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HEALTH INSPECTION & SANITIZING BY DRONE IN COVID PANDEMIC

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Abstract: Drones are being employed in our day-to-day lives as a result of their versatile applications. The main objective of this project to *design* and create a Pandemic Health Monitoring and Sanitizing System. Drones can be used to monitor and disinfect congested and dangerous places. This drone can detect temperature, recognize mask wearers and non-mask wearers, and disinfect the appropriate area. The use of a temperature pistol to monitor temperature is dangerous and ineffective and Hand-pump sanitization is a time-consuming and exhausting process. This health monitoring system will detect temperature without the need for a human interaction to solve this problem. The surface will be sanitized by the sanitizing system in the drone. The camera will take photographs of both mask wearers and non-mask wearers.

Index Terms **- Drone, Mask detection, temperature detection, sanitizing, non-contact.**

I. INTRODUCTION

Unmanned aircraft systems (UAS), also called drones, are a technology that has extended its use in recent years to many applications such as the audiovisual sector, surveying, infrastructure inspection, agriculture, forestry management and logistics, among others. Here we use this technology for health inspection and sanitizing. In this we are going to use Quadcopter. Quadcopters (otherwise referred to as quad-rotors) aircraft are emerging choices in Unmanned Aerial Vehicle (UAV) draft. This is often due to their capacity to drift in crowded areas and Vertical Take-Off and Landing (VTOL). Quad-rotor consists of 4 rotors that are hooked at the tip of the frame arrangement. Here the front and rear motors rotate counterclockwise and also the other two rotates clockwise, as a result of the online aerodynamic torque is going to be 'zero'. Each rotor is connected to fixed pitch propellers.

The movement of the quad-rotor is controlled by the speeds of the four motors to negate the consequences of counter-rotational torque from the motors; there are opposing rotations on the various axes. This causes a net torque of zero, cancelling out the unwanted rotation. Keeping the whole torque capable zero is critical for controlled flight. Vertical movement is made by increasing the speed of all four motors equally. Movement within the positive Y direction for instance is completed by increasing the speed of motor 3 while decreasing the speed of motor 1. This keeps the web torque zero while causing the craft to tilt allowing movement without rotation. The lean however will cause the lifting component of the thrust to scale back, requiring an equal increase of all four motor speeds to compensate. Controlled rotation is often caused by increasing the motor speeds on one axis while decreasing the motor speeds on the opposite, thus causing the torque to travel out of balance.

2. THE MAIN OBJECTIVE OF THIS PROJECT

i) To detect the mask wearer and non-mask wearer and capture their photos.
ii) To detect the body temperature using thermal cameras without human contact.
iii) To sanatize the isolated area without contact using drone.

3. COMPONENTS SELECTION

Motors: Brushless DC motors (BLDC motors) are utilized in Quad-rotor. The motor features a static magnet that rotates around a hard and fast point. Advantages over BLDC are more torque per weight, reduced noise, increased reliability, longer lifetime, and increased efficiency.
Motor calculations: The motors should be selected in such how that it follows the following thrust to weight relationship.
Ratio = (Thrust / weight) = (ma / mg) = (a / g)
VTOL is feasible only if (a / g) > 1 or in other words, the whole thrust to total weight ratio should be greater than 1 so the quadcopter can accelerate within the upward direction.
Total Thrust Produced = 2*(Total weight of Quadcopter)
T=2*1.5kg= 3kg
i.e. we are using 4 motors, each motor should create a thrust of 750 grams, so we select 1000Kv BLDC motor.

Propellers: A propeller may be a form of fan that converts rotational energy into thrust. Generally, propellers may be classified as supported by their diameter and pitch. The diameter of the propeller indicates the virtual circle that the prop generates whereas the pitch indicates the number of travel per single rotation of the propeller. To counter motor torque, Quad-rotor requires two clockwise and two anticlockwise rotating propellers. All the propellers utilized in the quadcopter should have identical diameters and pitches. So we have selected 10x4.5 inch propeller.

Electronic speed controllers: this is often also called ESC. ESC is employed to drive the motors at a particular speed by supplying a particular amount of current and voltage. So we selected 30A ESC which is compatible with 1000Kv motor.

Battery: Quad-rotors mainly use Lithium Polymer (Li-Po) batteries. The most purpose of using these batteries is that they are rechargeable and even have low weight and high voltage capacity as compared to other sorts of batteries.
Battery calculations:
Maximum Current withdrawal by motors = (no. of motors) * (maximum current withdrawal by single motor)=(4*15)=60 A
Rule- The discharge current from the battery should be over the utmost current withdrawn by the motors.
Where, discharge current = (Capacity in ampere) * (discharge rate).
Flight time = (Capacity in amperes/Current draw) * 60

Flight controller: To keep up the balance, the quad-rotor should continuously take measurements from the sensors and adjust accordingly to the speed of the rotors to stay at the body level. The 2 main factors to be considered while selecting a flight controller are flying capabilities and price. Flying capabilities are often considered by following basic factors-
Gyro stabilization: it's the power to stay the copter stable and level under the pilot control.
Self-levelling: it's the flexibility to automatically adjust itself during any stabilization so that the copter stays level.
Here we use Pixhawk flight controller.

Transmitter and receiver: The Transmitter (Tx) and Receiver (Rx) system allows the quadrotor to be remotely controlled through a wireless signal. The aircraft controls would typically include throttle, pitch, roll, yaw, and mode settings. 2.4GHz TX and RX systems are used for his or her better performance. The receiver used has a 6C 2.4 GHz system which is perfectly bonded with the two.4GHz transmitter.

RASPBERRY PI & PI CAMERA

The Raspberry pi is a single computer board with credit card size that can be used for many tasks that a computer can do. Raspberry pi works on LINUX operating system. Raspberry pi 3 has wireless LAN and Bluetooth facility by which we can setup WIFI hotspot for internet connectivity. The raspberry pi cam captures the video and send to the Raspberry pi fot processing and transmitting the video to the base station using internet connectivity.

THERMAL CAMERA

The AMG8833 is a 64-pixel temperature sensor that contains an 8x8 array of infrared thermopiles, which approximate the temperature by measuring the infrared radiation being emitted from emissive bodies. In this a Raspberry Pi is used to interface with the AMG8833, with Python acting as the programming language.

SPRAYING MECHANISM

The sanitizer is sprayed using a high pressured motors, which pumps out the sanitizer in the tubes to the nozzle of sprinklers. Whereas approximately one liter of sanitizer can be carried by the drone. Technical parameters, altitude control is a critical aspect to be considered in drone spraying to achieve a balanced fluid application in contaminated area.

4. CONSTRUCTION OF QUADCOPTER

- Solder the Electronic Speed Controller to the Power Distribution Board.
- Solder the Battery connectors to the power pads in Power Distribution Board.
- Mount the arms of the quadcopter to the Power Distribution Board.
- Screw the top board to the arms of the quadcopter.
- Mount the motors in the arms of the quadcopter.
- Fix the Pixhawk flight controller and receiver in the quadcopter.
- Now connect the motor and ESC together by confirming the direction of rotation of motors.
- Now connect the ESC to flight controller and flight controller to receiver respectively.
- Mount the landing gear at the bottom of the quadcopter and fix the spraying mechanism underneath.

5. HEALTH MONITORING SYSTEM

- The Raspberry pi is connected with Pi cam and thermal cam for mask detection and temperature detection respectively.
- Insert SD card with OS into Raspberry Pi, then setup the internet connectivity using wireless.
- Connect B-type cable to raspberry pi and usb cable to the computer; by this the power source is given to the raspberry pi.
- Connect the camera module to raspberry pi.
- Now code the raspberry pi using python programming for mask detection.
- Connect the thermal camera to raspberry pi and code them using phython programming to detect the bodt temperature.

6. RESULT

The drone with spraying mechanism and health monetizing has been constructed.

Figure1 Health Monitoring And Sanitizing Drone

The mask detection system using Raspberry pi and camera works perfectly. The mask detection is tested and got the results of identifying mask users and non-mask users. Our approach achieves exceptional accuracy of 98.2 percent using a large dataset of 50,000 photos. Thermal camera which is connected to the raspberry pi provides the thermal images of the people to identify the high temperature people who have high chances of infection. The result images are shown below.

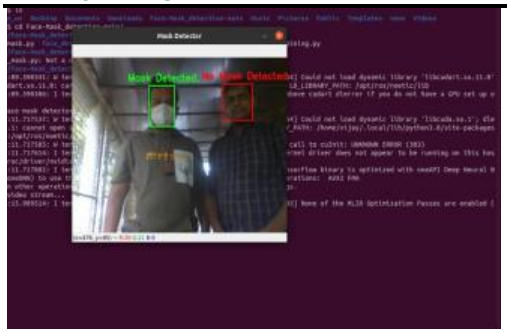

Figure 2 Face Mask Detection

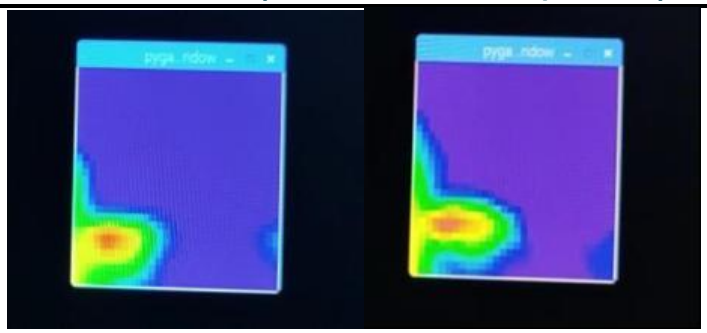

Figure3 Thermal Images

The sanitizing mechanism is attached to drone and tested for flying. On one end, the flow tubes are attached to the pump, and on the other end, they are connected to the nozzle. To avoid flow tube bulging and subsequent leakage owing to pressure buildup in the flow tube, the mass flow rate in the nozzle is controlled, as is the sanitising pump pressure. The on-board telemetry module, which is used for flight telemetry data transfer, can monitor the reservoir pressure, sanitizer level, tube pressure, and mass flow rate of the nozzle. The quadcopter will autonomously land where it took off once the indicated areas have been covered. If the sanitizer in the reservoir runs out before the given area is covered, the quadcopter is programmed to land so that the sanitizer may be refilled and the spraying operation can resume from the point of return. With a 5200 mAh battery, a quadcopter drone can carry 1 litre of sanitizer and fly for 10 minutes. A large area may be sterilised with a small number of people and in a short amount of time. Personnel working in the disinfection process are now safer.

Figure4 Sanitizing Using Drone

7. CONCLUSION

The epidemic has caused many problems for the country, and the virus's spread must be halted because it has affected millions of people around the world. As a result, the creation of a face mask detection system with audio response that can assess whether or not someone is wearing a mask and provide an audio response accordingly can be beneficial in many circumstances. The contactless sanitization system uses a drone and a temperature monitoring system to monitor and sanitize the environment. As a result, we intend to safeguard people from virus transmission and the spread of infectious diseases using this approach. We intend to expand on it by combining the two components of Face Mask Detection and Contactless Sanitization and Temperature Monitoring System into a single low-cost solution. Then, to monitor the process, integrate this system into a drone and fly it in a crowded area.

FUTURE SCOPE

The autonomous quadcopter powered by LiPo battery only runs for around 20-30 minutes. In order to increase the flight timing, research on battery technology continue. Most UAV operators do nott replace batteries, resulting in additional costs.

Current research also suggests the use of drone powered by internal combustion engine that runs on petrol and can operate for longer hours. The centrifugal pump can disperse an ultra-low volume spray and this ensures that every single droplet is broken down into thousands of smaller particles to cover wider area.

However, in most cases, the power is not transferred into all components efficiently. In such cases, hybrid drone generators are preferred, since it is portable and can operate for longer hours.

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71

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