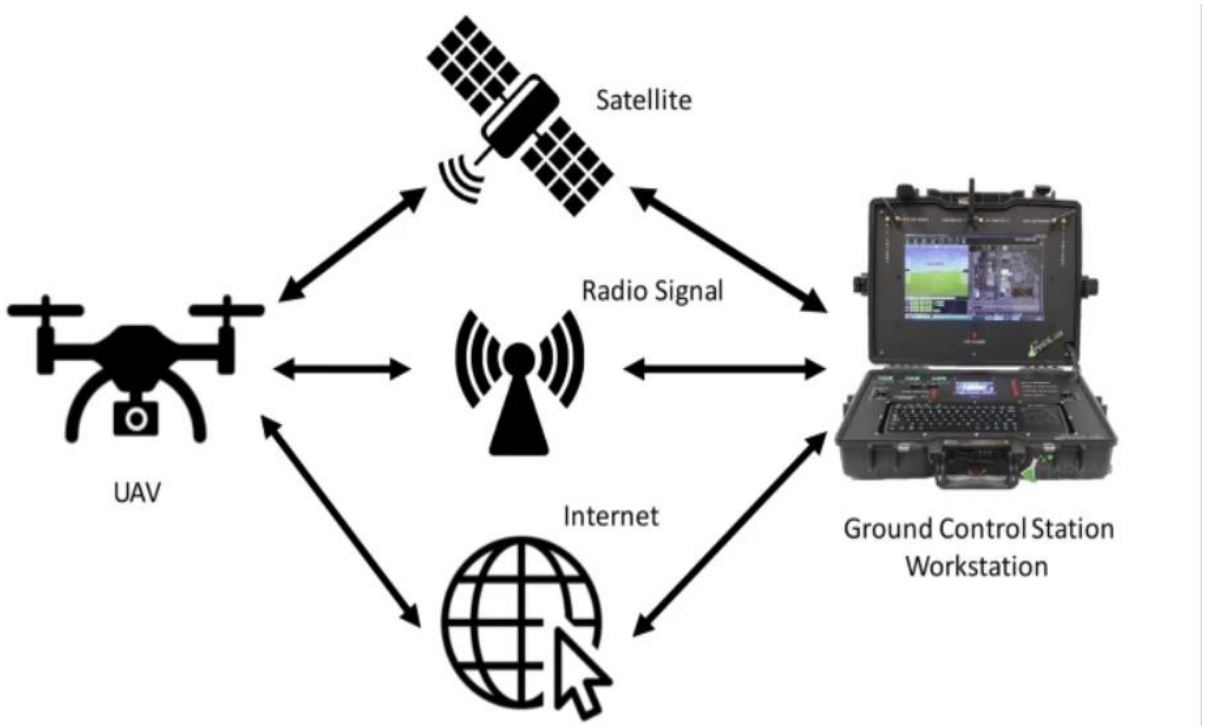
Software Installation: Installed required libraries and software on both the Raspberry Pi and the ground control station (GCS) for TCP communication. Configured the APM 2.8 firmware and parameters using Mission Planner software.

Networking Configuration: Configured network settings to establish TCP/IP communication between the Raspberry Pi and the GCS.

Programming: Developed scripts on the Raspberry Pi to read sensor data from the APM 2.8, process it, and send control commands to the quadcopter. Implemented scripts on the GCS to send commands to the Raspberry Pi over TCP and receive telemetry data.

Testing and Optimization: Conducted extensive testing to ensure reliable communication and control between the Raspberry Pi, APM 2.8, and quadcopter. Optimized control algorithms, PID settings, and sensor calibration for improved performance.

ARCHITECTURE:



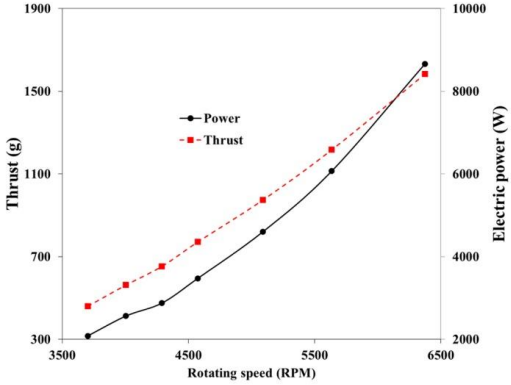
RESULTS & DISCUSSION :

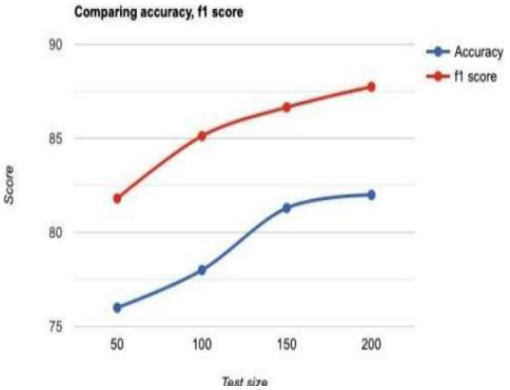
Control Flexibility: Raspberry Pi offers extensive programming capabilities, enabling you to implement complex control algorithms and integrate various sensors for navigation and stabilization. This can result in precise control over the drone's movements.

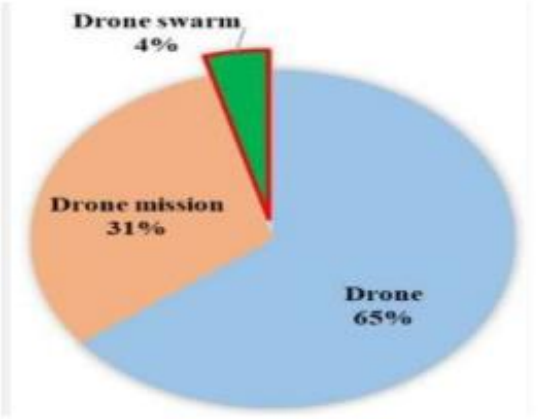
Integration: APM 2.8 is a popular open-source autopilot system that provides stability, GPS-based navigation, and autonomous flight capabilities. Integrating it with a Raspberry Pi allows for advanced functionalities like computer vision-based navigation or wireless communication with ground stations.

Customization: With Raspberry Pi, you have the freedom to customize every aspect of your drone's software. This includes adding features like live video streaming, telemetry data logging, or even autonomous mission planning and execution.

Scalability: Raspberry Pi's modular design allows for easy expansion and addition of peripherals. You can enhance your drone with additional sensors, cameras, or communication modules, depending on your specific application requirements.







CONCLUSION:

In this thesis, the design, modelling, and control of a UAV was presented. The conceptual design stages of the UAV were analyzed in detail. UAVs will continue to be useful as sky watchers indefinitely. UAVs are an effective and successful equipment in the field, and they play an important part in the military. Drones have been used to transport IEDs and destroy hostile locations. Agriculture, Drones, tree-based remote sensing applications, water quality monitoring, disease detection, crop monitoring, yield forecasting, and drought monitoring are just a few of the data sources. Drones can carry health care, microbiological and laboratory samples, medications, vaccines, emergency medical supplies, and patient transportation. Aspects such as lifecycle, current mission, future missions, and performance will be crucial factors in alternative selection for use in the development. UAVs will continue to be useful as sky watchers indefinitely. UAVs are an effective and successful equipment in the field, and they play an important part in the military. Drones have been used to transport IEDs and destroy hostile locations. Agriculture, Drones, tree-based remote sensing applications, water quality monitoring, disease detection, crop monitoring, yield forecasting, and drought monitoring are just a few of the data sources.

REFERNCES:

1) A. B. Reed. (2013). Drone Swarms–Offense and Defense in Depth. [Online]. Available: http://www.wikistrat.com/op-ed-drone-swarmsoffense-and-defense-in-depth/
2) S. J. Edwards, Swarming and the Future of Warfare. RAND Corp, Santa Monica, CA, USA, 2005.
3) UAV Cooperative Decision and Control Challenges and Practical Approaches, Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 2009.
4) P. Dasgupta, ‘‘A multiagent swarming system for distributed automatic target recognition using unmanned aerial vehicles,’’ IEEE Trans. Syst., Man, Cybern. A, Syst. Hum., vol. 38, no. 3, pp. 549–563, May 2008.
5) Coverage Control for UAV Swarm Communication Networks: A Distributed Learning Approach (5 April 2022)
6) Battlefield Mapping by an Unmanned Aerial Vehicle Swarm: Applied Systems Engineering Processes and Architectural Considerations From System of Systems (22 January 2020)
7) A Survey on Applications of Unmanned Aerial Vehicles Using Machine Learning (19 oct 2023)
8) Non-Orthogonal Multiple Access for Unmanned Aerial Vehicle Assisted Communication Date of Publication: 13 April 2018
9) A Survey of Cyberattack Countermeasures for Unmanned Aerial Vehicles Date of Publication: 02 November 2021
10) MUHAMMADYEASIR ARAFAT AND SANGMAN MOH Location-Aided Delay Tolerant Routing Protocol in UAV Networks for Post-Disaster Operation (8 November 2022)