Individual Lab Report #3

Progress Review 2

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Team B

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1 Individual Progress

1.1 MRSD Project

First, I continued previous work by integrating human pose estimation code, including NLF (https://github.com/isarandi/nlf) algorithm and Yolo11n-pose algorithm, into AirLab's humanflow repository. I modified the algorithm code to conform to the HumanFlowBaseNode standard structure.

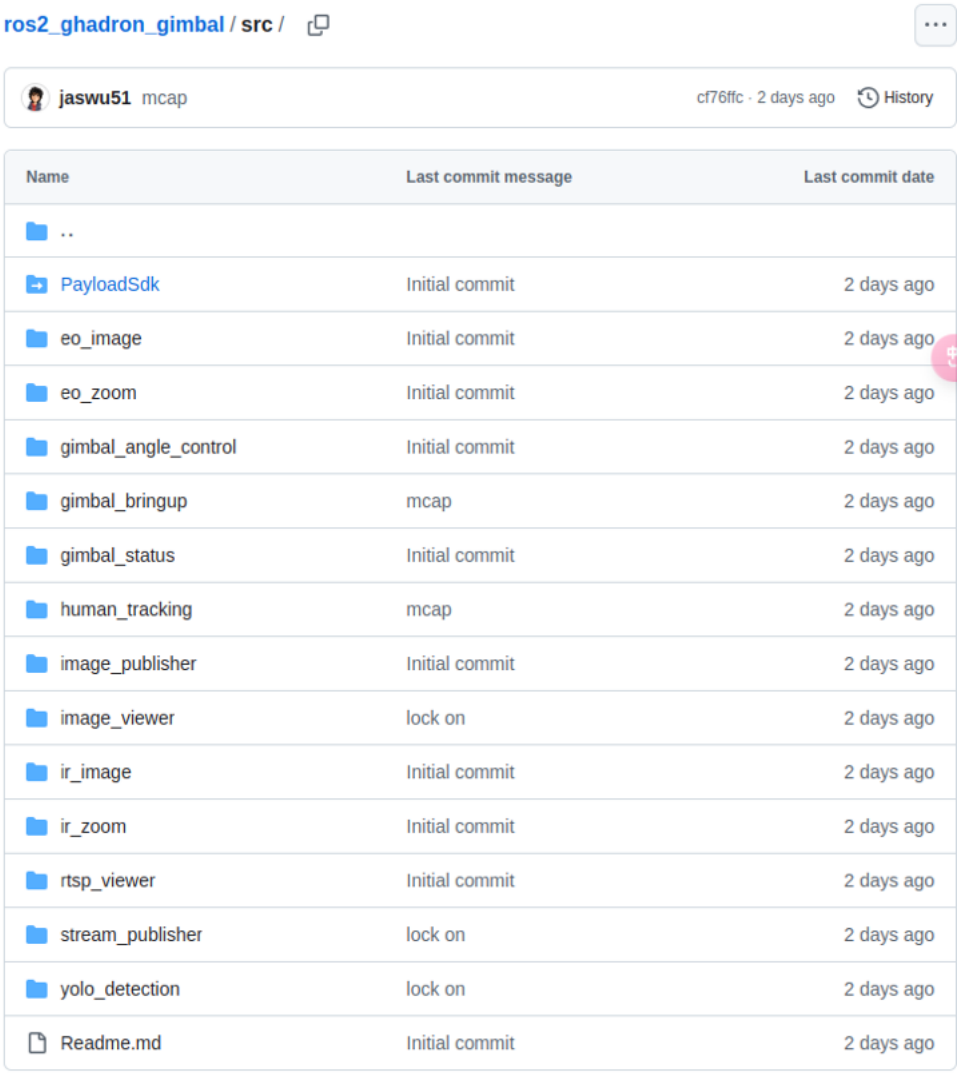

Figure 1: Github Code for Gremsy Ghadron Gimbal Control

The second part focused on gimbal control. This includes driving the gimbal via PayloadSdk and developing a series of packages. These packages handle low-level gimbal control, angle adjustments, image capture, streaming frames capture, and zoom functionality for both IR and ED (RGB) images, and for both Ubuntu and Jetson Orin systems, as shown in Figure 1 (https://github.com/jaswu51/ros2_ghadron_gimbal). Building on this foundation, I implemented human recognition using the YOLO11n-pose model and developed an incremental angle movement method to keep human bounding boxes centered in the frame, enabling human tracking. Finally, I added an image_viewer package

to display bounding boxes in real-time and a mcap storage system to store topic data, including streaming video frames, whenever ROS2 nodes are spinning.

Additionally, I initiated work on the Isaac-sim pipeline. I ran official examples and successfully established real-time communication between ROS2 and ISAAC SIM robot data.

2 Challenges

2.1 MRSD Project

During field testing, I discovered that the system can successfully detect humans in frontal view, but fails to detect humans in 45-degree downward-looking images. This issue requires further debugging to determine whether the limitation stems from the Yolo11n-pose model being too small and thus lacking the capacity to detect top-down views, or whether the entire Yolo11 series has inherent limitations in top-down detection capabilities.

Also, integrating the gimbal control with other subsystems requires thorough consideration of their calling logic. For instance, when the drone reaches a waypoint from a motion planning system, I will need to rotate the drone 360 degrees to check if there are patients, and stop the spinning the camera whenever a patient is detected, and lock on the patient. This needs careful design decisions: when to look directly downward, when to use a 45-degree angle, when to start spinning the camera, and when to stop the spinning, etc.

3 Team Work

3.1 MRSD Project

Name	Contribution
Jet Situ	Designed and implemented inter-subsystem electrical and data interfaces, providing internal data transfer infrastructure for drone sensor fusion. Implemented new radio interface for long-range communication over both MAVLink and a LAN-linked signal. Provided software architecture design and debugging assistance, as well as software QA prior to test flight. Assisted in debugging hardware and electrical issues prior to flight. Developed and executed pre-flight plans, test plans, integration plans, and safety tests. Coordinated with the FAA to schedule flights and demos, and practiced drone piloting for future tests. Designed the PCB schematic.
Joshua Pen	Designed, integrated, and tested Path Planner for searching the Geofence Zone and Local Search of Patient Planner with QGroundControl. Initial integration of Path Planner for searching the Geofence Zone to ROS2 network for flight test (not integrated with Patient Detection yet). Designed and installed new Orin and GPS mount. Repaired or replaced broken extension legs, gimbal attachment mount, and motor before flight test. Setup and conducted autonomous flight test. Initialized development of the new Foxglove GUI. Contributed to project management and logistics.
Lance Liu	Built and fine-tuned BehaviorExecutive – a ROS node that uses behavior trees to orchestrate drone operations. This node handles essential drone functions including auto-takeoff, auto-landing, arming/disarming, emergency hold (E-stop) with priority interrupt, navigation (altitude climbs and go-to-position commands with coordinate transforms), ROS plumbing (subscribers for GPS, altitude, and state telemetry; service clients for MAVROS integration; async handlers for non-blocking command execution), and a real-time execution control loop (10 Hz) to monitor active actions and service call status. Error handling was particularly improved by catching service timeouts, coordinate jumps, and FCU rejections with proper fallbacks.
Gweneth Ge	Primarily worked on project management and safety features required by DARPA for the March 7th workshop. Specifically, integrated Remote ID for continuous flight broadcasting, implemented a battery level monitor in QGroundControl to trigger a return-to-home when low, and fixed compass position issues to improve accuracy. Collaborated on various presentations including progress reviews, project management updates, and retrospectives.
Yi Wu	Modified human pose estimation code to conform to the standard base class in AirLab's HumanFlow repository. Designed ROS2 packages for gimbal control on both x86 and ARM systems (including angle control, zooming, and video streaming). Developed a patient lock-on algorithm featuring person detection, tracking, and visualization components. Initiated the Isaac Sim pipeline and established communication between Isaac Sim and ROS2.

Table 1: Team Members and Their Contributions

4 Plans

4.1 MRSD Project

Name	Contribution
Jet Situ	Will assist all software personnel with debugging and software QA and integration across several different stacks. Will coordinate with DARPA and other authorities to ensure proper protocols are followed prior to test. Will assist in coordinating and running all flight tests, and robustify existing electrical components. Finally, will represent MRSD Team at the DARPA Workshop in Georgia from 03-07 to 03-15
Joshua Pen	Fully integrate and test Path Planner for searching the Geofence Zone and Local Search of Patient Planner with QGroundControl with ROS2 network (also integrate with Patient Detection), Design, integrate and test Triage Planner. Design new mount for Rajant DX2 radio. Contribute to wire management.
Lance Liu	Implement dynamic geofence boundary subscription (replace hardcoded coordinates). Develop waypoint progress monitoring. Gimbal control integration: pixel-to-geodetic conversion, gimbal/FCU Sync, streaming, gimbal tracking. Robust autonomous flight: bugs fixing, performance fine-tuning and optimization.
Gweneth Ge	Integrate and test Foxglove as the GUI for easier commands to drone by Mar. 3rd, which will be used in workshop starting on Mar. 7th. Continue working on overall project management and meetings arrangement with the sponsor Airlab, as well as NREC and Mill19 to align upcoming flight tests and the DARPA Triage Challenge.
Yi Wu	Upgrade the gimbal control code, including enhancing the tracking logic design, improving the speed of camera tracking, and adding human pose estimation into the gimbal control. Integrate the gimbal control with other subsystems, like controlling the gimbal based on upstream path planning behavior designs.

Table 2: Team Members and Their Plans