Health Monitoring and Sanitizing Drone for Pandemic

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Abstract **- Due to the flexible application of drones, it is being used in our day-to-day life and has great demand in the market. They perform each task with good efficiency. The main objective of this project to design and develop a Health Monitoring and Sanitizing System for Pandemic. Temperature detection using a temperature gun is risky and unsafe. Sanitizing using hand pump methods is a tiring and time-consuming process. To overcome this problem, the health monitoring system will detect temperature without a human interface. The sanitizing system will sanitize the surface. The camera will capture the photos of sneezing or coughing action and notify the operator at the base station.**

Index Terms **- Covid-19, Pandemic, Drone, Camera, Health Monitoring, Sanitization.**

I.INTRODUCTION

Novel Corona Virus (SARS-CoV-2) or COVID-19 has brought complete life change in human society. WHO (World Health Organization), UNICEF, ICMR (Indian Council of Medical Research), etc. health organization are doing their level best to control the spread of the pandemic. Washing hands regularly, maintaining social distancing, sanitizing surfaces, regular health check-ups, etc. things are now part of our daily routine.

Volunteer checking human body temperature using a temperature gun is risky. The volunteer who is checking temperature may get infected if the volunteer comes into contact with the person who is already infected. So volunteers can become super spreaders. Also sanitizing using the hand pump technique is a too slow and tiring process. According to WHO's report, longer contact with surface sanitizer can bring serious health risks like Eye and skin irritation, Liver damage, Respiratory conditions, Central nervous system effects, Cardiac reaction, etc.

CCTV cameras have limitations in that they are stationary and they can't be moved automatically so they don't cover the footage that the operator desire. As our quadcopter has installed a camera module so it is flexible for the operator to get live footage of any place at the base station.

We have selected Quadcopter because of its durability and good weightlifting capacity. It can also lift about 3-4Kg weight easily. The health monitoring system is installed on the drone such that the operator can handle the drone from one fixed position or base station.

II. COPONENTS

A. Frame

This project is a quadcopter-based health monitoring system. In this project, we have used the Q450 frame. It is durable, light in weight, and can lift to 3-4 Kg material. It is made from lightweight materials like glass fiber and polyamide nylon hence its weight is just 330g. It has an integrated Power Distribution Board for direct soldering of ESCs.

B. Brushless DC Motors

To fly a quadcopter total 4 BLDC motors are required. A2212 motors provide good thrust. Each motor has a 1000kV rating and has a maximum weight of 53g without blades.

Fig.1 Frame

Fig. 2 Brushless DC Motor

Fig.3 APM 2.8

Fig.4 Li-Po Battery

C. Flight Controller

This project requires a better flight controller because the drone has to lift sanitizer tanks, camera, and health monitoring system at least 5-6 meters above. After comparing the KK Fight controller and APM 2.8 It is found that APM 2.8 has better stability, lifting capacity, and good autonomous fly as it has some better sensors. APM 2.8 has more digital I/O pins, GPS Portability, and navigation along with ground control using Mission Planner software. It has installed ATMEGA2560 and ATMEGA32U-2 microcontroller on it. Mission Planner software is required to program the board.

D. Battery

To power the drone and health monitoring system different batteries are used. If the entire system is powered with only one battery then it can affect the fly-time of the drone. To power motors, APM 2.8 and camera 2200MHz (Li-Po) Lithium Polymer battery is used. The purpose of using a Li-Po battery is that its weight is very less as compared to other batteries. The weight of the battery is approximately 175 gm. It gives about 15 minutes of fly-time to the drone. To power the temperature sensor 9V battery is used the power is given to the temperature sensor through Arduino Uno. 3.7V Li-ion battery is used to power DC pumps used for sanitizing purposes.

E. RC Transmitter and Receiver

After comparing different features of different types of RC Transmitters and Receivers 2.4GHz Fly-Sky 6 Channel RC Transmitter and Receiver is selected. It has a transmitting and receiving range up to 2.5Km. It has two liver, four toggle switches, and two variable switches. Out of two, one liver is the Throttle liver which is used to lift the drone from the surface another one liver is used to navigate the drone while flying. Toggle switches are used to give different modes to the drone. E.g. Loiter Mode, RTL Mode etc. Variable switches are used to rotate the position camera gimbal in the X and Y direction. Transmitter requires a 6V supply which is given by using Four AA batteries. The receiver has two receiving antennas and requires a 5V supply which is given through the APM flight controller.

Fig.5 RC Transmitter & Receiver

Fig.6 GPS

Fig.7 MLX90614 Sensor

Fig.8 433 MHz Tx & Rx

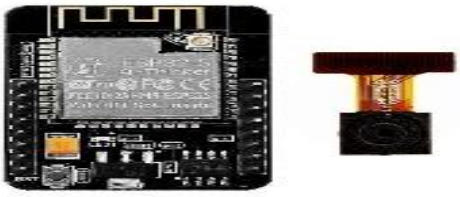

Fig.9 ESP32 AI Thinker Camera Module

F. GPS

The Global Positioning System is a satellite navigation system which gathers information from satellite revolving in an orbit of the earth. It has a radio receiver that determines information like Location, Velocity, and Time. The GPS provides better stability to the drone. Also, it is required to assign the path to the drone such that the drone will fly its own.

G. MLX 90614 Temperature Sensor

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H. Arduino UNO

Arduino UNO is an open-source microcontroller board based on Microchip ATmega328P Microcontroller. This project requires two Arduino UNO boards. One is installed on the drone with a

temperature sensor. Another is at the base station to receive signals provided by the sensor Arduino board

I. 433 MHz Transmitter and Receiver

Wireless communication is required to provide sensed temperature from the MLX sensor to the base station. So for that purpose 433 MHz Transmitters and receivers are used in this project. These Transmitters and receivers have a maximum transmitting range of 100Meters. Both Transmitter and Receiver require a 3.3V to 5V supply.

J. ESP32 Camera Module

This project requires a camera for surveillance and observation. The camera has a 2MP resolution. Inbuilt Wi-Fi camera module provides live telecast at the base station. The camera board is AI Thinker Module by programming it the auto face detection function can be enabled. The camera requires a 3.7V to 5V DC power supply. It supports a memory card of up to 4GB. A memory card is used to store captured pictures.

III. DESIGN AND DEVELOPMENT

A. Drone

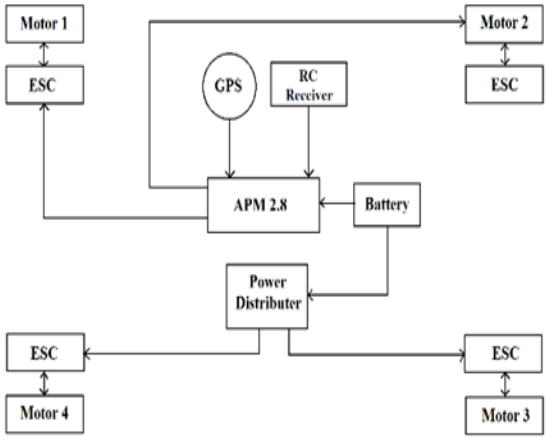

Fig.10 Block Diagram of Drone

The drone used in this project has four arms. The four-arm drone has two types are '+' type and 'X' type though their construction is quite similar their control is slightly different. 'X' type is easy to handle as compared to the '+' type. In this project, an 'X' type drone is used. The drone is controlled through the APM2.8 flight controller which is placed on the top side of the drone. ESCs are fixed below each arm of the drone. The motors are attached at the corners of each arm. For flying the drone two diagonally opposite motors must rotate in the clockwise direction and the remaining two diagonally opposite motors must rotate in the counterclockwise direction. The propellers of the motor are fixed such that they push the air in a downward direction and the drone starts flying. The 2200MHz battery is placed in the middle vacant place of the drone. The wires of ESCs and power module are soldered on the power distribution board. The GPS and RC receiver are mounted on the top of the drone. The drone can lift weight up to 4Kg.

Fig.11 Drone

B. Camera

ESP32 camera module has 2MP camera. It has inbuilt WI-FI. This camera is programmed such that it can capture photos and provide live footage at the base station either on PC or mobile. While programming the camera SSID and password of the WI-FI router must be provided. Once programming is done then in serial monitor IP address is given by the camera module. When the power source is given to the camera it turns on and automatically gets connected to the router whose SSID and Password are provided. Now by joining that IP address live footage can be viewed on multiple devices. ESP32 cam has a port where an external antenna can be added. By adding antenna range of camera and picture stability increases remarkably. AI Thinker Module has special feature of face and action detection. It can detect coughing or sneezing action of a person and capture the image of that person.

C. Temperature Detection System

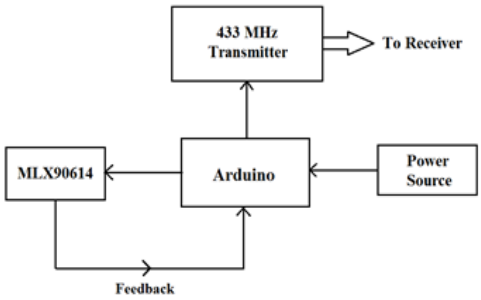

Fig.12 Block Diagram of Transmitter

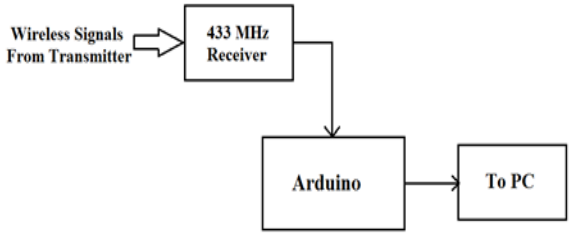

Fig.13 Block Diagram of Receiver

Arduino UNO had programmed in Arduino IDE software. The temperature sensor has a limited sensing range of nearly about 1 to 5cm. This drawback of the temperature sensor has been overcome by adding lens-hood to the sensor. Lens-hood is a lens that concentrates the infrared rays and increases the sensing capacity up to 5meters. The lens is made of high-quality HDPE material. The Lens hood is kept at a 2cm distance away from the MLX90614 sensor. The sensed temperature must transfer to the base station. The 433MHz transmitter connected to Arduino UNO transmits data at the base station. At the base station receiver Arduino receives data transmitted by the transmitter. Base station Arduino and pc are interconnected. On the serial monitor of the Arduino IDE sensed temperature shown. The transmitter and receiver have a maximum range of 100Meters without an external antenna. The block diagrams of Transmitter and receiver are shown in fig.12 and fig.13.

D. Sanitization Process

6V DC pumps are used to pump the sanitizer liquid from the tank mounted below the drone. The DC pumps are submersible type so they are kept inside the tanks. The sanitizing liquid is transferred to the nozzle through PVC flexible pipe having an outer diameter of 5mm. On two vertically opposite arms nozzles are fitted. The nozzle has an adjustable knob by adjusting knob spraying rage and capacity can be changed. The DC pumps are powered with a separate Li-ion battery. IR sensor is connected in between power source and pumps. Here the IR sensor works as an electrical switch. When the signal has been given to the IR sensor through IR remote circuits get completed and current start flowing and the sanitization process starts.

IV. SOFTWARE

A. Arduino IDE

This software is required to program both transmitter-receiver Arduino UNO as well as ESP32 AI Thinker camera module. Radiohead and MLX90614 libraries are necessary to program Transmitter and MLX sensor respectively. To program the camera, the ESP board must be selected in the tool window. The serial monitor gives the IP address of the camera and real-time sensed body temperature.

B. Mission Planner

This software is required to program both transmitter-receiver Arduino UNO as well as ESP32 AI Thinker camera module. Radiohead and MLX90614 libraries are necessary to program Transmitter and MLX sensor respectively. To program the camera, the ESP board must be selected in the tool window. The serial monitor gives the IP address of the camera and real-time sensed body temperature.

V.CALCULATIONS

A. Drone Weight Calculation

Component	Quantity	Weight in gm
Frame	1	330
APM 2.8 with Shock Absorber	1	100
BLDC Motors	4	150
GPS	1	30
Li-Po Battery	1	175
ESC	4	92
Power Module	1	23
RC Receiver	1	25
Propeller	4	56
Arduino Uno	1	25
9V Battery	1	37
Li-ion Battery	1	55
433MHz Tx	1	2

ESP32 Camera	1	20
MLX90614 Sensor	1	1
DC Pump	2	160
Sprayer Nozzle	2	20
Sanitizer Tank	1	20
Total Weight		1321 gm

Table.1. Component Weight

The weight of a drone with all systems installed is 1321gm that is approximately 1.3kg. The APM 2.8 flight controller with a Q450 frame can lift 4-5kg weight easily up to 7 meters.

1 Kg = 1 liter

So, the tank can be filled with 3 liters of surface sanitizer.

B. BLDC Motor's KV to RPM Calculation

KV * Applied Voltage = RPM

1000kV * 12V = 12000 RPM

VI.CONCLUSION

Health Monitoring and Sanitizing Drone for pandemic can be used to conduct any survey as well as at public places like Malls, gyms, railway stations, etc. to reduce manpower and chances of getting infected. Path planning using GPS endpoints and mission planner software helps for the automatic flying of the drone. This function is useful for sanitizing purposes. By using this technique, the time required to sanitize the surface will be reduced as compared to the old hand pump technique. The range dependency of the temperature sensor has been overcome in this process. The sensing range was 2-5cm which is boosted and increased up to 5 meters.

VII.ACKNOWLEDGMENT

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