The Search and Rescue (SAR) system is a coordinated air and ground multi-robot search team designed to alleviate the workload placed upon rescue teams by providing an automated tool for target identification and surveillance. Unmanned air and ground vehicles work together to supply advanced search capabilities in lieu or in support of deployed first responders.

Team Structure

The project is divided into three main teams of computer and software engineering students organized by experience, skills, and individual preference – Unmanned Aerial Vehicle (UAV), Unmanned Ground Vehicle (UGV), and Ground Control Station (GCS). The GCS is divided into four sub-teams, each responsible for a subsystem – Waypoint Management, Communication, User Interface, and Image Processing. Tasks are managed using the Crystal Clear agile process.

Design Summary

The UAV team is responsible for the design and development of a four-rotor helicopter (quad-copter). The vehicle must transmit a live video feed while navigating under autonomous or manual radio control (RC). Main tasks include the design and implementation of hardware, software, and stability control algorithms, as well as communication with the GCS.

The UGV team is tasked with the modification of a Power Wheels™ vehicle into a computer-controlled robot. The UGV must be able to drive autonomously or by RC and convey live video, targeted thermal readings, and bidirectional audio to allow an operator to communicate with victims. Tasks include hardware modification, algorithm creation, and GCS communication.

Each UAV autonomously flies to GCS supplied waypoints while providing visuals to the image processing system which uses basic blob analysis techniques to extract potential human targets from captured images. The waypoint management system distributes these points of interest to the UGVs which use multiple sensors to autonomously navigate to the supplied locations for closer investigation. GCS operators verify the vehicle’s findings, and take appropriate action.

Results Summary

By leveraging the stability of a quad-copter and the maneuverability of a small rugged ground vehicle, it is both feasible and practical to use autonomous systems to expedite rescue times, expand search areas, and decrease risks for rescue workers. The low cost and easy deployment of the system makes it an attractive tool in the arsenal of an emergency response team.

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