Hajj Aero Medicine (HAM) – Team 95

Senior Design Project -232

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Introduction

Problem statement

Annually, more than 2 million of Muslims converge in Mecca for the Hajj season. With numbers set to double by 2030. NUPCO faces challenges in delivering medicines promptly during Hajj. 'HAM', our medicine delivery drone, dramatically reducing delivery time. Unlike ambulances, HAM guarantees ideal medication temperature, swift transportation, and strong safety features to prevent accidents. With innovative solutions like fail-safe mechanisms for emergency situations and an enhanced navigation system.

Constraints

Throughout the project, we carefully consider several limitations. These include following the rules set by the Ministry of Hajj and Umrah, finding cost-effective solutions, keeping pilgrims and the Hajj area safe, and dealing with different weather conditions. Our main aim is to create a sustainable way to deliver medical supplies that works well despite these challenges.

Target Specification

- **Flight Time (15 minutes – 25 minutes)**
- **Speed (10-30 km/h)**
- **Accuracy (±2 meters)**
- **Payload (1.5 kg minimum)**
- **Secure Medicine Storage**

Prototype Design

1. Estimate Weight and Thrust:

$$\text{Weight}_{\text{drone}} = \text{Weight}_{\text{payload}} + \text{Weight}_{\text{insulated box}} + \text{Weight}_{\text{battery}} + \text{Weight}_{\text{structure}}$$

$$\text{Weight}_{\text{drone}} = 5.5\ \text{kg}$$

2. Select Propellers:

we select propellers that are suitable for your drone. Factors to consider include diameter, pitch, material, and the number of blades.

$$\text{Propeller Specific Thrust} \left(\frac{g}{W}\right) = \frac{\text{Thrust (g)}}{\text{Mechanical Power (W)}}$$

3. Select Frame:

We selected the YoungRC F450 frame kit which provides a sturdy and lightweight platform for building our drone.

4. Select Motor, Controller, and ESC :

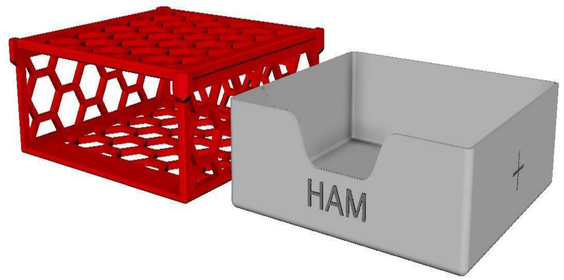
The 1000KV motors paired with the 40A Brushless ESC provide efficient power delivery and precise motor speed control.

5. Select Battery and Estimate Flight Time:

We chose a high-capacity battery, which is the 6000mAh 14.8V 50C LiPo battery. This battery provides ample power and capacity for extended time.

6. Designing Box for Medical Supplies:

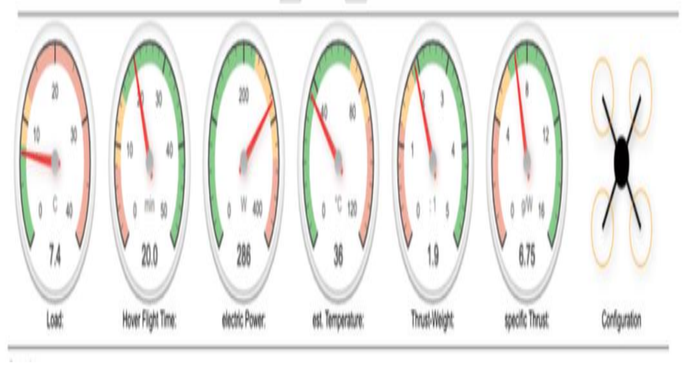
We designed a secure and compact box that fits within the drone's payload capacity and keep medication temperature ideal.



7. Enhancing Medical Supply Delivery with Mission Planning Software:

Automated mission execution streamlines operations, enabling precise delivery missions.

Design Result & Validation



❖Meeting our specifications:

1. **Weight and Payload Capacity:** **The total weight of the whole drone structure drone, is 5.5 kg. This is within the drone's carrying capacity, meeting the payload requirement of a minimum of 1.5 kg.**
2. **Insulation Effectiveness:** **The insulated box is designed with materials that have low thermal conductivity, ensuring that it can maintain the required temperature for the medicine during transportation.**
3. **Emergency Protocols:** **The drone design includes fail-safe and emergency procedures for unexpected situations.**

Conclusion and Future Work

HAM offers advantages over traditional methods including speed, cost-effectiveness, enhanced patient care, safety in transporting hazardous materials, reduction in human error, and increased health system resilience.

To further advance the Hajj Aero Medical (HAM) project, focus should be placed on <u>enhancing battery technology</u>, <u>robust communication systems</u>, <u>weatherproofing</u>, and <u>increasing payload capacity</u>.