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**Module 02**

**IE 5329 – Project Management, Fall Semester 2024**

Dr. Jennifer Cross

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Internet of Things Drones Integration

**Team 3**

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# Introduction:

In this module, our team is delighted to introduce the scheduling framework for our IoT-Integrated Drone Manufacturing project. Since Module 1, we have made significant changes to our idea, charter, and Work Breakdown Structure (WBS), which will help us enhance our approach in the future. Our major focus has been on identifying task durations and developing a realistic timeframe that is consistent with both our project goals and the capabilities of our team.

To accomplish this, we created a thorough task list with optimistic, pessimistic, and most likely time estimates for each action. By taking these predictions into account, we may gain a better understanding of the variability in job duration and change our planning accordingly. This technique is critical for establishing realistic expectations and being flexible throughout the project. Furthermore, we used two major project management techniques: PERT and CPM. PERT analyzes uncertainty in task durations, whereas CPM identifies our project's essential path the major milestones and activities that must be performed on time to keep the project on track.

We created a Gantt chart to clearly describe our project timetable. This chart clearly shows work sequences, durations, and dependencies, making it easy for our team and stakeholders to monitor progress and stay on track with our project goals. Overall, this systematic scheduling method is critical to ensure that our project is well-organized and capable of meeting deadlines.

# Updates on Concept/Charter

This report outlines the implementation of IoT integration in drone manufacturing.

# Work Breakdown Structure

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# Network Task List with Duration Estimates

In this portion of our report, we have taken all tasks within the WBS and have assigned each task an optimistic, pessimistic, and most likely estimates of completion. It is imperative to complete such a list as it allows for effective project management by having a clear visualization of tasks which provides clarity, accountability, and adaptability across the team. For our project scope and project closure sections of this list, we used the entire team's experience with previous projects to come up with these reasonable estimates.

Going into our drone hardware integration, data acquisition, and unit testing sections extensive research was required to help us come up with these estimates, we analyzed historical data regarding integration of 5G and IOT within different types of technologies,

For our project, we have considered real-world setbacks that could be associated with our type of project and integrated it into the chart for the most-likely section.

|  |  |  |  |
| --- | --- | --- | --- |
| **Objective** | **Optimistic Estimate (Days)** | **Pessimistic estimate**  **(Days)** | **Most likely estimate (Days)** |
| 1.1 **Define Project Scope** |  |  |  |
| * 1.1.1 Identify objectives and use cases for IoT in drones | 2 | 5 | 3 |
| * 1.1.2 Establish project requirements (functional, technical, safety) | 1 | 3 | 2 |
| * 1.1.3 Conduct feasibility study | 1 | 4 | 3 |
| * 1.2 **Assemble Project Team** | 1 | 3 | 1 |
| * 1.2.1 Assign roles and responsibilities | 1 | 2 | 1 |
| * 1.2.2 Schedule team meetings and set communication protocols | 1 | 3 | 1 |
| * 1.3 **Risk Assessment and Mitigation Planning** |  |  |  |
| * 1.3.1 Identify potential risks (technical, financial, regulatory) | 2 | 5 | 3 |
| * 1.3.2 Develop risk mitigation strategies | 2 | 5 | 3 |
| **Level 2: Design and Prototyping** |  |  |  |
| 2.1 **Drone Hardware Integration** |  |  |  |
| * 2.1.1 Select suitable drone platform | 4 | 6 | 5 |
| * 2.1.2 Identify necessary hardware components (sensors, cameras, processors, etc.) | 2 | 5 | 3 |
| * 2.1.3 Integrate IoT modules (Wi-Fi, LTE, Bluetooth) | 10 | 18 | 12 |
| * 2.2 **IoT Network Architecture Design** |  |  |  |
| * 2.2.1 Define communication protocols (MQTT, HTTP, etc.) | 3 | 5 | 4 |
| * 2.2.2 Set up cloud infrastructure for data transmission | 50 | 75 | 60 |
| * 2.2.3 Ensure data security and encryption standards | 12 | 20 | 15 |
| * 2.3 **Software Development and Integration** |  |  |  |
| * 2.3.1 Implement IoT control software for drones | 12 | 20 | 15 |
| * 2.3.2 Integrate with existing flight control systems | 7 | 14 | 10 |
| * 2.3.3 Create mobile/web interface for monitoring and control data uploads | 25 | 45 | 35 |
| * Stakeholder review…. | 2 | 8 | 5 |
| * 2.4 **Prototyping and Testing** |  |  |  |
| * 2.4.1 Build initial prototypes | 20 | 40 | 30 |
| * 2.4.2 Perform functional tests (sensor integration, communication tests) | 10 | 20 | 14 |
| * 2.4.3 Conduct performance testing (range, data accuracy) | 14 | 30 | 20 |
|  |  |  |  |
| **Level 2: IoT-Drone Communication and Data Management** |  |  |  |
| 3.1 **Configure Data Acquisition System** |  |  |  |
| * 3.1.1 Set up sensors for real-time data collection (environmental, positional, operational) | 10 | 20 | 14 |
| * 3.1.2 Configure data collection frequency and formats | 5 | 10 | 8 |
| * 3.2 **Establish Data Transmission** |  |  |  |
| * 3.2.1 Implement data transmission from drone to ground station/cloud | 10 | 20 | 14 |
| * 3.2.2 Optimize data transmission protocols for real-time communication | 10 | 14 | 12 |
| * 3.3 **Data Processing and Storage** |  |  |  |
| * 3.3.1 Process raw data into usable formats | 10 | 15 | 13 |
| * 3.3.2 Store processed data on cloud platforms | 10 | 15 | 13 |
| * 3.3.3 Set up backup and disaster recovery for data | 5 | 10 | 8 |
| **Level 2: System Testing and Deployment** |  |  |  |
| 4.1 **Unit Testing** |  |  |  |
| * 4.1.1 Conduct component-level testing (hardware and software) | 8 | 14 | 10 |
| * 4.1.2 Test IoT connectivity and response times | 5 | 10 | 8 |
| * 4.2 **Integration Testing** |  |  |  |
| * 4.2.1 Test full integration of IoT modules with drone systems | 8 | 14 | 10 |
| * 4.2.2 Ensure data synchronization between drones and cloud | 15 | 25 | 20 |
| * 4.3 **Field Testing** |  |  |  |
| * 4.3.1 Perform real-world tests under different conditions | 30 | 40 | 35 |
| * 4.3.2 Assess drone performance, battery life, and sensor accuracy | 12 | 15 | 14 |
| * 4.3.3 Collect feedback and make improvements | 30 | 40 | 25 |
| * 4.4 **Compliance Testing** |  |  |  |
| * 4.4.1 Ensure adherence to regulatory and industry standards (FAA, IoT security) | 42 | 70 | 56 |
| * 4.4.2 Perform environmental and safety assessments (dependent on Drone path) | 5 | 10 | 8 |
| * 4.5 **Final Deployment** |  |  |  |
| * 4.5.1 Deploy IoT-enabled drones for field operations | 8 | 14 | 10 |
| * 4.5.2 Monitor performance during early use | 5 | 10 | 8 |
| * 4.5.3 Provide post-deployment support | 10 | 20 | 14 |
|  |  |  |  |
| **Level 2: Project Closure** |  |  |  |
| 5.1 **Final Documentation** |  |  |  |
| * 5.1.1 Compile technical documentation (design specs, user manuals) | 28 | 56 | 42 |
| * 5.1.2 Develop training materials for end users | 7 | 28 | 14 |
| * 5.2 **Final Review and Sign-off** | 2 | 4 | 3 |
| * 5.2.1 Conduct final project review with stakeholders | 3 | 7 | 4 |
| * 5.2.2 Obtain final sign-off on deliverables | 1 | 3 | 2 |
| * 5.3 **Post-Deployment Maintenance** | 1 | 4 | 3 |
| * 5.3.1 Set up maintenance and support plan | 14 | 28 | 21 |
| * 5.3.2 Schedule periodic updates and performance reviews | 5 | 10 | 8 |

# Network Diagram with Precedence Information

The network diagram with precedence will help define the dependencies that the tasks have with one another.

**Event Code**

1. **Define Project Scope**
2. **Assemble Project Team**
3. **Risk Assessment and Mitigation Planning**
4. **Design and Prototyping**
5. **Drone Hardware Integration**
6. **IoT Network Architecture Design**
7. **Software Development and Integration**
8. **Prototyping and Testing**
9. **IoT-Drone Communication and Data Management**
10. **Configure Data Acquisition System**
11. **Establish Data Transmission**
12. **Data Processing and Storage**
13. **System Testing and Deployment**
14. **Unit Testing**
15. **Integration Testing**
16. **Field Testing**
17. **Compliance Testing**
18. **Final Deployment**
19. **Project Closure**
20. **Final Documentation**
21. **Final Review and Sign-Off**
22. **Post Deployment Maintenance**

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# PERT Analysis

This PERT (Program Evaluation and Review Technique) analysis is meant to assist in organizing, scheduling, and coordinating tasks. It is a project management tool that estimates the duration of project tasks by considering three time estimates: optimistic, pessimistic, and most likely. It calculates the expected time for each task, which then provides a weighted average that accounts for uncertainty. This method helps in planning, scheduling, and coordinating project activities, identifying critical paths, and facilitating resource allocation, ultimately enabling better decision-making and risk management throughout the project lifecycle.

|  |  |
| --- | --- |
| **Level 2: Concept Development and Planning** | **PERT Analysis per Task** |

|  |  |
| --- | --- |
| 1.1 **Define Project Scope** |  |
| * 1.1.1 Identify objectives and use cases for IoT in drones | | 3.166667 |

|  |  |
| --- | --- |
| * 1.1.2 Establish project requirements (functional, technical, safety) | 3.166667 |

|  |  |
| --- | --- |
| * 1.1.3 Conduct feasibility study | 3.166667 |

|  |  |
| --- | --- |
| * 1.2 **Assemble Project Team** | 3.166667 |

|  |  |
| --- | --- |
| * 1.2.1 Assign roles and responsibilities | 3.166667 |

|  |  |
| --- | --- |
| * 1.2.2 Schedule team meetings and set communication protocols | 3.166667 |

|  |  |
| --- | --- |
| * 1.3 **Risk Assessment and Mitigation Planning** |  |

|  |  |
| --- | --- |
| * 1.3.1 Identify potential risks (technical, financial, regulatory) | 3.166667 |

|  |  |
| --- | --- |
| * 1.3.2 Develop risk mitigation strategies | 3.166667 |

|  |  |
| --- | --- |
| **Level 2: Design and Prototyping** |  |

|  |  |
| --- | --- |
| 2.1 **Drone Hardware Integration** |  |

|  |  |
| --- | --- |
| * 2.1.1 Select suitable drone platform | 5 |

|  |  |
| --- | --- |
| * 2.1.2 Identify necessary hardware components (sensors, cameras, processors, etc.) | 3.166667 |

|  |  |
| --- | --- |
| * 2.1.3 Integrate IoT modules (Wi-Fi, LTE, Bluetooth) | 12.66667 |

|  |  |
| --- | --- |
| * 2.2 **IoT Network Architecture Design** |  |

|  |  |
| --- | --- |
| * 2.2.1 Define communication protocols (MQTT, HTTP, etc.) | 4 |

|  |  |
| --- | --- |
| * 2.2.2 Set up cloud infrastructure for data transmission | 60.83333 |

|  |  |
| --- | --- |
| * 2.2.3 Ensure data security and encryption standards | 15.33333 |

|  |  |
| --- | --- |
| * 2.3 **Software Development and Integration** |  |

|  |  |
| --- | --- |
| * 2.3.1 Implement IoT control software for drones | 15.33333 |

|  |  |
| --- | --- |
| * 2.3.2 Integrate with existing flight control systems | 10.16667 |

|  |  |
| --- | --- |
| * 2.3.3 Create mobile/web interface for monitoring and control data uploads | 35 |

|  |  |
| --- | --- |
| * Stakeholder review…. | 5 |

|  |  |
| --- | --- |
| * 2.4 **Prototyping and Testing** |  |

|  |  |
| --- | --- |
| * 2.4.1 Build initial prototypes | 30 |

|  |  |
| --- | --- |
| * 2.4.2 Perform functional tests (sensor integration, communication tests) | 14.33333 |

|  |  |
| --- | --- |
| * 2.4.3 Conduct performance testing (range, data accuracy) | 20.66667 |

|  |  |
| --- | --- |
|  |  |

|  |  |
| --- | --- |
| **Level 2: IoT-Drone Communication and Data Management** |  |

|  |  |
| --- | --- |
| 3.1 **Configure Data Acquisition System** |  |

|  |  |
| --- | --- |
| * 3.1.1 Set up sensors for real-time data collection (environmental, positional, operational) | 14.33333 |

|  |  |
| --- | --- |
| * 3.1.2 Configure data collection frequency and formats | 7.833333 |

|  |  |
| --- | --- |
| * 3.2 **Establish Data Transmission** |  |

|  |  |
| --- | --- |
| * 3.2.1 Implement data transmission from drone to ground station/cloud | 14.33333 |

|  |  |
| --- | --- |
| * 3.2.2 Optimize data transmission protocols for real-time communication | 12 |

|  |  |
| --- | --- |
| * 3.3 **Data Processing and Storage** |  |

|  |  |
| --- | --- |
| * 3.3.1 Process raw data into usable formats | 12.83333 |

|  |  |
| --- | --- |
| * 3.3.2 Store processed data on cloud platforms | 12.83333 |

|  |  |
| --- | --- |
| * 3.3.3 Set up backup and disaster recovery for data | 7.833333 |

|  |  |
| --- | --- |
| **Level 2: System Testing and Deployment** |  |

|  |  |
| --- | --- |
| 4.1 **Unit Testing** |  |

|  |  |
| --- | --- |
| * 4.1.1 Conduct component-level testing (hardware and software) | 10.33333 |

|  |  |
| --- | --- |
| * 4.1.2 Test IoT connectivity and response times | 7.833333 |

|  |  |
| --- | --- |
| * 4.2 **Integration Testing** |  |

|  |  |
| --- | --- |
| * 4.2.1 Test full integration of IoT modules with drone systems | 10.33333 |

|  |  |
| --- | --- |
| * 4.2.2 Ensure data synchronization between drones and cloud | 20 |

|  |  |
| --- | --- |
| * 4.3 **Field Testing** |  |

|  |  |
| --- | --- |
| * 4.3.1 Perform real-world tests under different conditions | 35 |

|  |  |
| --- | --- |
| * 4.3.2 Assess drone performance, battery life, and sensor accuracy | 13.83333 |

|  |  |
| --- | --- |
| * 4.3.3 Collect feedback and make improvements | 28.33333 |

|  |  |
| --- | --- |
| * 4.4 **Compliance Testing** |  |

|  |  |
| --- | --- |
| * 4.4.1 Ensure adherence to regulatory and industry standards (FAA, IoT security) | 56 |

|  |  |
| --- | --- |
| * 4.4.2 Perform environmental and safety assessments (dependent on Drone path) | 7.833333 |

|  |  |
| --- | --- |
| * 4.5 **Final Deployment** |  |

|  |  |
| --- | --- |
| * 4.5.1 Deploy IoT-enabled drones for field operations | 10.33333 |

|  |  |
| --- | --- |
| * 4.5.2 Monitor performance during early use | 7.833333 |

|  |  |
| --- | --- |
| * 4.5.3 Provide post-deployment support | 14.33333 |

|  |  |
| --- | --- |
|  |  |

|  |  |
| --- | --- |
| **Level 2: Project Closure** |  |

|  |  |
| --- | --- |
| 5.1 **Final Documentation** |  |

|  |  |
| --- | --- |
| * 5.1.1 Compile technical documentation (design specs, user manuals) | 42 |

|  |  |
| --- | --- |
| * 5.1.2 Develop training materials for end users | 15.16667 |

|  |  |
| --- | --- |
| * 5.2 **Final Review and Sign-off** | 3 |

|  |  |
| --- | --- |
| * 5.2.1 Conduct final project review with stakeholders | 4.333333 |

|  |  |
| --- | --- |
| * 5.2.2 Obtain final sign-off on deliverables | 2 |

|  |  |
| --- | --- |
| * 5.3 **Post-Deployment Maintenance** | 2.833333 |

|  |  |
| --- | --- |
| * 5.3.1 Set up maintenance and support plan | 21 |

|  |  |
| --- | --- |
| 5.3.2 **Schedule periodic updates and performance reviews** | 7.833333 |

From the PERT analysis above, we see that the Cloud Infrastructure Set Up and the Compiling Technical Documentation steps are the most likely to take the longest. Since they are already extensive steps, they are the most imperative in reThis method helps in planning, scheduling, and coordinating project activities, identifying critical paths, and facilitating resource allocation, ultimately enabling better decision-making and risk management throughout the project lifecycle.

# CPM Analysis

|  |  |  |  |
| --- | --- | --- | --- |
| S.NO | **Tasks** | **Duration (in days)** | **Predecessors** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1.1.1 | Identify objectives and use cases for IoT in drones | 3 | NONE | |
| 1.1.2 | Establish project requirements | 2 | 1.1.1 |
| 1.1.3 | Conduct feasibility study | 3 | 1.1.2 |
| 1.2.1 | Assign roles and responsibilities | 1 | 1.1.3 |
| 1.2.2 | Schedule team meetings and set communication protocols | 1 | 1.2.1 |
| 1.3.1 | Create project charter document | 2 | 1.2.2 |
| 1.3.2 | Get stakeholder approval | 1 | 1.3.1 |
| 1.4.1 | Identify potential risks | 3 | 1.3.2 |
| 1.4.2 | Develop risk mitigation strategies | 3 | 1.4.1 |
| 2.1.1 | Select suitable drone platform | 5 | 1.4.2 |
| 2.1.2 | Identify necessary hardware components | 3 | 2.1.1 |
| 2.1.3 | Integrate IoT modules | 12 | 2.1.2 |
| 2.2.1 | Define communication protocols | 4 | 2.1.3 |
| 2.2.2 | Set up cloud infrastructure for data transmission | 60 | 2.2.1 |
| 2.2.3 | Ensure data security and encryption standards | 15 | 2.2.2 |
| 2.3.1 | Implement IoT control software for drones | 10 | 2.2.3 |
| 2.3.2 | Integrate with existing flight control systems | 35 | 2.3.1 |
| 2.3.3 | Create mobile/web interface for monitoring and control data uploads | 30 | 2.3.2 |
| 2.4.1 | Build initial prototypes | 14 | 2.3.3 |
| 2.4.2 | Perform functional tests | 20 | 2.4.1 |
| 2.4.3 | Conduct performance testing | 14 | 2.4.2 |
| 3.1.1 | Set up sensors for real-time data collection | 8 | 2.4.3 |
| 3.1.2 | Configure data collection frequency and formats | 14 | 3.1.1 |
| 3.2.1 | Implement data transmission from drone to ground station/cloud | 12 | 3.1.2 |
| 3.2.2 | Optimize data transmission protocols for real-time communication | 13 | 3.2.1 |
| 3.3.1 | Process raw data into usable format | 13 | 3.2.2 |
| 3.3.2 | Store processed data on cloud platforms | 8 | 3.3.1 |
| 3.3.3 | Set up backup and disaster recovery for data | 10 | 3.3.2 |
| 4.1.2 | Test IoT connectivity and response times | 8 | 3.3.3 |
| 4.2.1 | Test full integration of IoT modules with drone systems | 20 | 4.1.2 |
| 4.2.2 | Ensure data synchronization between drones and cloud | 35 | 4.2.1 |
| 4.3.1 | Perform real-world tests under different conditions | 14 | 4.2.2 |
| 4.3.2 | Assess drone performance, battery life, and sensor accuracy | 25 | 4.3.1 |
| 4.3.3 | Collect feedback and make improvement | 56 | 4.3.2 |
| 4.4.1 | Ensure adherence to regulatory and industry standards |  | 4.3.3 |
| 4.4.2 | Perform environmental and safety assessments | 8 | 4.4.1 |
| 4.5.1 | Deploy IoT-enabled drones for field operations | 10 | 4.4.2 |
| 4.5.2 | Monitor performance during early use | 8 | 4.5.1 |
| 4.5.3 | Provide post-deployment support | 14 | 4.5.2 |
| 5.1.1 | Compile technical documentation | 42 | 4.5.3 |
| 5.1.2 | Develop training materials for end user | 14 | 5.1.1 |
| 5.2.1 | Conduct final project review with stakeholders | 4 | 5.1.2 |
| 5.2.2 | Obtain final sign-off on deliverables | 2 | 5.2.1 |
| 5.3.1 | Set up maintenance and support plan | 21 | 5.2.2 |
| 5.3.2 | Schedule periodic updates and performance reviews | 8 | 5.3.1 |
| S.NO | **Tasks** | **Duration (in days)** | **Predecessors** |
| 1. | Define Project Scope | 5 | NONE |
| 2. | Assemble Project Team | 5 | 1.1.1 |
| 3. | Risk Assessment and Mitigation Planning | 7 | 1.1.2 |
| 4. | Design and Prototyping | 201 | 1.1.3 |
| 5. | Drone Hardware Integration | 20 | 1.2.1 |
| 6. | IoT Network Architecture Design | 74 | 1.2.2 |
| 7. | Software Development and Integration | 48 | 1.3.1 |
| 8. | Prototyping and Testing | 61 | 1.3.2 |
| 9. | IoT-Drone Communication and Data Management | 57 | 1.4.1 |
| 10. | Configure Data Acquisition System | 12 | 1.4.2 |
| 11. | Establish Data Transmission | 25 | 2.1.1 |
| 12. | Data Processing and Storage | 22 | 2.1.2 |
| 13. | System Testing and Deployment | 137 | 2.1.3 |
| 14. | Unit Testing | 13 | 2.2.1 |
| 15. | Integration Testing | 29 | 2.2.2 |
| 16. | Field Testing | 67 | 2.2.3 |
| 17. | Compliance Testing | 35 | 2.3.1 |
| 18. | Final Deployment | 31 | 2.3.2 |
| 19. | Project Closure | 83 | 2.3.3 |
| 20. | Final Documentation | 56 | 2.4.1 |
| 21. | Final Review and Sign-Off | 4 | 2.4.2 |
| 22. | Post Deployment Maintenance | 27 | 2.4.3 |

CRITICAL PATH FOR THE PROJECT

CONSIDERING THE MAJOR TASKS

1.1.1 → 1.1.2 → 1.1.3 → 1.2.1 → 1.3.1 → 1.3.2 → 1.4.1 → 2.1.1 → 2.1.3 → 2.2.2 → 2.2.3 → 2.3.1 → 2.4.1 → 3.1.1 → 4.2.2 → 4.3.1 → 5.1.1 → 5.3.1 → 5.3.2

EXPECTED DURATION OF THE PROJECT FROM CPM

633 days (about 1 year 9 months)

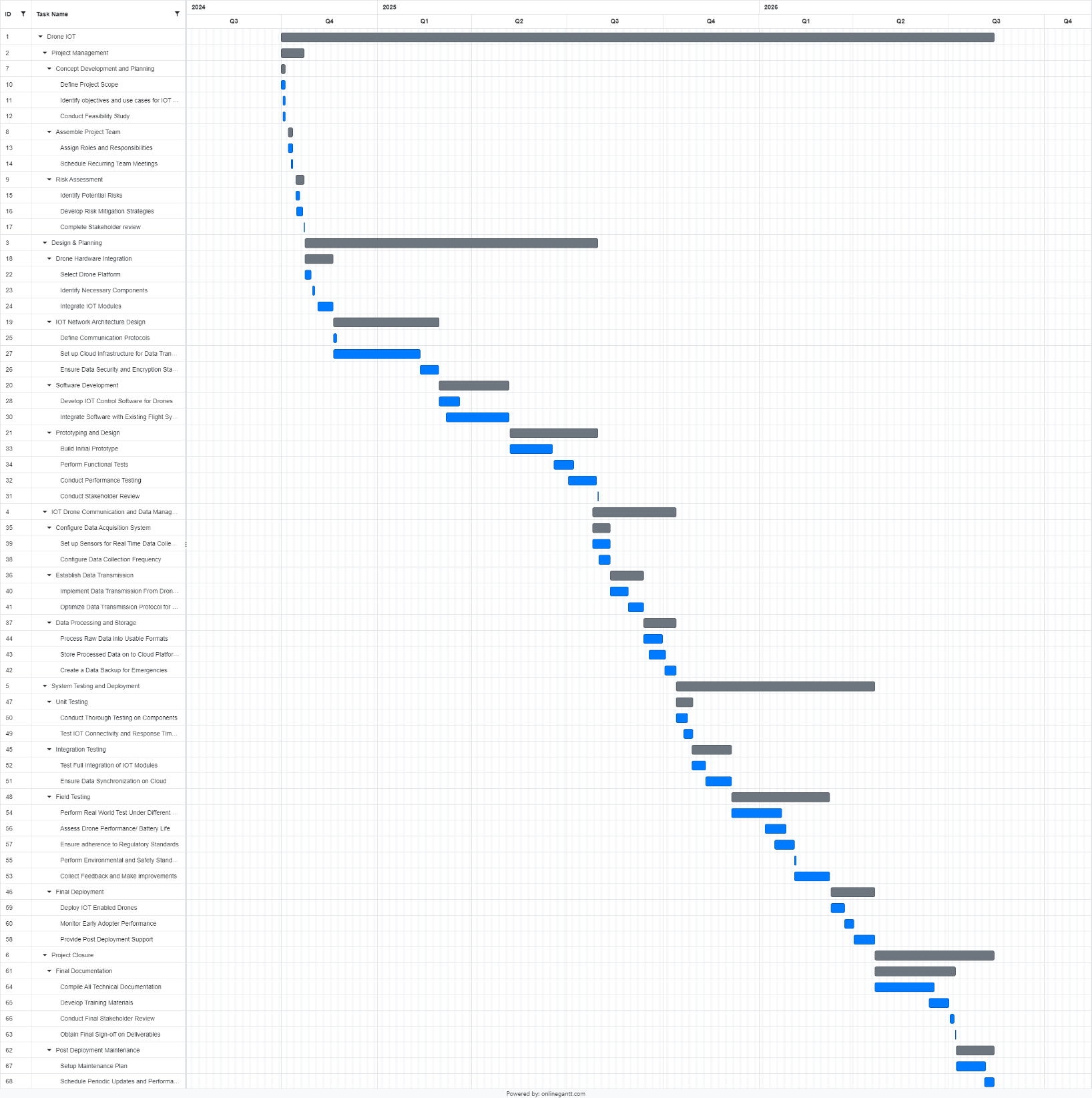
ACTIVITY INFORMATION

|  |  |  |
| --- | --- | --- |
| EARLY START  14-10-2024 | TIME DURATION  633 DAYS | EARLY FINISH  18-07-2026 |
| PROJECT | TOTAL SLACK  56 DAYS    FREE SLACK | BUDGET  10 MILLION $ |

|  |  |  |  |
| --- | --- | --- | --- |
| LATE START  14-10-2024 | COST/PROFIT CENTER  Cost of the product is not considered at | | LATE FINISH  12-09-2026 |

Gantt Chart

**Scheduling Overview Diagram**

* The Gantt chart for the IoT-Integrated Drone System Project gives clarity on a proper visual representation of the timeline of the project. It encompasses all aspects, from the very conceptualization in October 2024 to the final deployment and closure in March 2026.
* Moreover, each phase of the project has been subdivided into specific tasks whose duration and dependency are properly mapped. It will therefore be easy to plan the start and end dates of all tasks and ensure they have been aligned with the overall project objectives. The Gantt chart ensures, through its graphical timeline, that progress is monitored at a granular level and hence will be easier for the project lead, Arun, to adjust priorities, allocate resources, and anticipate possible bottlenecks.
* This chart has now become a visual dashboard not only for tracking the project internally but also for the stakeholders by letting them understand and visualize when key deliverables are expected and the critical dependencies there are between various tasks and milestones.
* 

A graph of a project

Description automatically generated

**Milestones and Task Durations**

* The milestones that will mark the critical point for the completion of this project are conceptualization tasks, hardware integration, software development, and system testing, which surely will fall in place on time and within budget.
* **Key milestones include:**
* **Project Charter Completion-October 2024**: To lay down the basic structure of the project.
* **Hardware Integration Completion**: January 2025 - Ensuring that the physical components of the drones are ready.
* **Software Development Completion**: May 2025 - Marks the integration of IoT control software.
* **Field Testing and Final Prototyping**: July - August 2025 - To test the system in the real environment.
* **Final Deployment and Monitoring**: January - February 2026 - Marks the culmination of launching IoT-integrated drones into operations.
* Each of these milestones marks a critical point in the project timeline, when a major deliverable gets completed, and where team efforts shift in focus from development to testing and final deployment.
* Each task has a different length because some tasks are more complex to execute than others. Examples include:
* Project team formation will take just a short time to complete (1 to 3 days).
* IoT Network Architecture Design, Prototyping, and Testing are comparatively more involved and have been scheduled over 60 to 80 days (about 2 and a half months) to adequately ensure thorough testing and optimization.
* Specifically, the prototyping and testing phases have been given generous buffers for contingencies that might arise at field testing so that the team would have time for iterations and necessary adjustments before moving to the final stages of deployment.

**Task Dependencies and Critical Path**

* The critical path in any project indicates the pattern of activities that should be finished on time for the whole project to be finished as scheduled. The activities on the critical path are the most important because any delay in such an activity means that the whole project will be expanded by a similar unit of time.
* Some of the activities of the critical path for the IoT-Integrated Drone System project are as follows:
* **Drone Hardware Integration**: This involves the selection of the platform, identification of hardware components, and integration of IoT modules.
* **Cloud Infrastructure Setup**: Setting up cloud infrastructure for data transmission would take 60 days (about 2 months).
* I**oT Control Software Implementation**: IoT control software will take 15 days (about 2 weeks) to implement.
* **Prototype and Test**: Prototyping and testing activities would take approximately 56 days (about 2 months).
* Each of these activities has a significant consequence for the success of the project, and hence exact planning without any slack in the schedule is imperative. Each phase is dependent on the successful completion of the previous stage, and hence coordination of the project and resource allocation would be of prime importance to ensure that there are no delays beyond scheduled dates.

**Resource Allocation and Risk Management**

* Resource allocation in a project is rightly planned at various stages of completion. For example, during the initial definition of a project's scope, only fewer resources are needed to gather the requirements, assign roles, and establish communication protocols.
* These are steps that follow next in line, which require increased resource loading with skilled personnel for both hardware and software fields. Further ahead, the team expects another peak of resource utilization during the testing phases where integration among developers, testers, and engineers will play a crucial role in completing the task.
* The Gantt chart also captures the contingency required should there be any delay, especially for phases that bear a high level of risk, such as field testing and compliance testing. Considering this, additional time buffers have been set aside for these phases in the schedule to accommodate technical setbacks or issues, regulatory obstacles, and even environmental factors that may arise unexpectedly.
* The work has integrated risk mitigation strategies, including feasibility studies from the very beginning and risk assessments to identify potential roadblocks early into the project timeline. This proactive approach helps ensure critical risks are mitigated before they escalate and reduces their impact on the overall project timeline.

**Schedule Adoption and Team Alignment**

* The project schedule has been developed in the same fashion in relation to the team's capability and availability. For every member of the project team, clear responsibilities are stated, thus each member of the project team knows what is expected from them throughout the whole phase of the project life cycle. This clear definition of roles is required as it enables accountability and assists in ensuring that all members contribute to the success of the project.

# Schedule Vulnerability and Risk Analysis

1. Identification of Vulnerabilities.   
  
Our team has discovered various risks in the project timeline that could cause delays:

• Our project has several linked tasks. Delays can have an impact on the entire project timeline.

• Prototyping and field testing can be time-consuming processes. Unexpected complications during this phase may result in additional delays.

• Regulatory clearances, such as compliance testing, might cause delays due to external circumstances.

2. Discussion of Critical Points on the Schedule

Several crucial points in our timeline are critical to the project's success.

• Hardware Integration (January 2025): Selecting and integrating drone hardware components, such as sensors and processors, is crucial. Any delays in this phase will have an influence on later activities, such as IoT module integration and software development.

• IoT Network Setup (March-May 2025): Setting up the IoT network, including cloud infrastructure and secure data transfer, is a complicated and time-consuming process. Any delays in this step may cause the software development and testing stages to be pushed back.

• Prototyping and Testing (July-August 2025): This phase involves creating drone prototypes and testing their functionality and performance. Success here is critical for progressing to the deployment phase.

• Compliance testing (January 2026): FAA permits and IoT security testing are required before implementation (Marshall D. Abrams, 2003). Delays in gaining clearances would have an impact on the overall deployment timetable.

3. Potential Risks and their Impact on Timelines

• Delays in getting critical hardware components, such as sensors, might cause delays in hardware integration and related operations.

• Integrating IoT modules into drones may cause delays in hardware and software development, impacting testing timelines.

• Delays in regulatory clearances during compliance testing can dramatically impact project timelines.

• Field testing failures can cause delays and impact project timelines.

4. Mitigation Strategies.   
  
Our team created the following measures to manage risks and keep the project on track:

• Add buffer time to the timetable, especially for jobs with high uncertainty (e.g., testing and regulatory clearances), to account for any delays.

• Good relationships with hardware suppliers and contingency plans to deal with delays in the supply chain involving several CPU and computer suppliers.

• Early testing helps discover and correct issues before they create delays.

• Regular Risk Reviews: Our team assesses risks and updates mitigation plans to prevent problems from escalating.

• Open communication with regulatory agencies and stakeholders will help us detect possible delays and take proactive actions to address them.   
  
  
By addressing vulnerabilities, identifying important points in the schedule, and adopting mitigation methods, our team can manage risks and keep the project on track.

# Conclusion and Next Steps

In summary, the project timeline created by our team in this module represents our combined efforts and meticulous preparation for the IoT integration project. Using PERT and CPM, we identified essential tasks and significant hazards that may impact our timeframe. This proactive strategy has enabled us to integrate risk-management methods, such as adding buffers for tasks that are risky to account for any unexpected issues that may develop.

The Gantt chart we produced is a useful tool for tracking progress and communicating with team members and stakeholders. It clearly outlines our milestones and deliverables, ensuring that everyone is informed and on the same page. As we go on with the project, our team is committed to completing duties carefully and periodically analyzing any possible hazards, allowing us to make educated decisions and adjust our plans as needed.

The Gantt chart that we created is a great tool for tracking progress and communicating with teammates and stakeholders. It clearly defines our milestones and deliverables, keeping everyone informed and on the same page. As we progress through the project, our team is devoted to meticulously performing tasks and frequently reviewing any potential dangers, allowing us to make informed judgments and change our plans as needed.

Moving ahead, our immediate objective will be to carry out the project timetable stated in this module. This involves establishing work allocations and ensuring that all team members understand their duties. We will have frequent meetings to assess progress and handle any new difficulties or modifications to the project scope. In addition, we will begin the project's first phase, which will include defining project objectives and performing a feasibility assessment. Gathering data and insights throughout this period will be critical for guiding future decisions and improving our strategy.

Furthermore, open communication and collaboration among team members will be critical to our success. By ensuring that everyone understands their roles and duties, we can efficiently traverse the project's intricacies while leveraging each member's unique abilities and knowledge.

Ultimately, we are dedicated to delivering a high-quality, IoT-integrated drone system that meets our objectives and satisfies the expectations of our stakeholders. Through our careful planning and teamwork, we aim to complete the project on time and within budget, positioning ourselves for success in the ever-evolving field of drone technology.

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