Progress Evaluation: Milestone 3

SRCIS

Search and Rescue Coordinated Intelligence Systems

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Faculty Advisor & Client
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Milestone 3 task matrix:

Task	Completion	Yav	Young	Pop
Heartbeat Safety	100%	30%	0%	70%
Static Target Detection	100%	25%	50%	25%
Multi-agent View	100%	50%	25%	25%
Location Info (SLAM)	100%	40%	60%	0%
Moving Target Detection	100%	60%	40%	0%
Complete repair of LIMOs	100%	33%	33%	33%
Drone integration (Parrot)	10%	0%	10%	0%
Multi-agent Coordination	0%	0%	0%	0%

Discussion of accomplished tasks / Contribution:

- **All Members**
  - **Complete repair of LIMO robots**

    This task was milestone 3's most important task since our group only had one operating LIMO robot. After getting the upgraded wheels from the Design Center at FIT, we carefully matched each wheel to its correct side, since every wheel had a specific ID number.. Later, we reassembled them using available parts. Now we have four operable LIMO robots.

- **Pop:**
  - **HeartBeat Safety**

    Originally the prompts were in a stack to ensure all of the code executes in correct order. However, during the experiment the robots had a problem when internet connection was unstable. It executed all commands of the user when it was not connected to the robot. To solve this problem, we implemented a heartbeat safety system. This ensures that the robot only performs actions when it continuously receives a valid signal, preventing unwanted commands from running during disconnection.

  - **Logo Design**

    Our design is a Unicycle with a Gear instead as the wheel. This symbolizes both the balance required to ride a unicycle and the coordination of gears when meshed together in a machine. In parallel with our project's focus on agents collaborating in a coordinated manner, our slogan is "Balanced. As all things should be".

- **Yav:**
  - **Multi-Agent View + operation**

    On the user interface, the user can now switch between different camera views for each robot. In addition, the user can control each robot individually using Hazelcast, which helps solve the previous ROS2 publisher communication issues. With this setup, managing multiple robots at the same time has become more stable and much easier.

  - **Location Info (SLAM)**

    By ArUco detection, we could get the SLAM working. To get the world origin, we have put four markers(4 X 4) ArUcos in a 2 X 2 matrix. After averaging four markers we can calculate the whole map successfully.

  - **Moving Target Detection**

    This functionality utilizes the ArUco detection and SLAM algorithm to identify the target and its disposition in the environment.

- **Young:**
  - **ArUco Detection**

    For Milestone 2, we have integrated Color detection for the robot. However, even though we had set a specific color for the robot to detect, there were two problems. First, the results varied due to hue in different situations. Second, the robot detected unexpected objects, including ones that had similar or even completely different colors. To solve this issue, we decided to implement ArUco markers, which provide stable and reliable detection in any situation. We are currently using ArUco markers for both SLAM and target detection.

  - **Drone integration**

    For the Drone, we decided to use the PARROT since it has an existing library for ROS2. We have made an intro code for the drone to take off and land again. Though the parrot drone normally connects with Linux or windows software. We tried to bypass this situation by virtual environment, but couldn't go through. Because of this, the drone setup will be continued as part of Milestone 4.

Milestone 4 Task Matrix

Task	Yav	Young	Pop	To Do
Drone integration (Parrot)	33%	33%	33%	Develop code for drone operation(Basic) + **operate**
Multi-agent Coordination	33%	33%	33%	Setup Unitree GO2 + operation
Unitree Go2 Setup	33%	33%	33%	With SLAM, share map
Concurrent Map Sharing	33%	33%	33%	When target is found, robots will share location information
Target Sharing	33%	33%	33%	When a potential target is found, compare with the target and give a confidence score to whether to proceed or not
Target engagement algorithm	33%	33%	33%	Make an efficient algorithm for multiple robots to surround the target.
Robot Operator	33%	33%	33%	

Discussion of planned tasks for the next Milestone:

- **Drone integration (Parrot)**
  Setup parrot using the correct operating system or bypassing it. Also, develop code to move the drone in the air with caution.
- **Unitree GO2 setup**
  Setup Unitree with ethernet cable (Official document). After, manipulate the LIMO code for the basic operations and generate code that only the Unitree can do.
- **Multi-agent coordination**
  After realizing multi-agent coordination will be the most important and time consuming task, we have splitted it into four major tasks.
    - **Concurrent Map sharing + updating**
      By using SLAM developed in milestone 3, we will be able to have one map that has all informations including
        - Robots (LIMO, Unitree, Parrot)
        - Target
        - Local objects
    - **Efficient Target Sharing (if found)**
      When a target is found, the robot will inform the Robot operator and will notify all of the other robots.
    - **Algorithm for robots to head to target**
      There will be multiple robots, so create an efficient algorithm for the robots to surround the target robot.
    - **Robot Operator**
      When the robot sends the target image(Arucos), to the operator and the operator will decide whether to continue to proceed or not(confidence rate). This will be essential for the future when the target is an object, not an Arucos.

Advisor Section

Date(s) of meeting(s) with Client during the current milestone:

- See faculty advisor dates below

Client feedback on the current milestone

- See faculty advisor feedback below

Date(s) of meeting(s) with Faculty Advisor during the current milestone:

- 11/6/25

Faculty Advisor feedback on each task for the current Milestone

- Milestones all look good. One thing I encourage you to spend some time on during this next development period is the development of a demonstration that highlights the capabilities of the robots as team members at their current state of development. This will highlight communication/coordination issues that should be addressed moving forward that may not appear until such a demonstration is attempted.

Faculty Advisor Signature: __Thomas C Eskridge_____ Date: __11/25/2025___