Drag & Lift Force, Biomedical Application, Hardware & Software Using in Quad copter Drone

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***Abstract*- In this project, the use of current drone technologies is reviewed, optimized, and used to demonstrate the feasibility of medical supply delivery to remote areas. via UAV (unmanned aerial vehicle). This project focuses on the design of a biocompatible payload and a modified drone to accomplish medical supply delivery to remote areas. The design of the payload and UAV arm mechanism must consider the safety of medical supplies, medical equipment and blood biocompatibility throughout the duration of the delivery. Multiple drone and payload design iterations were created to address the lack of medical attention in remote areas. Various designs were implemented in a prototype to create a demonstration of concept feasibility. Each design has its own parameters and components that collectively make up the payload and drone delivery system. This research paper describes, analyzes and reports experimental results of the final drone delivery and payload design, as well as the steps taken throughout the duration of the project.**

Index Terms- Building inspection, Bridge inspection, Drone photography and video, Drone Services.

1. INTRODUCTION

In this project, the use of current drone technologies is reviewed, optimized, and used to demonstrate the feasibility of medical supply delivery to remote areas of China via UAV (unmanned aerial vehicle). This project focuses on the design of a biocompatible payload and a modified drone to accomplish medical supply delivery to remote areas of China. The design of the payload and UAV arm mechanism must consider the safety of medical supplies, medical equipment and blood biocompatibility throughout the duration of the delivery. Multiple drone and payload design iterations were created to address the lack of medical attention in remote areas of china. Various designs were implemented in a prototype to create a demonstration of concept feasibility. Each design has its own parameters and components that collectively make up the load and drone delivery system. This research paper describes, analyzes and reports experimental results of the final drone delivery and payload design, as well as the steps taken throughout the duration of the project.

1.2 EXECUTIVE SUMMARY

This study is aimed to provide medical assistance to people through the delivery of medical supplies by unmanned drones. The use of unmanned drones is reinforced through an application that has the potential to benefit people in distant areas around the world. This study hopes to expand drone technology and the application of drones. The timetable for this project was broken into two categories: Pre and post-departure. The pre-departure research for this project was conducted over six weeks at Worcester Polytechnic Institute (WPI) in the United States. The design, prototyping Unmanned Drones for Medical Supply Delivery in China and testing of the project was conducted over seven weeks at the University of Beijing Chemical Technology (BUCT) where the project was completed alongside of three BUCT students. The nature of the project and how it was conducted will be explained in further detail through outcomes of this study include a proof of concept, the assembly of a working prototype and the evaluation of the prototype's performance. In order to make the project a success, adequate funding and resources were sought out for prototype assembly.

2. ENGINEERING PRINCIPLES PERTAINING TO DRONES

2.1 Forces Related To Flight

To understand the motion of flight for a drone, it is important to understand what forces the drone is experiencing during flight. The same forces that allow a plane to fly are the same for any object in flight - for example a ball or Frisbee. The forces are thrust, drag, weight and lift. Thrust s a force that moves an object in the direction of motion, allowing air to be pulled in and then pushed out the opposite direction. Drag is the force that acts opposite of motion. Drag is caused by friction and difference in air pressure. Drag is what slows down the object in flight. Weight is the force caused by gravity and lift is the force that holds an object in the air. Consequently, these forces are what a pilot experiences while in flight. The same forces experienced by the pilot would be true for any load being carried by the drone [3]. This becomes important when analyzing the load that will be delivered. The forces experienced by the pilot in flight, directly relate to the degrees of freedom (DOF) also experienced by the pilot. The trajectory of an airplane in flight has three degrees of freedom. There is also the altitude along the trajectory that has three degrees of freedom, totaling six DOF while in flight. Understanding the forces applied during flight and the degrees of freedom will help determine which maneuvers a drone can experience. As seen in Figure 1 below, the drone will experience rotation about axes x, y, and z simultaneously experiencing translation in positive x and y-axes [4, 5].

3. EXISTING HARDWARE AND SOFTWARE FOR PROTOTYPING DRONES

3.1 Flight Controller: Ardu pilot Mega (APM) is an open source flight controller. We use it to maintain the balance of the UAV by PID algorithm.

3.2 camera and Video Transmission Module (VTM): Camera can capture image data and VTM can send the image data to the user, providing the user with information around the UAV.

3.3 Data Transmission Module (DTM): Use the DTM for UAV and terminal connection. The terminal includes smart phones and computers. Can send commands from mobile phones or computers to control the UAV.

3.4 Electronic Speed Controller (ESC): ESC uses the information and signals gathered by the sensors of the flight controller to control the current provided to the motors.

3.5 Motor: Motor converts electrical energy into mechanical energy to rotate the propellers which provide the aircraft with lift.

3.6 Motor Power Hub: The power from the battery is divided into four parts for the motors and is made by PCB (printed circuit board) board.

3.7 On-Screen Display: Displays the current flight information to the user. Provide information about the performance of the UAV as well as video.

3.8 Power Hub: This module converts the battery voltage (22.4V in our case) to the standard voltage (5V) and controls part of the power supply.

3.9 Remote Control: Converts the physical change of the joysticks and buttons on the remote control to information that is converted to electrical signals and sent to the wireless signal receiver.

3.10 Receiver: Converts the wireless signal from the remote-control and sends information to the flight control unit.

3.11 Servo: Provides control of a desired operation through the use of feedback. It can be rotated to the angle needed for control of the UAV arm.

4. LIFT AND DRAG CALCULATIONS

4.1 Lift

It known in the motor racing world, is the force generated perpendicular to the direction of travel for an object moving through a fluid (gas or liquid). The same effect occurs when a fluid moves over a stationary object, such as an airfoil in wind tunnel. Airfoils are the most efficient shapes found so far that can generate lift while at the same time minimizing drag.

4.2 Drag

Drag is an unavoidable consequence of an object moving through a fluid. Drag is the force generated

parallel and in opposition to the direction of travel for an object moving through a fluid. Drag can be broken down into the following two components:

1. From drag (or pressure drag) - dependent on the shape of an object moving through a fluid
2. 2. Skin friction - dependent on the viscous friction between a moving surface and a fluid, derived from the well shear stress.

5. BIOMEDICAL APPLICATIONS OF DRONES

5.1 Medical Relief

Drones have proven to be effective in many commercial applications when abiding by the regulations set by respective governments. But, aside from commercial applications, UAVs can also be used to transport blood and small emergency medicine and medical supplies, such as a portable heart defibrillator or first-aid kit. In the express delivery industry, the development of package delivery systems through the use of UAVs is far from maturity but has reached the stage of broadening its applicability. Using unmanned aerial vehicles for applications in the field and study of biomedical engineering seems to be the next immediate step in the broadening of drone applicability.

First and foremost, in the event of an emergency situation drones can be a form of immediate relief. Hospitals located in remote areas have a limited amount of supplies, and during a state of emergency the supplies run out extremely fast. Drones can aid in the restocking of supplies in remote hospitals as well as the delivery of needed supplies to area in need. The time that a truck delivery would take is too late for the majority of people in need. This raises the biomedical application of drones to cut down the time of an emergency delivery from what could take up to 4 hours to just 20 minutes. For example, if a mother is giving birth and is suffering from postpartum hemorrhaging, her life is dependent on receiving a blood transfusion. The blood is needed immediately and depending on the geographical location, there may be many forms of physical boundaries and obstacles that would impede ground vehicles. With blood being readily available

at nearby hospitals, drones could be safely loaded with blood bags and the necessary equipment for transfusion upon delivery, ultimately saving the mother's life. Transportation in remote and underdeveloped rural areas is a prominent issue in many countries, and UAV transport undoubtedly provides a quick pass through closed roads and rugged terrain while carrying small and light transportable medicine and other medical supply solutions.

5.2 Understanding Biology And Physiology

Identifying relevant biological and physiological systems for review is essential in understanding the choices made throughout this project. More importantly, understanding the appropriate biological components will allow for a meaningful analysis of the biocompatible materials and designs. The biological and physiological components to be transported include blood, medicine, and first-aid supplies. All chemical, biological and physiological elements must be treated in different respects and therefore must be briefly introduced to understand why. But first, it is necessary to recall what the differences and similarities are between biology and physiology.

6. CONCLUSION

From detonating inflatables to the unmanned flying taxi, the historical backdrop of automatons is an interesting point. I incredibly delighted in finding the opportunity to compose this article, and I trust all of you appreciated getting the chance to peruse it. On the off chance that you have increasingly extraordinary automaton history realities make certain to tell our perusess in the remarks, and please drop us a line if this automaton history timetable has been useful to you here and there.

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