Matthew Dubea – Multi Payload Water Sampling Device

Introduction:

Primary Objective: Design a multi payload system which can navigate to water, collect multiple samples, and record date.

Ideal Situations: This project exercises the potential uses of a drone equipped with sensors on payloads to monitor and respond to environmental disasters remotely. Using the precision of sensors and the convenience of unmanned aerial vehicles, enhanced data collection is possible and higher efficiency and safety in doing so are achieved. This reduces the need for human exposure to dangerous conditions.

Task 1 : Orientation -ensuring correct payload orientation

Task 2 : Display Tilt Angle -measuring tilt angles to navigate over water bodies

Task 3 : Object detection within 10 inches - detecting objects in the drone's path

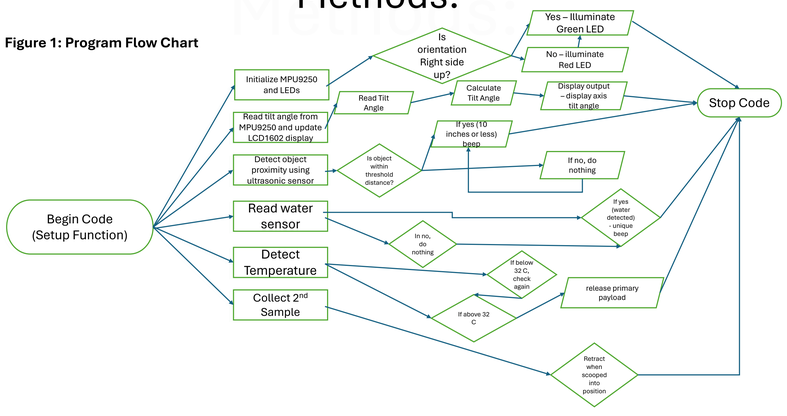
Task 4 : detection of water source - identifying water sources via density changes

Task 5 : Sense Elevated temperature and release primary payload from drone

Task 6 : Collect a secondary water sample for further measurements or for confirmation of initial data sample collected.

Methods:

Figure 1: Program Flow Chart



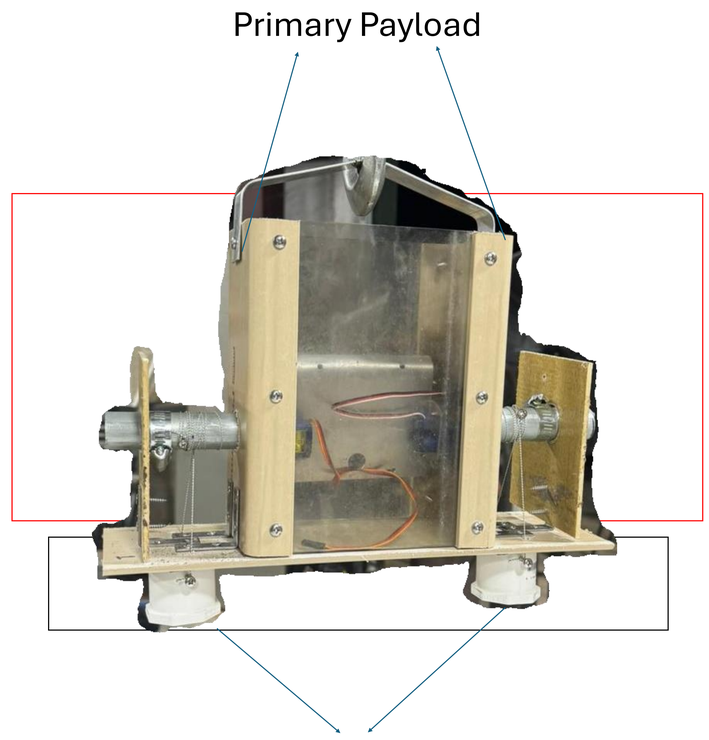
- Methods used to complete the entire task list above are shown in the program flow chart.

- The code was initially completed in segments, accomplishing and programming each task by task. All 6 segmented codes, were then analyzed and compiled into one final code, which is depicted in **Figure 1: Program Flow Chart.**

Results:

-The table outlines our drone's key tasks for surveying environments from a safe distance.
-First, we ensure the drone is level (Task 1) and then keep an eye on its tilt (Task 2) for steady flight.
-The system alerts us if it gets too close to something (Task 3), crucial for avoiding crashes.
-It also beeps differently when hitting water (Task 4), which is handy for spotting spills. If things get too hot, the drone drops its gear automatically (Task 5), handy in emergencies.
-Lastly, it can grab water samples with a robotic cup (Task 6), useful for testing pollution or radiation levels potentially.
-Ultimately, with the completion of these accomplishments would create an ideal multi payload device that would make water sampling a safer and more efficient task to complete.

Task	Measurand	Task Description	Sensor Used	Expected outcome	Additional Notes
1	Orientation (up/down)	Sense Device's orientation (upright or inverted)	MPU-9250	LED activated (Greed or Red)	LED turns green for right-side-up and red for upside down.
2	Tilt Angle (degrees)	Display the tilt along the axis of travel	MPU-9250	Numerical Angle Display	Tilt angle displayed on LCD in real-time
3	Distance (inches)	Beep when detection of forward object is 10 inches or less.	Ultrasonic Sensor	Buzzer Alert	Buzzer sounds when an object is within a predefined proximity.
4	Density (change in density from air to water)	Beep when water detected	Water Level Sensor	Unique Beep pattern as water detected	Beep pattern changes when water is detected.
5	Temperature (°C/°F)	Elevated temperature detected to release primary payload from drone	Thermistor	Payload released when temperature of 32 Celsius detected.	Payload released when a certain temperature threshold is exceeded.
6	Position (inches)	Secondary water sample	Servo Motor	Scooping Action	Servo motor actuates to scoop water for secondary sampling



Conclusions & Future Work:

- This innovative approach not only expands what we can do with distant environmental checks but also creates new ways to investigate nature and manage emergencies from afar, all while keeping people safe.

- Together, these parts describe the aim, implementation, and what might come next for the project, highlighting how drone tech can tackle environmental risks both securely and effectively.

References:

- [1]https://www.instructables.com/LCD-1602-With-Arduino-Uno-R3/