



Fire Truck Ladder Automated Ladder Guidance System (FTLAGS)

Thank you



Team Optimus Climb: Martin Diaz, Gaukas Wang, Jack Biegel, Linda Palacios, Jackson Cedzich-Grant, Dustin Ramsay
University of Colorado Boulder, Department of ECEE

Background

In an aerial rescue involving a fire truck ladder, timing is critical. Traditionally, the task is handled by an operator using three joysticks to navigate a ladder to a point of rescue. Even for an experienced firefighter, ladders can delay a rescue due to human error, since the distance from the tip of the ladder to the target is extremely hard to judge, this could increase risk of ladder-building collisions. Even though this is a problem, modern ladders do not incorporate sensors for preventing this type of collision, but this is where our system comes into play.



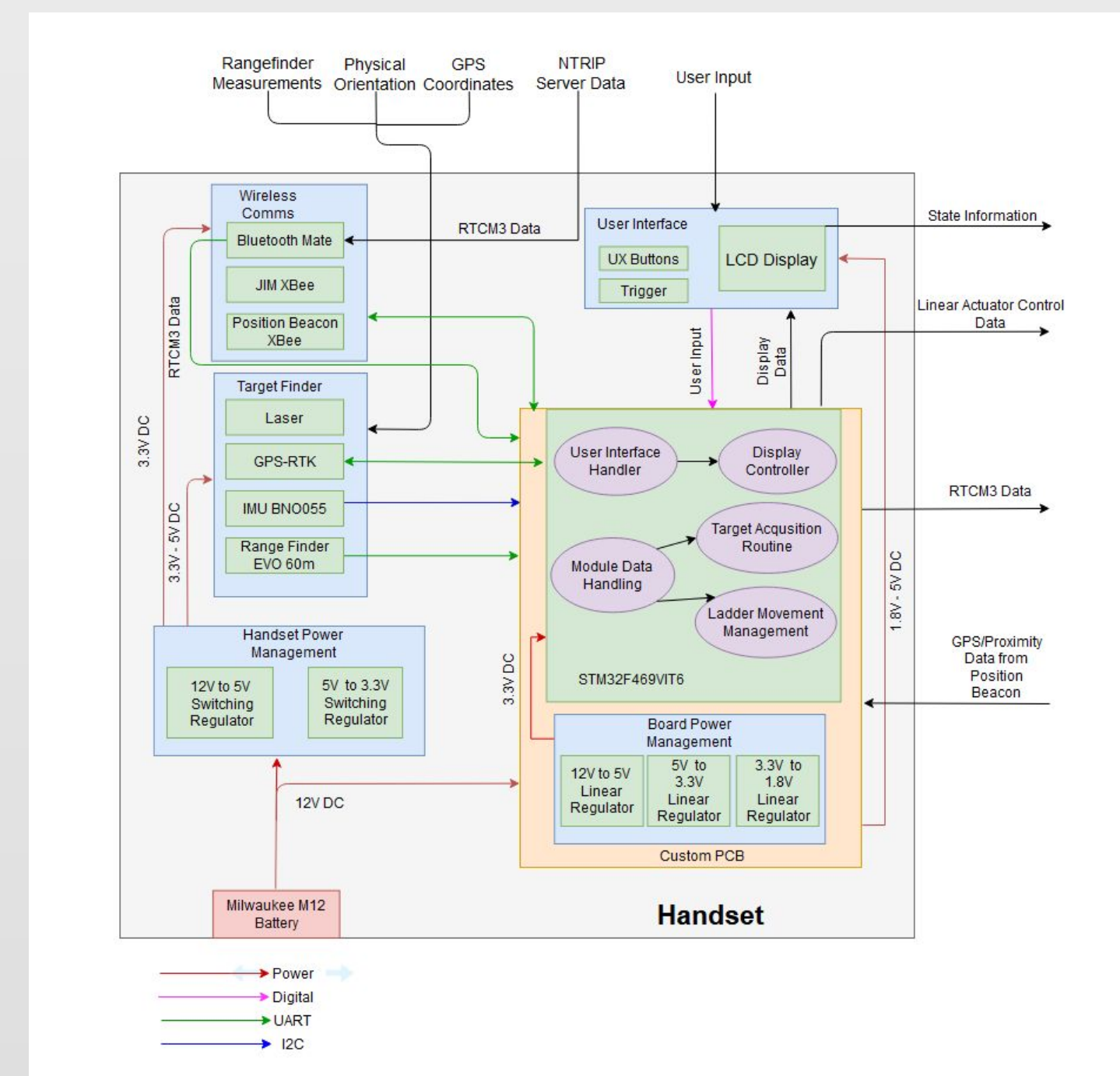
Our Solution

Our solution is simplifying and partially automating the control of the ladder on a fire truck aerial apparatus. FTLAGS reimagines the ladder deployment process. The user designates the ladder's target using a "point and shoot" interface. The microcontroller in the Handset in conjunction with linear actuators on the Joystick Integration Module then uses the truck's existing controls to place the ladder at the target. This product decreases the possibility of human error, and the time and cost of training human operators.

FTLAGS - System Diagram

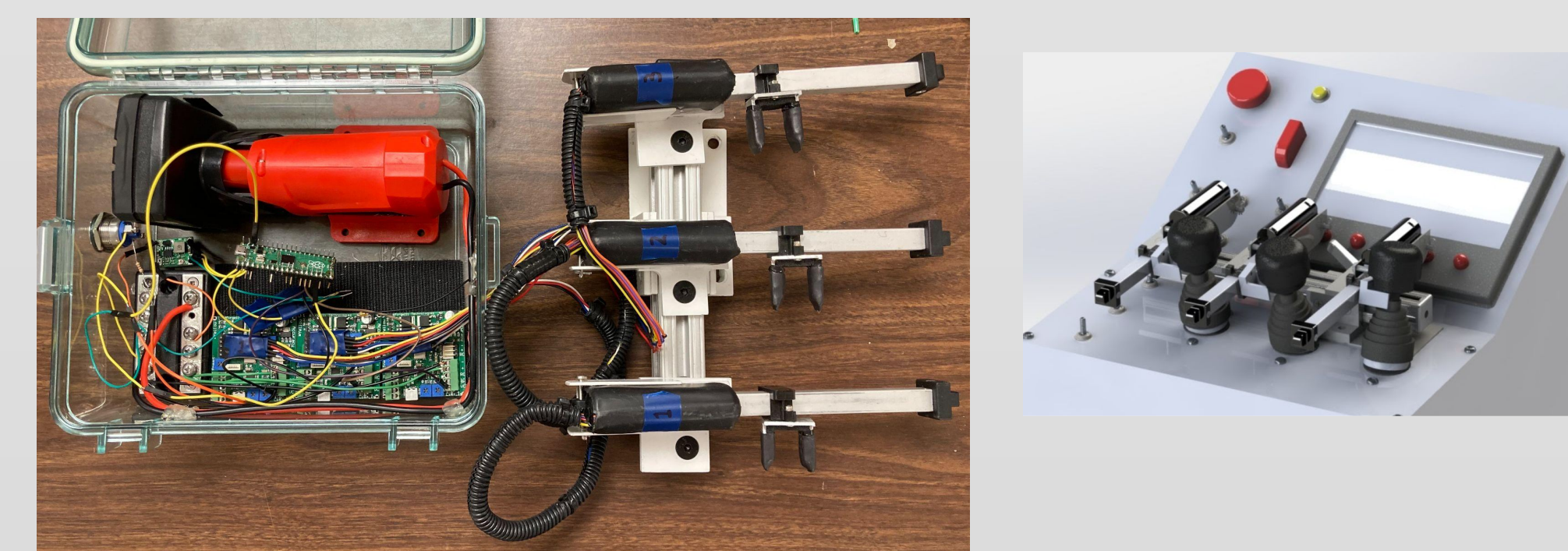
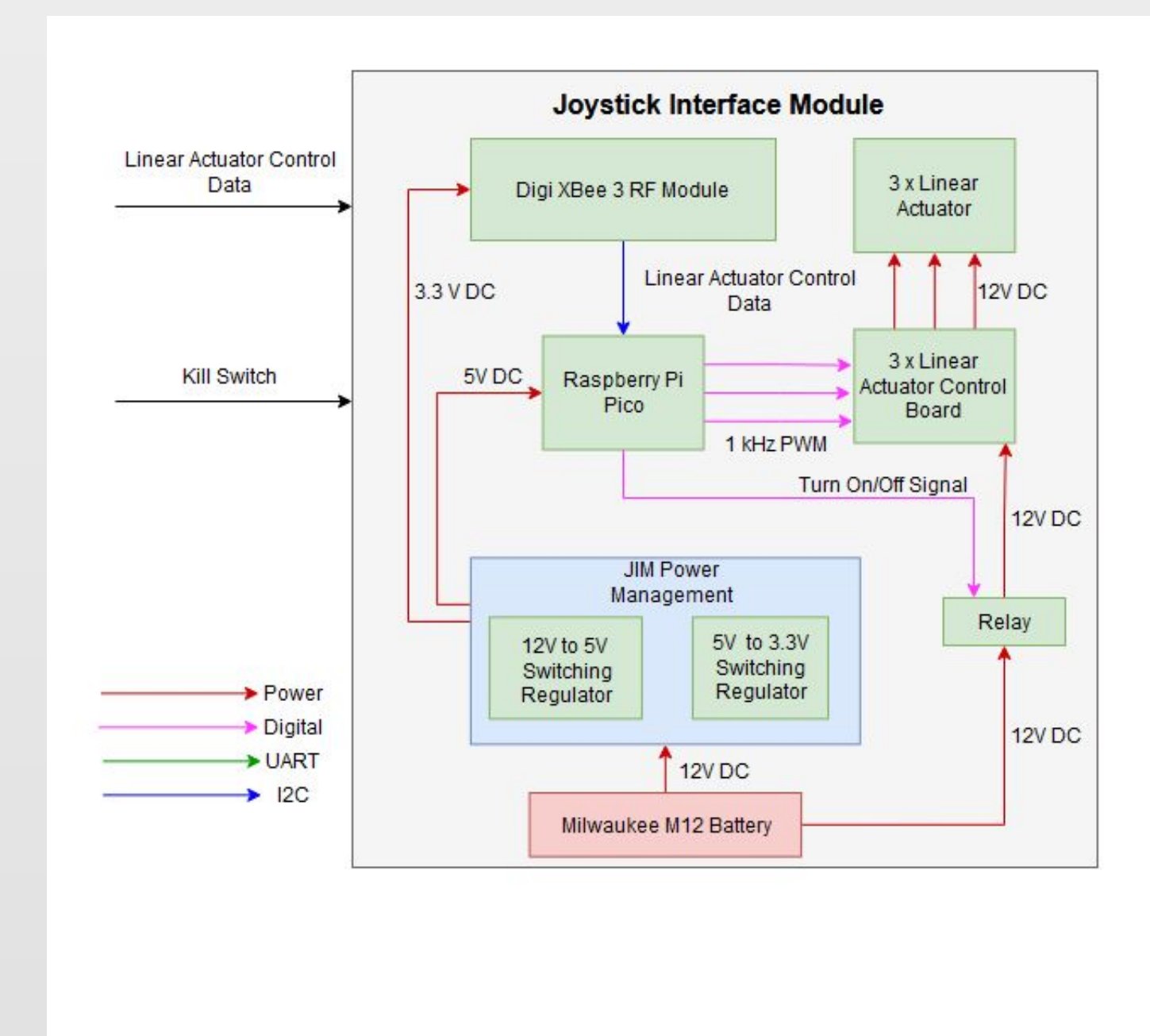
Handset

Optionally select ladder path waypoints (to route the ladder around obstacles), it manipulates the ladder through all three degrees of freedom (rotate, elevate, extend) with no human input.



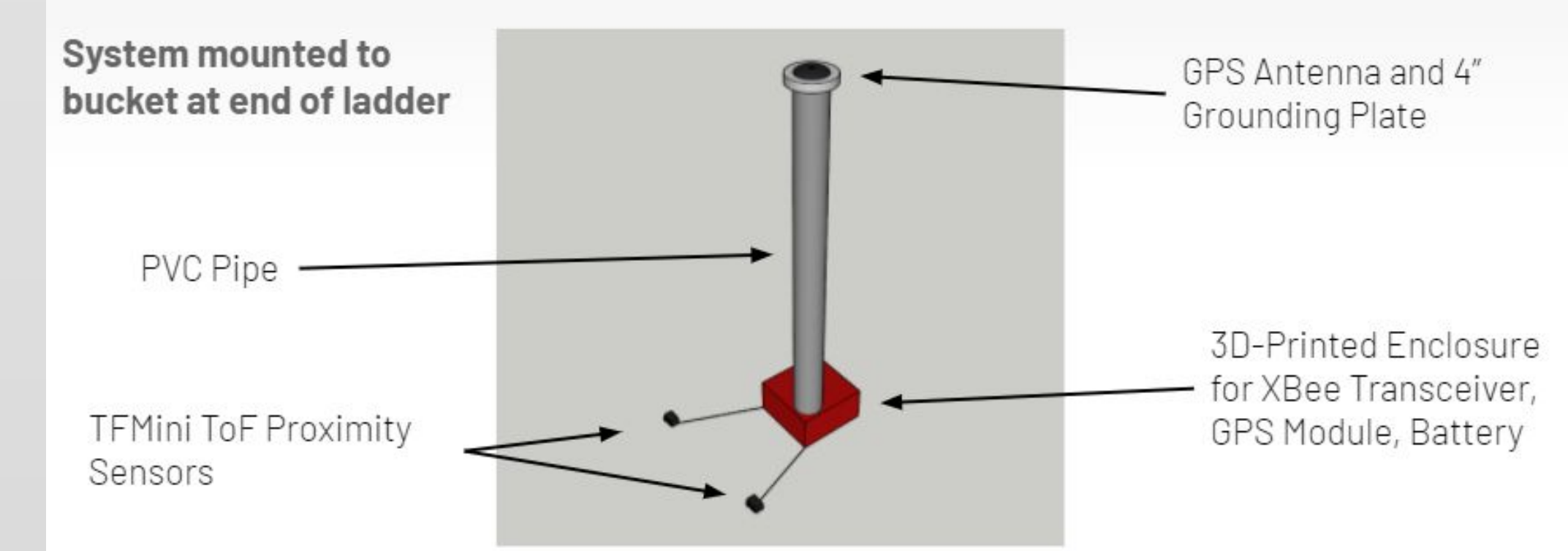
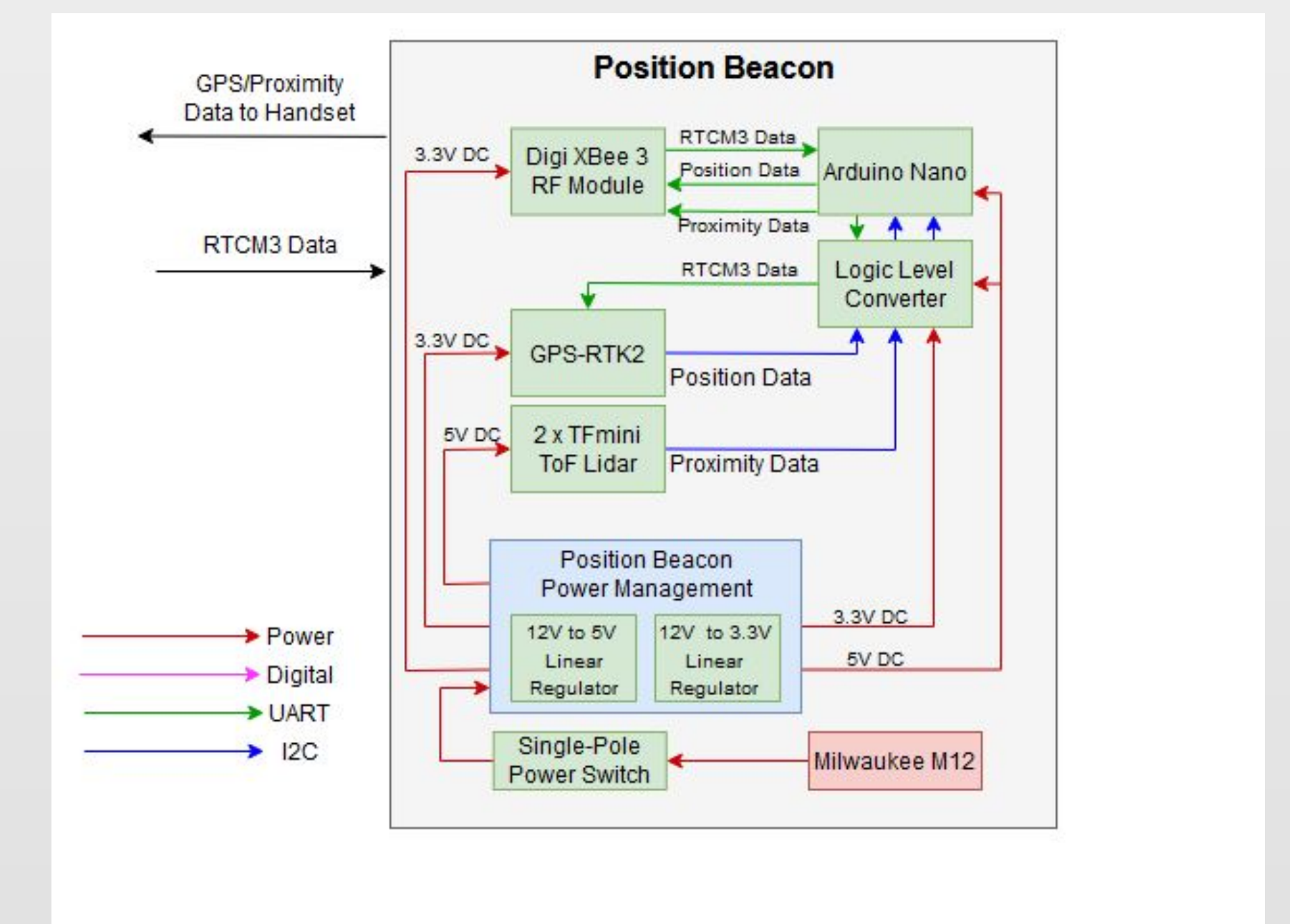
Joystick Integration Module (JIM)

Takes control of the aerial apparatus using a mechanical integration with the joystick controls.



Position Beacon

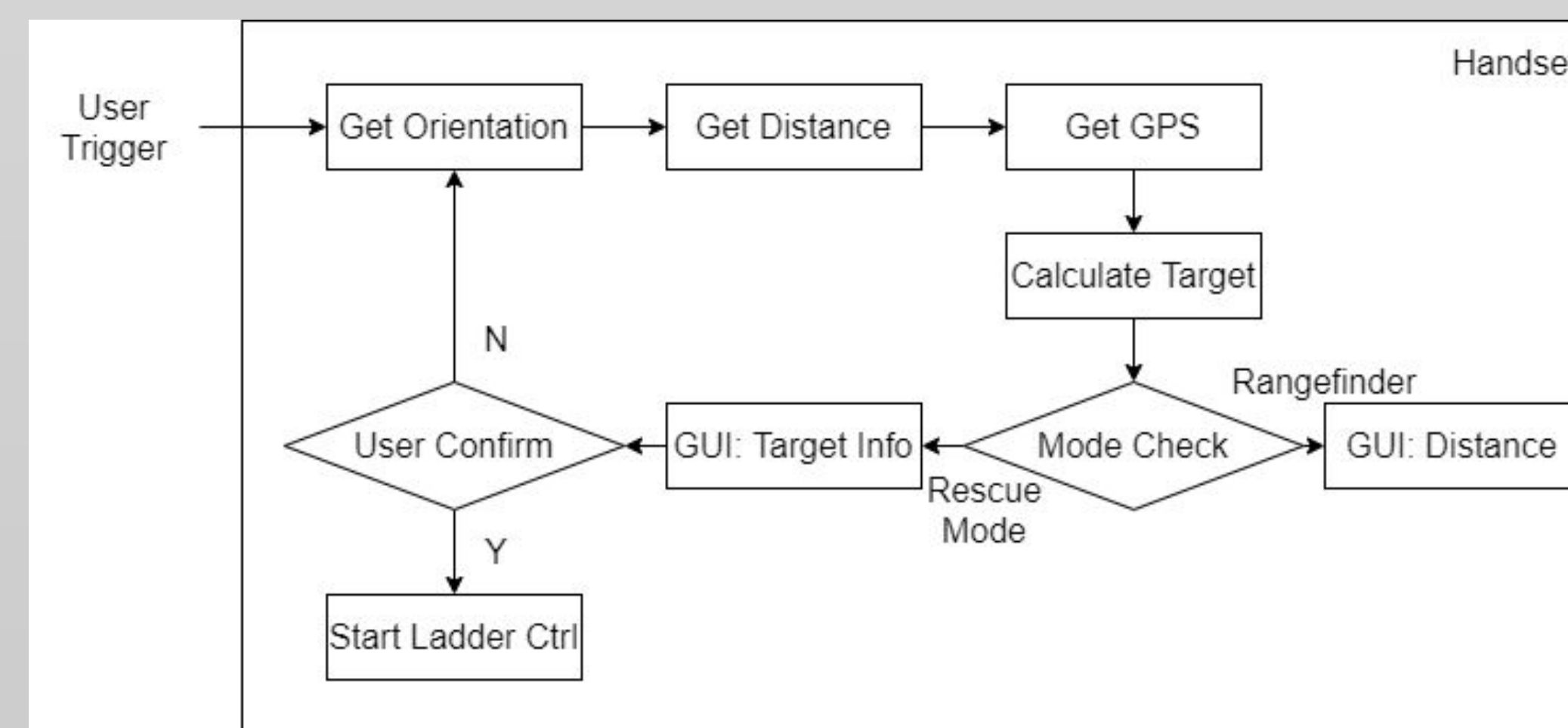
Tracks position of the tip of the ladder via a GPS-RTK2 sensor. It also uses IR ToF distance sensors to detect obstacles.



FTLAGS - Software Flow Diagram

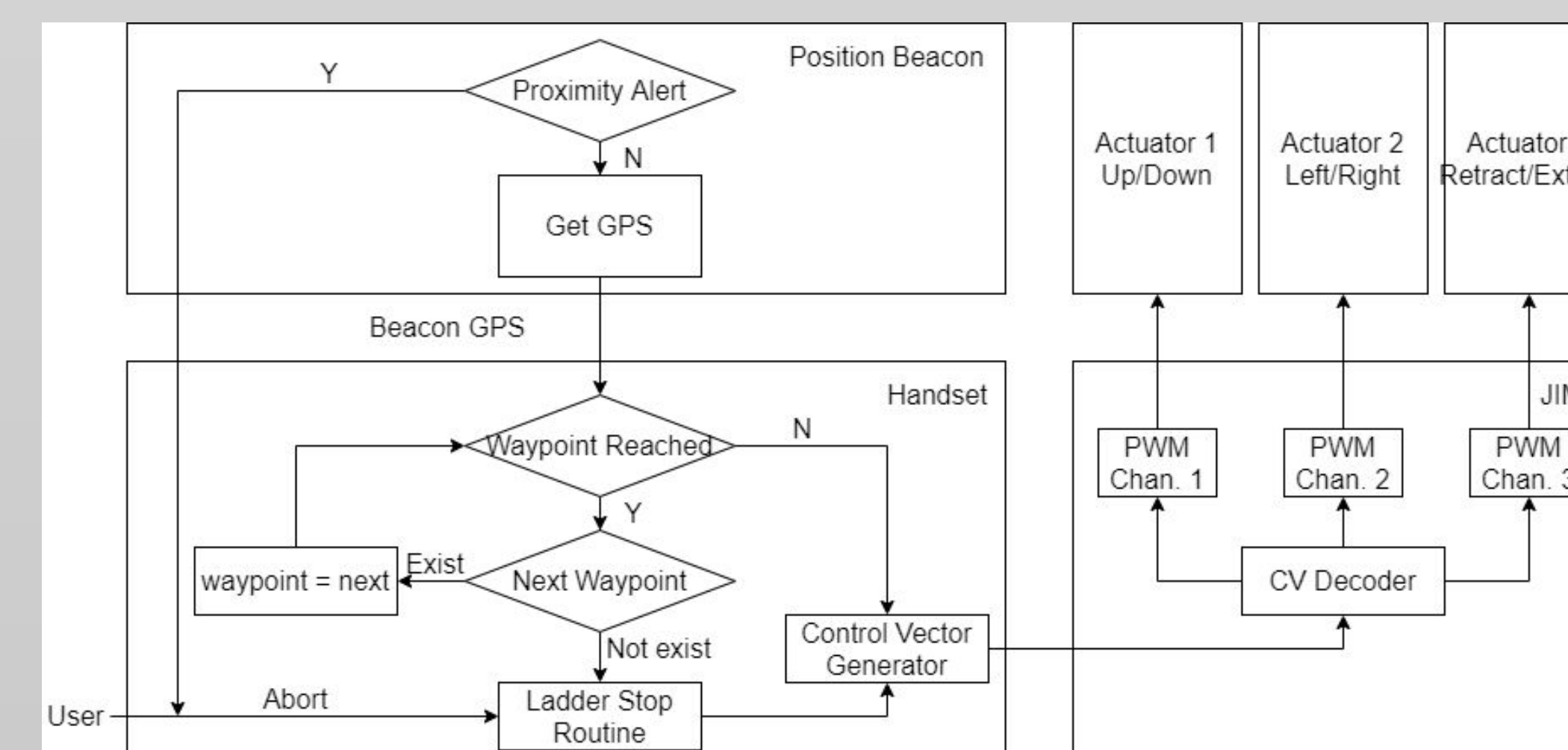
Target Acquisition

This routine captures the absolute position of a target represented in GPS coordinates.



Ladder Positioning

This routine operates the ladder to approach the target acquired by Target Acquisition routine.



Operational Safety

Operations Safety implemented in each module.

Handset

- Remote Kill-Switch: Mechanical + GUI Touchscreen button to freeze the ladder immediately.

Position Beacon

- Proximity Sensor Array: Providing proximity feedback & alerts.

JIM

- Local Kill Switch: Mechanical button to freeze the ladder and remove the control mounting.