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BENGALURU

Development of Drone for Emergency Services

AY 2020-24

Major Project
Project ID: CS17

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A University should be a place of light, of liberty, and of learning.

Department of Electrical Electronics and Communication Engineering

Project Team:
- Jagannath Sagar Karri

Project Mentor:
- Sanhita Manna

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Project Group – Details

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Photo	Track	Roll No	Name
	EECE AI/ML	BU21EECE0100162	Jagannath Sagar Karri

Objective and Goals

Objective

Brief Description

Objective: The project aims to develop an assistance drone specifically designed to enhance the capabilities of emergency services. The drone will focus on providing real-time situational awareness, reconnaissance, and support for rescue operations in hard-to-reach or disaster-affected areas.

Goals

Main Goals

•Implement high-resolution imaging for detailed situational assessment.
•Integrate real-time communication capabilities for continuous data transmission.
•Achieve a flight time of up to 40 minutes and a 1-kilometer operational range.
•Autonomous Navigation complimented with Geo-Fencing

Additional Goals

•Ensure the drone can withstand harsh environmental conditions.
•Utilize dual-band for reliable communication.
•Focus on reducing response times by up to 50%.

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Project Plan

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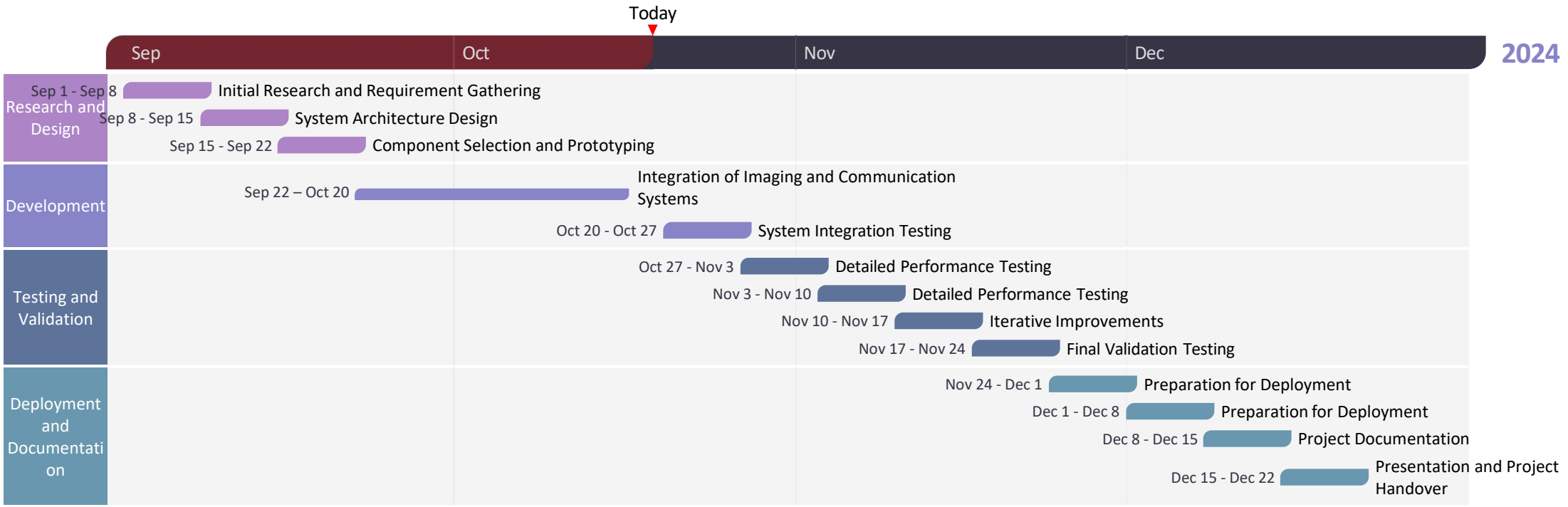


Literature Survey

Key Publications

- APPLICATIONS OF UNMANNED AERIAL VEHICLES: A REVIEW

http://dx.doi.org/10.17993/3ctecno.2019.specialissue3.85-105

- A review of UAV autonomous navigation in GPS-denied environments

https://doi.org/10.1016/j.robot.2023.104533

- Reliable Flying IoT Networks for UAV Disaster Rescue Operations

https://doi.org/10.1155/2018/2572460

- UAV- based Photogrammetry and Geocomputing for Hazards and Disaster Risk Monitoring – A Review

https://doi.org/10.1186/s40677-016-0060-y

Key Resources – Whitepaper| Application Notes | Datasheet| Others

- **Component:** Ublox NEO-M8N GPS Module Datasheet
- **Component:** Sharp GP2Y0A21YK0F Analog Distance Sensor Datasheet
- **Component:** HC-SR04 Ultrasonic Distance Sensor datasheet

Existing Implementations – Products| Opensource| GitHub etc

- **Aerial Drones for Fire Disaster Response**

10.5772/intechopen.1002525

- **DJI ENTERPRISE – Firefightinng**

https://enterprise.dji.com/public-safety/firefighting

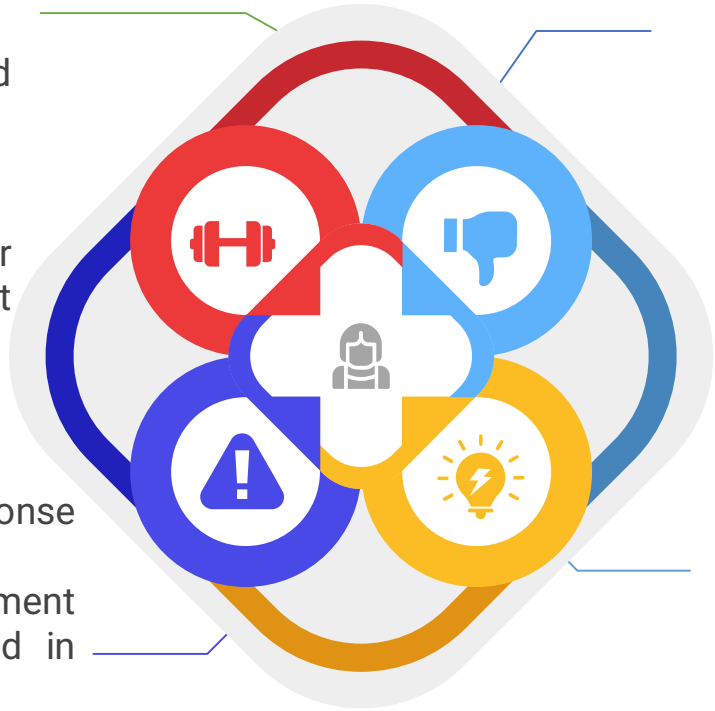
Analysis - SWOT

Strengths

S1. High-resolution imaging provides detailed situational awareness.
S2. Real-time communication enhances coordination and decision-making.
S3. Autonomous navigation allows for operation in challenging environments without constant human intervention.

Opportunities

O1. Increasing need for efficient disaster response solutions worldwide.
O2. Potential partnerships with government agencies, NGOs, and private sectors involved in disaster management.
O3. Expansion into other applications, such as surveillance, wildlife monitoring, and infrastructure inspection.



Weaknesses

W1. Battery limitations restrict flight time and range.
W2. Dependence on communication infrastructure may affect performance in areas with poor connectivity.

Threats

T1. Potential for signal interference or hacking, compromising communication and control
T2. Environmental challenges (e.g., severe weather conditions) that could affect drone operation.

Analysis – 4W1H

Why:

- To provide emergency responders with immediate, reliable situational awareness to make informed decisions quickly, improving response times and reducing risks to human life.

What:

- A multi-functional drone equipped with advanced sensors, high-resolution cameras, and reliable communication systems to support emergency services in disaster-affected areas.

Where:

- Can be deployed in various scenarios, including urban disaster sites, remote natural disaster areas, and hazardous environments where human access is limited or dangerous

When:

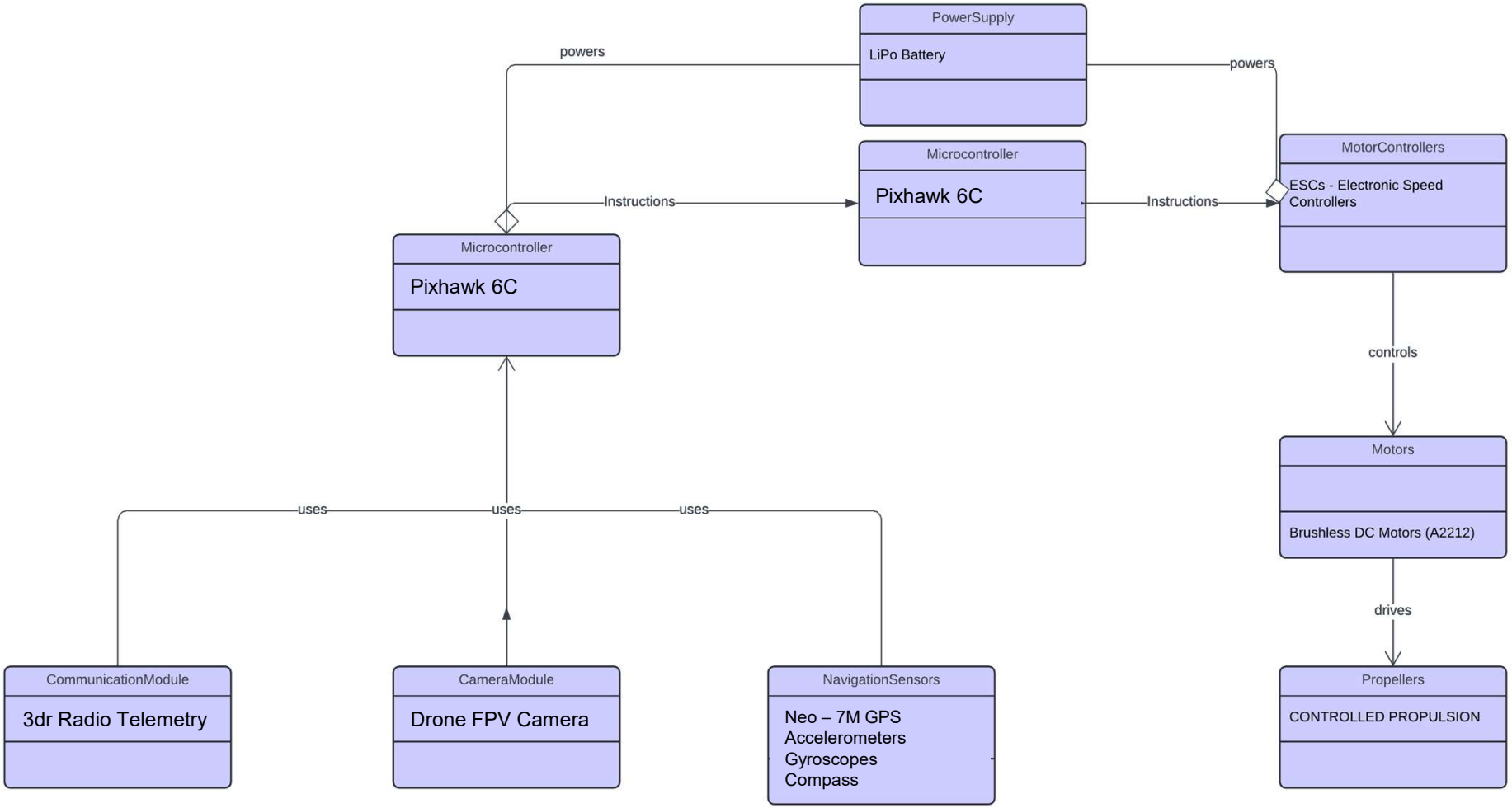
- During natural disasters (e.g., earthquakes, floods, wildfires), man-made incidents (e.g., industrial accidents, terrorist attacks), and in search and rescue operations.

How:

- By leveraging state-of-the-art UAV technology, integrating high-resolution cameras, and ensuring robust, real-time communication to transmit critical data to emergency control centers

Architecture

Structural Diagram & Behaviour Diagram



Use Cases & Testing

Use Cases

- **Scenario 1: Urban Disaster Site Monitoring:** The drone flies over a collapsed building, providing real-time images and thermal scans to locate trapped victims.

- **Scenario 2: Remote Area Surveillance:** In a wildfire scenario, the drone captures high-resolution footage to map fire spread and help direct firefighting efforts.

- **Scenario 3: Hazardous Environment Assessment:** The drone assesses a chemical spill site, providing situational awareness without exposing responders to toxic conditions.

Test Cases

- Verify the effectiveness of autonomous navigation in different terrains

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- Test the range and reliability of real-time data transmission under various network conditions.

- Evaluate the drone's durability and performance in harsh environmental conditions (e.g., rain, wind)

Implementation and Results – Iteration 1

Iteration 1 : Results

Implementation and Results – Iteration 2

Iteration : Results + Validation against the use cases and test cases

Implementation and Results – Iteration 3 (Optional)

Iteration : Results + Validation against the use cases and test cases

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Contribution

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Team Progress and Movement

- Xx
- Xx
- X
- X

Individual Contribution

Key contributions: Team Member Name
- XX
- XX

Key contributions: Team Member Name
- XX
- XX

Key contributions: Team Member Name
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Key contributions: Team Member Name
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Key contributions: Team Member Name
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Conclusion & Future Work

Summary and Conclusion

Future Work

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THANK YOU