Deliverable B: Needs Identification and Problem Statement

GNG1103D – Engineering Design
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## Beacon

**Problem Statement:** An emergency beacon with the ability to communicate with a drone operator on its position is to be designed. It must be able to update the operator on its status and communicate with bystanders.

JAMZ requested that a beacon be designed and installed on the drone in case of emergencies. The beacon's purpose is to notify the drone operator that the drone has crashed and has been disabled. It must be able to ping its location continuously to the operator using the GPS system already installed to maintain communication with the operator. Because the beacon is expected to work on a disabled and potentially heavily damaged drone, it must be durable enough to withstand any crash impact. It must also be able to draw its own power from an independent battery should the primary power source be cut off due to impact or malfunctions. The beacon should also be connected to other systems in the drone and provide an update status to the operator (i.e., damage, overheating). In event of a crash, the drone must also be able to communicate with bystanders who want to interact with the drone, warming them to not touch the drone, to keep a safe distance of 5m from the drone, and notifying them that an operator is inbound to retrieve the drone.

## Climate Sensor

**Problem statement:** A reliable and consistent method of monitoring humidity and temperature of the food contents of the drone that can relay that information back to the drone operator is required.

The climate sensor is to provide the condition of the food content within the drone and notify the operator to let them know if the food is going bad using humidity and temperature sensors. JAMZ has stated that the ideal temperature range is round room temperature with the ideal humidity being 50-55% relative humidity. In order to measure the inside environment of the box, the sensor should ideally have access to inside the box which would mean that access point like a hole may be required. Data from the sensor also needs to be analyzed in relation to flight time and, if possible, the type of food/weight to more accurately determine if the food is going bad. From the analysis, a quantitative value could be provided to the operator that notifies them about the food's quality.

## Anti-Theft System

**Problem Statement:** An anti-theft system that relays its coordinates to the operator and is comprised of lights and noise. This is used to deter thiefs from continuing the action of stealing a drone and alert the public.

JAMZ intends to incorporate an anti-theft system to their delivery drones to prevent individuals from stealing them. The drones are at risk of being stolen both while in service of a delivery or if a drone is downed due to malfunctions. While each drone is on delivery, an expected flight path is monitored by an operator as the drone relays its coordinates during its flight. If the drone's coordinates do not follow the expected flight path, then the drone is assumed to be stolen. If this occurs, JAMZ wants to be able to not

only track the coordinates of the drone on its new path, but also have an alarm system that would deter people from stealing the drone. This alarm system would comprise of lights and a siren that would be very noticeable to the public and would indicate that the drone is being stolen. The purpose of the anti-theft system is not to harm the thief but deter them from continuing with the stolen drone. Once the drone is discarded, JAMZ will need to be able to locate the stolen drone by having access to its coordinates.

Violent Shake Alarm (Handling of Food)

**Problem Statement:** Create a violent shake sensor that relays accurate and precise data back to the flight operator on the movements of the package and contents inside, in terms of its six degrees of freedom.

JAMZ wants to collect continuous information on the movements of a package during flight. In cases where a user reports a damaged item was delivered, JAMZ can refer to the fight history and determine if damage occurred due to a violent shake. The attachable violent shake sensor must be able to detect movement on all six degrees of freedom of the package. The sensor should send back raw data in serial format which is then displayed on the operator's screen using visual aids. The accuracy and precision of this data holds priority. The attachment should be kept as light as possible and threshold values that define a violent shake should be configurable depending on the type of payload that is being transported. A payload weight of up to 10kg should be considered.