**Project Title: Report on MAVLink Protocol Setup and Simulated Drone Testing**

**Introduction**

MAVLink (Micro Air Vehicle Link) is a protocol for communicating with small, unmanned vehicles, widely used in the drone industry. The goal of this project is to enhance the security of the MAVLink protocol in the most energy and resource-efficient way. This means the end result should use the least power and cause the least latency of all potential encryption methods.

To start the research process, this preliminary phase of the project focuses on experimenting with a simulated drone to learn the common MAVLink communication techniques. Simulating the drone allows for an accelerated learning environment before testing with real-world equipment. By the end of this phase, the researchers and readers should have a strong understanding of open-source drone communication using MAVLink.

**Project Goals**

* Describe the MAVLink protocol structure.
* Explain the simulated drone process and how to use it.
* Detail the basic drone functions used in this project.
* Discuss the challenges encountered.
* Present the response time results.
* Provide a future work timeline for the next month.

**2. MAVLink Protocol Setup**

**2.1 MAVLink Protocol Fundamentals**

* Briefly explain the MAVLink protocol and its importance in UAV communications.

**2.2 Setup Process**

* Step-by-step description of how the MAVLink protocol was set up.
  + Tools and software used.
  + Configuration steps.
  + Any customizations or modifications made.

**2.3 Challenges and Solutions**

* Discuss the challenges faced during the setup process.
* Describe how these challenges were addressed or overcome.

**MAVLink Protocol**

MAVLink is designed to be flexible and lightweight, which makes it great for hobbyists and professional users. It’s important to UAV operations because it enables efficient and reliable communication for control and monitoring, facilitating safe and effective UAV management. MAVLink messages can be used to communicate data, control the drone, and even manipulate drone subsystems like a camera gimbal.

A MAVLink message consists of a predefined structure including a header, payload, and checksum. The header contains essential information such as the message ID, sequence number, and sender and receiver IDs. The payload carries the actual data, which can vary in size depending on the message type. The checksum ensures message integrity by allowing the receiver to verify that the message was not corrupted during transmission. This structured approach enables reliable and efficient communication between UAVs and ground control stations.

**Creating the Project Environment**

This project uses a Python 3 virtual environment which can be run on any operating system that supports Python 3. Dronekit and dronekit-sitl is used to simulate a drone and facilitate MAVLink communications.

1. (Optional) Mission Planner Installed
2. Python 3 installed.
   * Install from <https://www.python.org/downloads/>
   * (Optional) Install using the command “python” in Powershell on Windows.
   * (Optional) Install from a package manager on Linux machines.
3. Python virtual environment created.
   * Virtual environment created with “python -m venv mavlink-env”
4. Required packages installed inside virtual environment.
   * Install with “pip install dronekit dronekit-sitl”
   * MAVLink is automatically installed.
5. Virtual drone instance created.
   * Start a new dronekit-sitl instance with the “start-sitl” script.
6. (Optional) Virtual drone connected to Mission Planner.
   * Connect to TCP on 127.0.0.1:5760
7. Virtual drone controlled with python scripts.
   * Run desired scripts, like box\_mission.py

**3. Simulated Drone Setup**

**3.1 Simulation Environment**

* Describe the simulation software and environment used (e.g., PX4 SITL, ArduPilot SITL).
* Specify the hardware and software requirements.

**3.2 Drone Configuration**

* Detailed steps on how the simulated drone was configured.
  + Selection of drone model.
  + Configuration of flight parameters.
  + Integration with the MAVLink protocol.

**3.3 Challenges and Solutions**

* Outline the difficulties encountered while setting up the simulated drone.
* Explain the methods used to resolve these issues.

**4. Basic Drone Functions Testing**

**4.1 Testing Procedures**

* Describe the testing procedures for basic drone functions:
  + Takeoff.
  + Land.
  + Move forward.
  + Move backward.
  + Turn left.
  + Turn right.

**4.2 Results and Observations**

* Present the results of the basic function tests.
* Include response time data and any anomalies observed.

**4.3 Challenges and Solutions**

* Discuss any problems faced during testing.
* Explain how these problems were resolved.

**5. Box Mission Testing**

**5.1 Mission Description**

* Define what a box mission entails (e.g., takeoff, move in a square pattern, and land).
* Explain the significance of this mission in testing the drone's basic capabilities.

**5.2 Testing Procedure**

* Describe the step-by-step procedure for executing the box mission.

**5.3 Results and Observations**

* Present the results and observations from the box mission.
* Include response times and any issues encountered.

**6. Conclusion**

* Summarize the progress made in setting up the MAVLink protocol and testing the simulated drone.
* Highlight key findings and successful outcomes.
* Emphasize the importance of the next steps in the project's overall objectives.