Steps for Build and Operation of the Drone:

A) Drone Assembly:

1. Mount 1000KV Brushless motors to the F450 quadcopter frame using M3 screws.
2. Solder the ESC and power wire to the power pads and insert the power wire in the Pole Wire Terminal block, making sure to connect blue for positive or negative.
3. Mount the KK2.1 flight controller on the top of the quadcopter frame.
4. Connect the ESCs to the motors and connect the signal cable from the ESCs to the flight controller (white wire is the signal, red is power, and black is ground).
5. Connect the Flysky receiver to the flight controller (signal to signal, +5V to +5V, and ground to ground).
6. Connect the receiver channels to the flight controller, starting with Channel 1 at the topmost pin on the left side.
7. Assemble the top and bottom boards to the arms and legs of the quadcopter frame.
8. Calibrate the Flight controller and ESC.
9. Connect the propellers and test the drone in an open environment.
10. Mount all components, such as the Raspberry Pi, sensors, and carriage mechanism, on the drone.
11. Create a box or make a box from cardboard and cut a sheet metal of 12x12cm dimension and fix it with the base of the box.
12. Attach the box to the top plate of the drone with spacers.

B) Interfacing Raspberry Pi with required components:

1. Connect the Pole Wire Terminal block output to the input of the Dual USB Output module.
2. Use a USB to type C cable to connect the Dual USB Output module to the USB port of the Raspberry Pi 4 to power it.
3. Connect the Raspberry Pi camera to the camera module port of the Raspberry Pi 4.
4. Connect the Vcc pin of the Neo6M GPS module to 5V of the Raspberry Pi 4, the Ground pin of the GPS module to Ground of the Raspberry Pi 4, and the Tx pin of the GPS module to the Rx pin (GPIO 27) of the Raspberry Pi 4.
5. Connect the Vcc pin of the DHT11 Temperature sensor to 3.3V of the Raspberry Pi 4, the Ground pin of the Temperature sensor to Ground of the Raspberry Pi 4, and the data pin of the temperature sensor to GPIO 4 of the Raspberry Pi 4.
6. Connect the Vcc pin of the TowerPro Micro Servo SG90 Motor to 5V of the Raspberry Pi 4, the Ground pin of the servo motor to Ground of the Raspberry Pi 4, and the signal pin of the servo motor to GPIO 18 of the Raspberry Pi 4.
7. Connect the Vcc pin of the GSMSim900A module to 5V of the Raspberry Pi 4, the Ground pin of the GSM module to Ground of the Raspberry Pi 4, and the Rx pin of the GSM module to the Tx pin (GPIO 14) of the Raspberry Pi 4 and the Tx pins of the GSM module to the Rx pin (GPIO 15) of the Raspberry Pi 4.
8. Connect the microphone and speaker to the ports on the GSM module, with the positive wire of the microphone connecting to the "mic_p" port and the negative wire connecting to the "mic_n" port, and the positive wire of the speaker connecting to the "spk_p" port and the negative wire connecting to the "spk_n" port.

C) Generate networks :

1. Load on your Google Drive the notebook files: SyntheticData.ipynb , forestfire_prediction.py.
2. Load on your Google Drive forestfires.csv dataset to be used with the SyntheticData.ipynb file in order to generate the synthetic data.
3. Open the file SyntheticData.ipynb with Google Colaboratory, choose runtime session from the Menu and execute.
4. Load on your Google Drive the file generated from step 3 or you can load the forestfire_augmented.csv dataset to be used with forestfire_prediction.py to train the ANN model and make predictions.
5. Repeat step 3 with forestfire_prediction.py, the output model files will be saved in the same directory of the notebook file.

D) Flysky Transmitter and Receiver Pairing

If the Flysky receiver LED is blinking, this means that the ESC is not paired with the transmitter. To pair the two devices, follow these steps:

1. Disconnect all connections from the Flysky receiver.
2. Connect one of the ESCs to the receiver.
3. Power the ESCs by connecting the battery (P02) to the power cable of the frame.
4. Connect the ESC cable that will go to the flight controller to Channel 1 (CH1) of the receiver.
5. Short the signal and ground pins of the receiver at the BAT channel. If the receiver is not paired, the LED on the receiver will blink continuously.
6. Set the trim levels of the transmitter to the middle position.
7. Press and hold the bind button on the transmitter while turning it on.
8. Observe the receiver LED. If it stops blinking, this means that the transmitter and receiver are paired.
9. Disconnect the power and turn off the Flysky transmitter.

E) Calibrating the Flight Controller

1. Turn on the Flysky transmitter and power the quadcopter by connecting the battery to the power cable.
2. Press the S4 button to access the menu and select the quadcopter X mode by navigating with S2 and S3 buttons.
3. Calibrate the ACC by placing the drone on a flat surface.
4. Perform a Receiver Test in the menu by using S2 and S4 buttons.
5. Set the PI settings according to the table given below.

Instructions for PI Settings:

Parameter	Roll (Aileron)	Pitch (Elevator)	Yaw (Rudder)
P Gain	75	75	75
P Limit	50	50	20
I Gain	40	40	30

I Limit	20	20	10

6. Go to the Mode Settings and set the self-level to always.
7. Go to the Miscellaneous Settings and set the Alarm 1/10 volts to 108. This alarm will sound when the supply voltage drops to 10.8V.

F) ESC Calibration

1. Turn on the Flysky transmitter with the throttle stick at minimum and all switches off.
2. Move the throttle stick to maximum.
3. Press and hold S1 and S4 buttons on the flight controller, then connect the battery.
4. Listen for two beep sounds, then move the throttle stick to minimum and listen for a single beep sound.
5. This will complete the ESC calibration.
6. Arm the quadcopter by moving the throttle stick to the bottom left corner.
7. Increase the throttle to verify that the motors are running. Do not attach the propellers.
8. Check the motor rotation and make sure it follows the X configuration.
9. If the rotation is incorrect, interchange the last two wires of the ESC connected to the motor.

G) Calibrating the Raspberry Pi:

1. Write the Raspberry Pi operating system to an SD card using the Raspberry Pi Imager tool.
2. Insert the SD card into the Raspberry Pi and power it on, then follow the on-screen instructions to set it up.
3. Open the terminal and install the required libraries: tkinter, DHT11, PIL, OpenCV, panda, sklearn, keras, pynmea, and smtplib.
4. To use the internet with a GSM module, disable the serial option and connect the Raspberry Pi to the internet via WiFi or Ethernet. Install the PPP software and create a PPP peer configuration file, changing the APN and communication port as needed.
5. Use soft_uart to convert the GPIO pins into Rx and Tx for serial communication.
6. Test the functionality of each sensor/module before running the final file.
7. Install VNC Server on Raspberry Pi and VNC Viewer on the master computer, then connect to the Raspberry Pi remotely using the IP address.
8. Run the "forest-copter" micro python file to see the GUI with information on temperature, humidity, camera feed, GPS module, and forest fire prediction.