Project Instructional Plan

Month 1: Drone Build and Initial Testing

Week 1-2: Drone Assembly

- Day 1-3: Introduction to drone components and safety procedures
- Day 4-7: Assemble drone frame and motors
- Day 8-10: Install flight controller and electronic speed controllers (ESCs)

Week 3: Drone Electronics and Configuration

- Day 1-2: Connect and configure radio receiver
- Day 3-4: Install and connect battery
- Day 5: Configure flight controller software

Week 4: Initial Drone Testing

- Day 1-2: Conduct motor spin tests and ESC calibration
- Day 3-4: Perform initial flight controller tuning
- Day 5: Carry out tethered hover tests

Month 2: Sensor Development and Integration

Week 1-2: Sensor Design and Assembly

- Day 1-3: Research and select environmental parameters to measure
- Day 4-7: Design sensor circuits
- Day 8-10: Assemble sensors on breadboard

Week 3: Sensor Programming and Calibration

- Day 1-3: Develop initial sensor code
- Day 4-5: Test sensors in controlled environments
- Day 6-7: Calibrate sensors and refine code

Week 4: Sensor-Drone Integration

- Day 1-2: Design sensor mounting system
- Day 3-4: Integrate sensors with drone

- Day 5: Develop data logging system for in-flight data collection

Month 3: Comprehensive Testing and Flight Operations

Week 1: Integrated System Testing

- Day 1-2: Conduct ground tests of integrated drone and sensor system
- Day 3-4: Perform short hover tests with sensors active
- Day 5: Analyze and troubleshoot any issues

Week 2: Flight Testing

- Day 1-2: Conduct controlled flight tests in open area
- Day 3-4: Practice maneuvers and flight patterns for data collection
- Day 5: Refine flight controller settings based on test results

Week 3: Sensor Calibration in Flight Conditions

- Day 1-2: Calibrate sensors in various flight conditions
- Day 3-4: Test data logging system during flight

- Day 5: Analyze collected data and make necessary adjustments

Week 4: Flight Operations Planning

- Day 1-2: Identify local areas for environmental data collection
- Day 3-4: Develop flight plans and safety protocols
- Day 5: Conduct team training on flight operations and emergency procedures

Month 4: Data Collection, Analysis, and Project Conclusion

Week 1-2: Data Collection Flights

- Day 1-5 (Week 1): Conduct daily data collection flights in various locations
- Day 1-5 (Week 2): Continue data collection flights, focusing on different times of day

Week 3: Data Analysis

- Day 1-2: Download and organize collected data
- Day 3-4: Perform initial data analysis and visualization

- Day 5: Identify patterns and anomalies in the data

Week 4: Project Conclusion and Presentation

- Day 1-2: Finalize data analysis and draw conclusions
- Day 3-4: Prepare project presentation and report
- Day 5: Present findings to school and local community

Throughout the project:

- Maintain daily project logs
- Conduct weekly team meetings to discuss progress and challenges
- Engage in ongoing safety training and best practices review

Project Phases and Material Usage

1. Drone Assembly and Flight Principles (Weeks 1-2)
   - Assemble hexacopter frame, learn flight mechanics and aerodynamics
   - Materials: Hexacopter Drone Building Material

2. Environmental Sensor Exploration and Design (Weeks 3-4)
   - Research sensor types, design sensor circuits, create schematics
   - Materials: Arduino Uno Build Kit (reference), Arduino Build Materials (prototyping), Breadboard

3. Sensor Construction and Programming (Weeks 5-6)
   - Construct sensors, introduce Arduino programming, develop and test sensor code
   - Materials: Arduino Uno Build Kit, Arduino Build Materials, Breadboard, Pin Headers, Dupont Wires, Arduino Battery 9V

4. Drone and Sensor Integration (Weeks 7-8)
   - Design sensor mounting, integrate sensors with drone, develop data logging system
   - Materials: Soldering Mats, Micro SD Card reader, Arduino Camera

5. Flight Testing and Calibration (Week 9)
   - Conduct flight tests, calibrate system, troubleshoot issues
   - Materials: All assembled components

6. Data Collection and Analysis (Weeks 10-12)
    - Plan and conduct environmental data collection flights, analyze data, prepare presentations
    - Materials: All assembled components, Micro SD Card reader

Standards Alignment

The project aligns with:

- NGSS Science Standards (e.g., HS-ETS1-2, HS-PS2-1, HS-ESS3-6)
- Computer Science Standards (e.g., algorithmic thinking, programming)
- Common Core ELA Standards (technical reading/writing, presentation skills)
- Common Core Math Standards (data analysis, geometry applications)

Anticipated Learning Outcomes

Students will:

1. Develop critical thinking and problem-solving skills through engineering design
2. Gain hands-on experience with scientific method and data analysis
3. Enhance technological literacy (programming, electronics, sensor design)
4. Improve collaboration and communication skills
5. Develop environmental awareness and civic responsibility
6. Explore STEM careers in aerospace, sensor technology, and environmental science

Assessment Methods

1. Pre/post-project surveys on STEM interest and career awareness
2. Formative assessments (quizzes, practical skills tests)
3. Engineering logbooks review
4. Project-based assessments of final drone/sensor systems
5. Peer and self-assessments for collaborative skills
6. Elementary student feedback on high school student teaching
7. Participation in science competitions

Conclusion

The Aerospace Engineering and Design Project offers a quality learning experience for Monroeville High School students. By designing and building environmental sensing drones, students gain skills in aerospace technology, electronics, programming, and environmental science. The cross-age teaching component creates a STEM enthusiasm pipeline within our district.

This project prepares students for future challenges in rapidly evolving STEM fields, potentially inspiring careers in aerospace engineering, sensor technology, and environmental science. By bringing advanced engineering experiences to our rural school district, we allow our students to compete effectively with urban and suburban counterparts.

Through this comprehensive STEM experience, we aim to inspire innovation, spark lifelong passion for STEM, and equip students with critical workforce skills. Your support will make a significant impact on our students and community, fostering the next generation of STEM leaders from rural America. Thank you.