FIND - PROJECT REPORT

FIND-
FINDING INDIVIDUALS VIA DRONE

PROJECT REPORT
submitted by

AMAL R JAYAKUMAR
PEC16EE006
ANAND A
PEC16EE008
SANDEEPKRISHNA S
PEC16EE027
MANJIMA R
PEC16EE020
RADHIKA ANILKUMAR
PEC16EE024

to

the APJ Abdul Kalam Technological University in partial fulfilment of the requirements for the award of the Degree

of

Bachelor of Technology
in
Electrical and Electronics Engineering

Department of Electrical and Electronics Engineering
College of Engineering Pathanapuram
Elikkatoor P O, Kollam, Kerala

JUNE, 2020

DECLARATION

I undersigned hereby declare that the project report FIND-Finding Individuals via Drone, submitted for partial fulfilment of the requirements for the award of the degree of Bachelor of Technology of the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by me under the supervision of Assistant Professor Anas S R, EEE Department. This submission represents my ideas in my own words and where ideas or words of others have been included, I have adequately and accurately cited and referenced the sources. I also declare that I have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in my submission. I understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

Place

Date Signature

Amal R Jayakumar

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COLLEGE OF ENGINEERING, PATHANAPURAM

CERTIFICATE

This is to certify that the report entitled '**FIND- Finding Individuals via Drone**' submitted by **Amal R Jayakumar, Anand A, Sandeepkrishna S, Radhika Anilkumar and Manjima R** to the APJ Abdul Kalam Technological University in partial fulfilment of the requirements for the Degree of Bachelor of Technology in Electrical and Electronics Engineering is a bonafide record of the project work carried out by them under my guidance and supervision. This report in any form has not been submitted to any other University or Institute for any purpose.

Asst. Prof. Anas S R,

EEE Dept., PEC

External Supervisor

Asst. Prof. Abhilash B L,

Head of the Department,

EEE, PEC

ACKNOWLEDGEMENT

We thank Dr S Ananda Resmi, our Principal for helping us out to complete and thus implement the project. We thank her from the bottom of our heart for helping us complete the project.

We express our sincere gratitude to Assistant Professor Anas Subair R, our Project Guide, Department of Electrical and Electronics Engineering, for helping us conceive the idea and guiding us through the project. We thank him from the bottom of our heart for helping us in each step for the completion of the work.

We also express our sincere gratitude to Project Coordinator and Head of the Department of Electrical and Electronics Engineering, for helping us conceive the idea and also for guiding us to complete the project. We also express our gratitude for the valuable suggestions and advice during the course of work.

We are happy to thank other faculty members, the technical and supervisory staff of the Department of Electrical and Electronics Engineering for their valuable support and ardent cooperation. We thank our families and friends for giving us mental support and empowering us to work efficiently on the project.

Amal R Jayakumar

Anand A

Sandeepkrishna S

Manjima R

Radhika Anilkumar

ABSTRACT

Disasters strike the world every day. The most recent ones were the heavy flood that affected South India. Many have suffered from it. Many are still suffering. Even today there are many missing.

Here we have developed a method to find stranded people during these kinds of natural disasters.

The technology utilizes the UAV/drone technology combined with Heat Signature Imaging from the high power Thermal Imaging Sensors to Identify stranded lives. After identifying the heat signature, the vehicle will be able to hover above the area where the signature is obtained, so that the search and rescue personals will be able to get to the correct point without any mistakes. This technology will give new hopes to search and rescue missions in the case of a natural calamity.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

UAV	-	Unmanned Aerial Vehicle
GPS	-	Global Positioning System
IR	-	Infrared
PID	-	Proportional Integral Derivative
BCM	-	Broadcom
LPDDR	-	Low-Power Double Data Rate Synchronous Dynamic Random Access Memory
SDRAM	-	Synchronous Dynamic Random Access Memory
Ghz	-	Giga Hertz
BLDC	-	Brushless Direct Current
CAD	-	Computer Aided Design
LCD	-	Liquid Crystal Display
ESC	-	Electronic Speed Control
RAM	-	Random Access Memory
HDMI	-	High Definition Multimedia Interface
SoC	-	State of Charge
FoV	-	Field of View
USB	-	Universal Serial Bus
TDM	-	Time Division Multiplexing
FHSS	-	Frequency-Hopping Spread Spectrum
APM	-	Application Performance Management
GPIO	-	General Purpose Input/output
MIPI	-	Mobile Industry Processor Interface

NOTATION

$T = Thrust, Kg$

$R = \ Propeller\ radius\ , m$

$\rho = Air\ density, Kg/m^2$

$\mu = APC\ propeller\ constant$

$pf\ = Power\ factor$

$rpm = Revolutions\ per\ Minute$

$mm = millimeter$

$Kg = Kilogram$

$gms = Grams$

$v = Voltage$

$A = Amperes$

CHAPTER 1

INTRODUCTION

1.1. GENERAL BACKGROUND

Disasters strike the world every day. The most recent ones were heavy flood that affected the South India. Many have suffered from it. Many are still suffering. Even today there are many missing.

The technology utilizes the UAV/drone technology combined with Heat Signature Imaging from the high power Thermal Imaging Sensors to Identify stranded lives. After identifying the heat signature, the vehicle will be able to hover above the area where the signature is obtained, so that the search and rescue personals will be able to get to the correct point without any mistakes. This technology will give new hopes to search and rescue missions in the case of a natural calamity.

1.2. OBJECTIVE

The project sheds new lights for the search and rescue team to find and rescue stranded people when there is no visible light. The Thermal Camera placed under the UAV can show the image of any object with a heat signature when there is no light available. The base station will receive the data from the UAV. This data can be uploaded into the server for future viewing and references or can be uploaded to the server in real-time if the internet is available at the moment.

1.3. SCOPE

This system can survey for rouge animals in the large plantation areas that can be a potential threat to human lives. Law Enforcement can use the system for surveillance missions with slight modifications to the software. Autonomous cargo delivery to remote areas is one of the main advantages of using a UAV system.

1.4. SCHEME

The project aims at finding individuals who are stranded without reach or communication facility for contacting rescue. The system consists of an Unmanned Aerial Vehicle which has a thermal imaging camera and a normal camera. The vehicle can be sent to an area and can scan the place even when there is no light.

CHAPTER 2
LITERATURE REVIEW

These are the few research papers related to this system selected for the literature review. They are given below.

2.1THEORETICAL DEVELOPMENT AND STUDY OF TAKE-OFF CONSTRAINT THRUST EQUATION FOR A DRONE

The paper presents ways to develop thrust equation for the quadcopter. From this paper we have adopted the thrust equation:

$$T = (2 \times \pi \times R^2 \times \rho \times (\mu \times (rpm)^{pf})^2)^{\frac{1}{3}}$$

R= Propeller radius

ρ=Air density

μ=APC propeller constant

pf=Power factor

2.2PIXHAWK- A SYSTEM FOR AUTONOMOUS FLIGHT USING ONBOARD COMPUTER

Looked at the different aspects of using PIXHAWK module as flight controller

2.3DRONE (UNMANNED AERIAL VEHICLE) USING KK 2.1.5 BOARD FOR SURVEILLANCE

Guidance for using the KK 2.1.5 Flight Control Module for the drone piloting.

2.4REAL TIME FUZZY CONTROLLER FOR QUADCOPTER STABILITY CONTROL

This paper was used for study the efficiency and cost effectiveness of the usage of fuzzy logic for Yam and pitch control. But we concluded that the fuzzy is not a cost-effective option but is highly efficient for the pitch and yam control.

2.5 AUTONOMOUS UAVS WILDLIFE DETECTION USING THERMAL IMAGING, PREDICTIVE NAVIGATION AND COMPUTER VISION.

This paper deals with the wildlife mapping using thermal imaging system and an on-board computer. This paper is the base paper for our project. Thermal image processing on-board and off-board UAV systems and hovering control is acquired inference from this paper.

2.6 DESIGN OF SURVEILLANCE DRONE WITH X-RAY CAMERA AND METAL DETECTOR

This paper deals with the counter terrorism drone using x-ray, IR and metal detection system. This paper is used for the understanding the usage of IR system for night time visibility and X-ray vision for visibility through walls.

2.7 HEAT LEAKAGE DETECTION AND SURVEILLANCE USING AERIAL THERMOGRAPHY DRONE

This paper deals with the thermal imaging and processing system used for heat leakage system. From this paper we got the understanding of thermal image processing system for smart detection of stranded people.

2.8 AN EFFECTIVE SURVEILLANCE SYSTEM USING THERMAL CAMERA

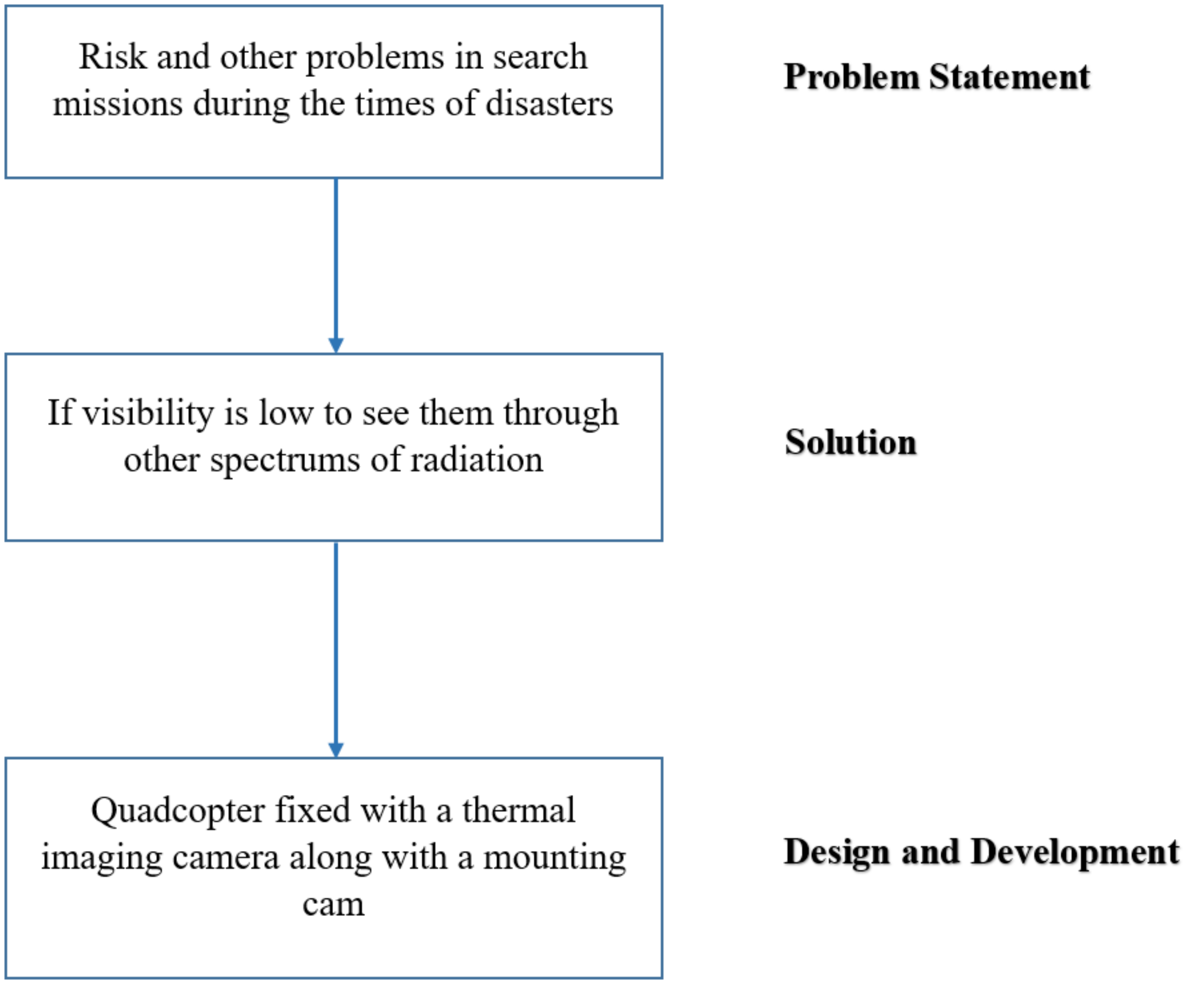
This paper deals with Thermal Surveillance Camera System. The idea of using thermal image system.

2.9 DRONE FORENSICS: DIGITAL FLIGHT LOG EXAMINATION FRAMEWORK FOR MICRO DRONES

This paper analyses the essential log parameters of autonomous flight and proposes a comprehensive drone –forensics related software architecture. The Flight-log system tuning, and smart interfacing of individuals found.

CHAPTER 3

3.1METHODOLOGY



3.2THEORY

People stranded in the dark cannot be seen in remote locations. Search and rescue teams usually have to scour large portions of land that are sometimes life-threatening, time-consuming and less efficient and sometimes, with no backup.

So it is best to see stranded people in highlands or at rooftops by looking for them through a drone which will be able to cover large areas by itself. This will make sure the safety of the rescuers and will cut the time taken and thereby increase efficiency. During times of low visibility, feed is obtained using thermal cameras that record the body heat instead of visible color. If the view is obtained from a high altitude, then an area that is more than twice the height is visible to the camera.

Fig.3. 1Thermal Image

CHAPTER 4

EXPERIMENTATION

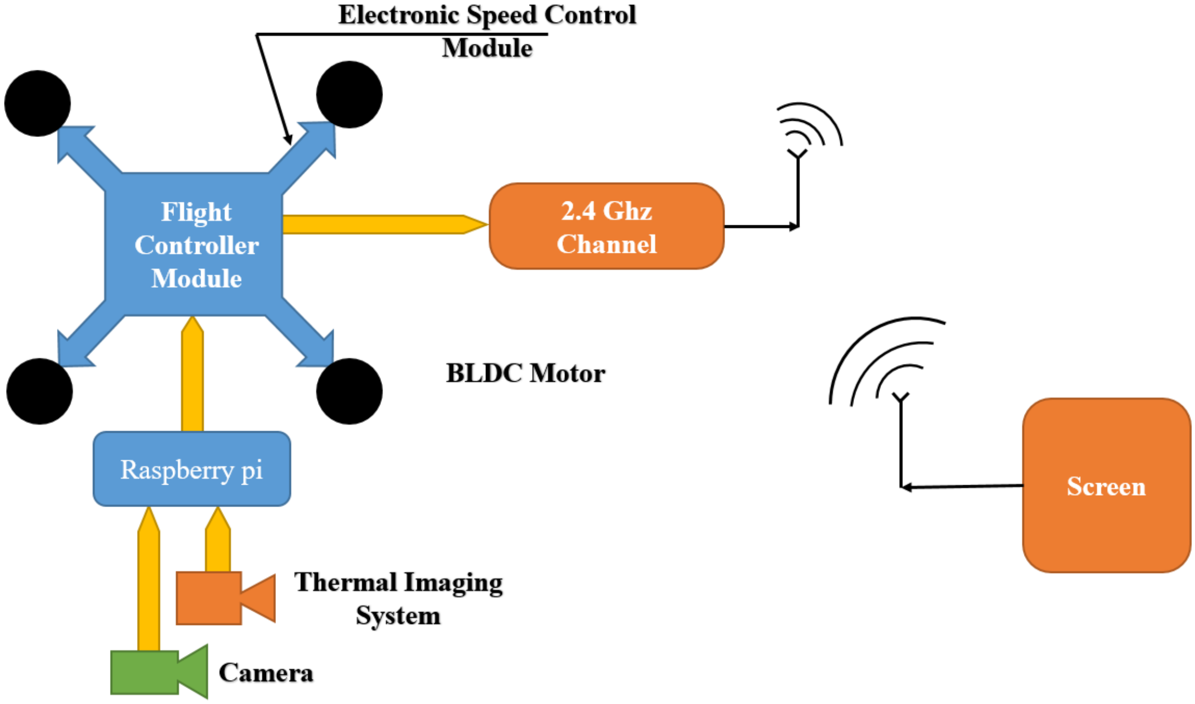


Fig.4. 1Block diagram of the UAV model.

The system comprises of a drone, that is fitted with two cameras – a thermal and a normal drone camera. The Raspberry Pi will obtain footages from both the cams and will be able to process them using computer vision for humans. The footages can be obtained directly from the drone to the base station through a 2.4 Ghz Channel.

4.1 COMPONENT IDENTIFICATION

4.1.1 FLIGHT CONTROL MODULE

The Flight Control Module monitors and controls all the mechanical functions of a drone. Many kinds of readily made flight controllers are available today. The fight control module of the KK series is cost effective when compared to flight controllers like the Ardupilot or the Pixhawk boards. It comes with a prebuilt-in firmware. The board consist that can be used to define the functions of the board. That is why we chose the KK 2.1.5 Flight control module.

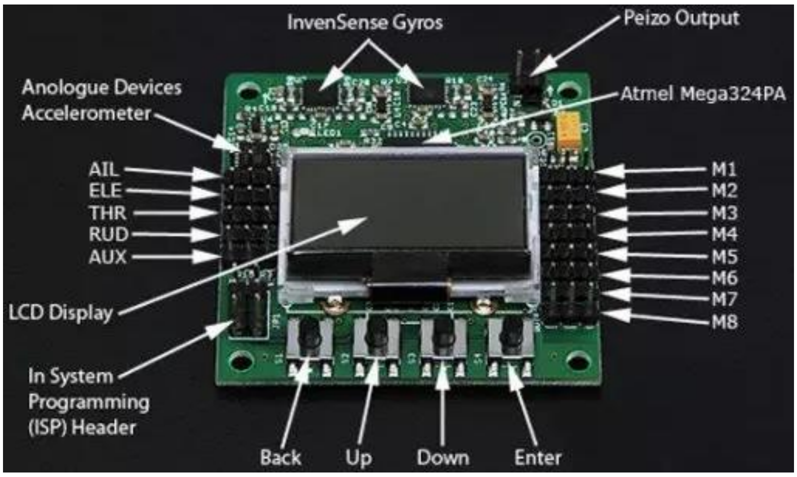


Fig.4. 2 KK 2.1.5 Module

Model	KK 2.1.5
Input Voltage (v)	4.6 - 6.0 500mA DC
Sensors	6050 MPU
Processor	Atmel 644PA
Micro-SD Card Slot	No
Dimensions (mm)	52 x 52 x 12
Weight (gm)	26

Table 4. 1 Flight Control Module Specifications

4.1.2 RASPBERRY PI

The Raspberry Pi Module is where the image and Video Processing takes place. The obtained input from the cameras are processed through computer vision and is directly sent to the base system and can be streamed anywhere. It runs on the Raspbian OS with a 1.5 GHz processor and 4GB Synchronous Dynamic RAM.

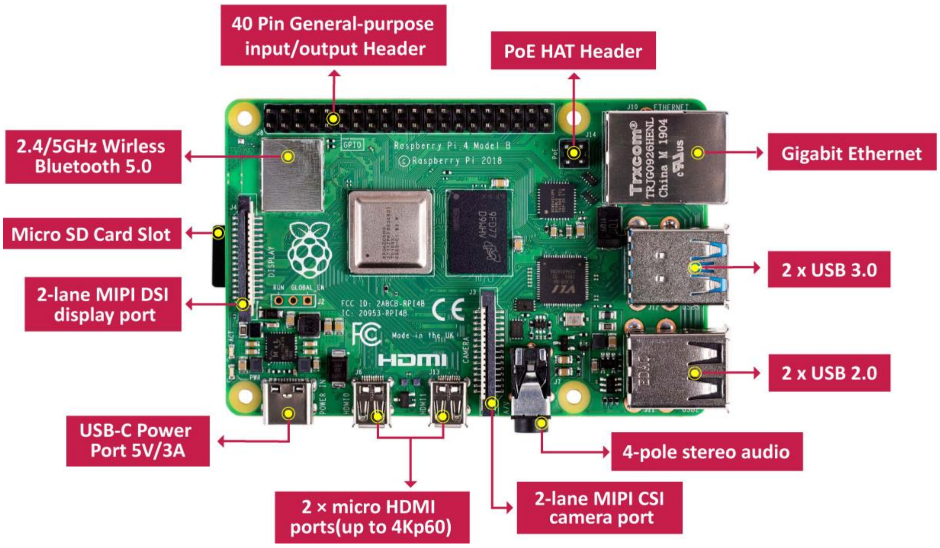


Fig.4. 3 Raspberry Pi Module

Specification	Value
Processor	BCM2711, Quad core Cortex-A72 64-bit SoC
RAM	4 GB LPDDR4-3200 SDRAM
Micro-SD Card Slot	Yes
Connectivity	2 × USB 2.0 Ports 2 × USB 3.0 Ports 2.4 GHz and 5.0 GHz wireless LAN Bluetooth 5.0
Operating Power	5V 2.5A DC via GPIO Header 5V 2.5A DC via USB Type-C Connector
GPIO	Standard 40-pin GPIO Header
Dimensions (mm)	85 x 56 x 19
Weight (gm)	52g

Table 4. 2Raspberry Pi Specifications

4.1.3 RC TRANSMITTER AND RECIEVER

The 2.4 GHz 6CH transmitter is an entry-level system offering the reliability of 2.4 GHz signal technology and a receiver with 6 channels. CT6B 2.4 GHZ 6CH transmitter radio is a value for money, entry-level 6 channel transmitter, ideal for quadcopters and multicopters that require the 6CH operation.

Fig.4. 4 2.4 GHz 6 Channel Radio Transmitter and Receiver

Specification	Value
Model Type	Digital Radio Trans-receiver
Channels	6 Channels
Band-Range	2.4055 – 2.475GHz
Power Supply	12v 8xAA Battery
Dimensions (mm)	189 x 97 x 295
Weight (gm)	511

Table 4. 3 RC Trans-Receiver Specifications

4.1.4 BLDC MOTOR

This 1400kv brushless motor is equipped with the solid metal case which makes it reliable and durable. The Motor comes with the pre-soldered good quality connector for a fast and direct connection between ESC and the motor.

The motor is chosen using the Thrust Equation.

$$T = (2 \times \pi \times R^2 \times \rho \times (\mu \times (rps)^{pf})^2)^{\frac{1}{3}}$$

$R = Propeller\ radius$
$\rho = Air\ density = 1.225 kg/m^3$
$\mu = Propeller\ Constant = 0.015$
$pf = Power\ Factor\ of\ the\ Propeller = 3.20$
$R = Radius\ of\ Propeller = 0.254m$
$Thrust\ Required, T = 24Kg$

$$rpm = \sqrt[pf]{\frac{1}{\mu} \times \sqrt{\frac{T^3}{2 \times \pi \times R^2 \times \rho}}} \times 60$$

$$rpm = \sqrt[3.20]{\frac{1}{0.015} \times \sqrt{\frac{24^3}{2 \times \pi \times 0.254^2 \times 1.225}}} \times 60$$

$$rpm = 1103.20$$

Therefore, the standard 1400KV Motor is chosen.

Fig.4. 5 1400KV A2212 10T BLDC Motor

Specification	Value
Diameter(mm)	22
Height(mm)	12
Shaft Diameter (mm)	3.17
Current Handling Capacity	16A/60S
Max. Efficiency Current	6-12A
No-Load Current	0.7A @10V
Maximum Efficiency	80%
Weight (gm)	72

Table 4. 4 BLDC Motor Specifications

4.1.5 PROPELLER

Propellers are chosen such a way that the thrust needed for lift is achieved by the Motor-Propeller Combination. The propellers are available in many different sizes, number of blades and pitch. Here we have chosen the 1045 Propeller which provides a good lift and manoeuvrability.

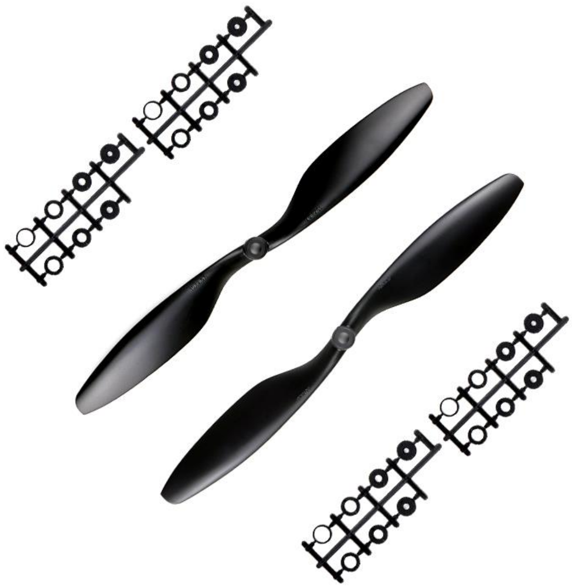


Fig.4. 6 1045(10×4.5) Propellers

Specification	Value
Material	ABS
Colour	Black
No. of Blades	2
Length(inch)	10
Pitch(inch)	4.5
Shaft Diameter (mm)	6
Total Length(mm)	254
Plastic Reducers	2.75, 3, 3.17, 4, 4.70, 5, 6, 6.25
Weight(gm)	28

Table 4. 5 Propeller Specifications

4.1.6 GPS MODULE

This module has a high level of sensitivity and features active circuitry for the ceramic patch antenna. It is enclosed in the plastic case to protect the module from the elements. This module outputs precise position updates at 10Hz and also has a rechargeable backup battery for warm starts. Capable of accuracy between 0.6 and 0.9 meters it is a significant improvement over previous models.

Fig.4. 7 GPS module

Specification	Value
Receiver Type	56 Channels Galileo E1B/C1 GPS L1C/A QZSS L1C/A SBAS L1C/A
Receiver Frequency	L1 [1575.42MHz]
Supply Voltage (V)	$+3.5V \sim +5.5V$
Sensitivity	Cold Start (without aiding): -147 dB Hot Start: -155 dB Reacquisition: -160 dB Tracking & Navigation: -161 dB
Position Accuracy	Autonomous: 2.5 m SBAS: 2.0 m
Operating Temperature Range	$-24℃ \sim 84℃$
Dimensions (mm) $L \times W \times H$	60 x 11.5 ($D \times H$)
Weight (gm)	26
Cable Length	20 cm

Table 4. 6 GPS with Compass for KK 2.1.5 Flight Control Module

4.1.7 ELECTRONIC SPEED CONTROLLER

An electronic speed control or ESC is an electronic circuit that controls and regulates the speed of an electric motor. It may also provide reversing of the motor and dynamic braking. The ESC used in this project is a Simonk BLDC Electronic Speed Controller. It works on 2S-3S Lithium

Polymer batteries. This electronic speed controller offers a battery eliminator circuit (BEC) that provides 5V and 2A to the receiver so we don't need extra receiver battery.

Fig.4. 8 Electronic Speed Controller

Specification	Value
Model	SIMONK 30A
Burst Current	40A for 10 sec.
Constant Current	30A Max 40A<10s
BEC	3 Amp.
Suitable Batteries	2-3S LiPo battery
Application	BLDC Motors, Multirotor, RC Planes etc.
Length (mm)	34
Width (mm)	24
Height (mm)	9
Weight (gm)	23

Table 4. 7 Specifications of the 30A Simonk ESC

4.1.8 QUADCOPTER FRAME

Our first plan was to 3D-Print the whole frame from Fab Lab. But thanks to the COVID-19 Pandemic, we got a Q450 Quadcopter Frame with an Integrated power distribution board. The Q450 Quadcopter Frame is made from Glass Fiber which makes it tough and durable. They have the arms of ultra-durable Polyamide-Nylon which are the stronger moulded arms having a very good thickness so no more arm breakage at the motor mounts on a hard landing. The arms have support ridges on them, which improves stability and provides faster forward flight.

Fig.4. 9 Q450 Quadcopter Frame

Specification	Value
Model	Q450
Material	Glass Fibre ＋ Polyamide Nylon
Wheelbase (mm)	450
Height (mm)	50
Weight (gm)	330
Arm Size (mm)	$220 \times 40\,(L \times W)$
Motor Mounting Hole Dia. (mm)	3

Table 4. 8 Q450 Quadcopter Frame Specifications

4.1.9 THERMAL CAMERA

The IR thermal camera carries a 32×24 array of thermal sensors (MLX90640), it can detect the temperature of objects from feet away with the accuracy of ±1.5℃. In order to obtain the thermal image easily, the I2C protocol is used to get the low-resolution image from the camera. The FOV (Field of View) of this camera is 55°x35°, and the temperature measurement range is -40℃~300℃.

Fig.4. 10 MLX90640 IR 32*24 Thermal Imager Module

Specification	Value
Operating Voltage	3V-3.6V
Current Consumption	~18mA
Field of View	55°x 35°
Measurement Range	-40°C-300°C
Resolution	±1.5°C
Refresh Rate	0.5Hz-64Hz
Interface	I2C Grove interface
I2C Address	0x33
Length (mm)	40
Width (mm)	24
Height (mm)	15
Weight (gm)	4

Table 4. 9 MLX90640 IR 32*24 Thermal Imager Module Specifications

4.1.10 CAMERA

This interface uses the dedicated CSI interface; therefore, it is designed especially for interfacing to cameras. The CSI bus is capable of extremely high data rates, and it exclusively carries pixel data. Furthermore, this system doesn't require any adapters as it can directly be plugged into the Raspberry Pi Board.

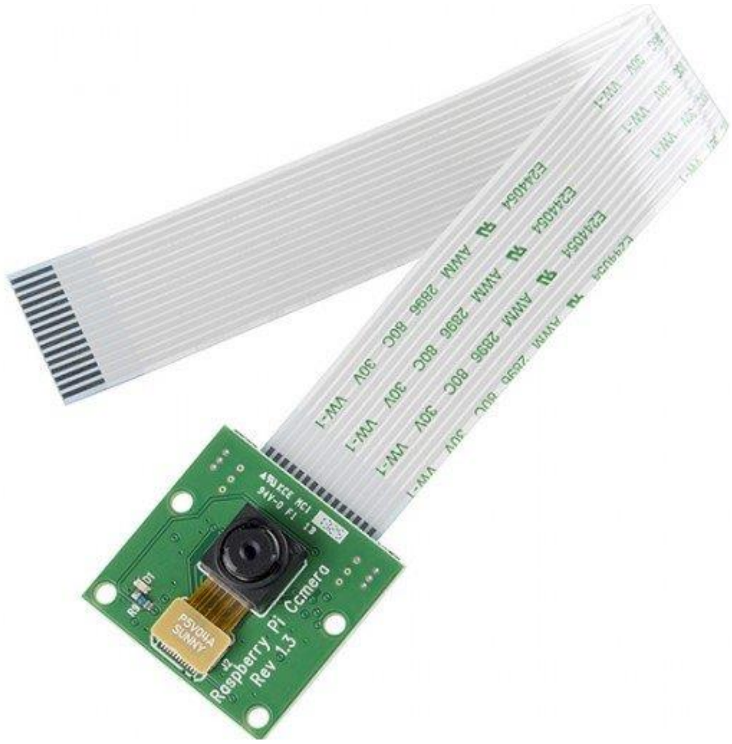


Fig.4. 11 5mp Camera with CSi

Specification	Value
Resolution	5 MP
Lens Focus	Fixed Focus
Interface Type	CSI(Camera Serial Interface)
Sensors	Omnivision 5647 fixed-focus
Aperture	2.9
Focal Length	3.29
FOV	72.4°
Length (mm)	25
Width (mm)	23
Height (mm)	8
Weight (gm)	3

Table 4. 10 5MP Camera for Raspberry Pi

4.1.11 POWER SOURCE

This high performance LiPo Battery pack is specifically manufactured to be used with quadcopters and multirotors. It is a 3 Cell 2200 mAh battery pack that is suitable to power standard size quadcopters. The HRB li-po Battery is choden because of its Stable High pack voltage through duration of use, high discharge rate, giving more power under load, Greater thermal control, packs stay much cooler under extreme conditions and it maintains higher pack capacity even after many cycles of use.

Fig.4. 12 11.1v, 30C 3S Lithium Polymer Battery

Specification	Value
Capacity(mAh)	2200
Weight(gm)	185
Configuration	3S1P / 11.1v / 3Cell
Constant Discharge	30C
Charge Plug	JST-XH
Discharge Plug	XT60 connector

Table 4. 11 Li-Po Battery Specifications

4.2 SOFTWARE INTEGRATION

4.2.1 VIDEO CAPTURING PROCESSING AND SAVING

```
# THERE ARE CODE LINES IN COMMENT FOR EACH PURPOSES.
# READ CAREFULLY
import cv2
#OBJECTS
# 1. video
# 2. FourCC_Codec
# 3. save
# These objects help process the video capturing
cam_port=0  #change it to 1 for normal webcams
```

```
video=cv2.VideoCapture(cam_port)
#codec_id='XVID'
#FourCC_Codec=cv2.VideoWriter_fourcc(*codec_id)        #Video codec definition
 from FourCC Website. the * denote multiple arg entry like *arg
#save=cv2.VideoWriter('Web Cam Video Output file.avi',FourCC_Codec,30.0,(640,4
80))# video file saved through "save object".
#arg 1 = video output file name
#arg 2 = the file CODEC
#arg 3 = frame rate
#arg 4 = frame size of the video in the form of a tuple
while video.isOpened(): #works if the "cam_port" variable has the right port
    ret,frame = video.read() #frame reads video. ret is boolean
    if ret==True:
    #    save.write(frame) # saving the file
    #    grey=cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY) #greyscale output conver
sion
        cv2.imshow('Video Palyer',frame)   #colour video
    #    cv2.imshow('frame',grey)   #grayscale video
        k = cv2.waitKey(1) & 0xFF
        if  k  == ord('q') or k%256 == 27:
            # "& 0xFF" is given for 64 bit operating systems. Haven't figured
out why......yet.
            break
        elif k % 256 == 32 or k == ord('s'):
            cv2.imwrite("Capture.png", frame)

            video.release()
            cv2.destroyAllWindows()
    else:
        break
video.release()
#save.release()
cv2.destroyAllWindows()
```

4.2.2 CONNECTING CAMERA THROUGH WIFI

```
import urllib.request
import cv2
import numpy as np
url_id='http://25.13.177.28:8080/shot.jpg'
while True:
    img_phone=urllib.request.urlopen(url_id)
    image_array=np.array(bytearray(img_phone.read()),dtype=np.uint8)
    image=cv2.imdecode(image_array,-1)
    grey_frame=cv2.cvtColor(image,cv2.COLOR_BGR2GRAY)
    grey_frame=cv2.cvtColor(grey_frame,cv2.COLOR_GRAY2BGR)
    hsv_image=cv2.cvtColor(image,cv2.COLOR_BGR2HSV)                          ##
 The HSV frame of the normal decoded image
```

```
    red_lower_1 = np.array([0,130,140])                                                ##
 The Colour Range(min) in the order Hue Saturation Brightness
    red_upper_1 = np.array([40,255,255])                                               ##
 The Colour Range(max)
    red_mask_0=cv2.inRange(hsv_image, red_lower_1, red_upper_1)                        ##
 Range of Colours to be identified
    red_colour_1 = cv2.bitwise_and(image,image,mask=red_mask_0)                        ##
 Embedding
    grey=cv2.add(red_colour_1,grey_frame)
    cv2.imshow('grey',grey)
    cv2.imshow('image viewer',image)
    i=1
    if red_mask_0.any() == True:
        cv2.imwrite(f'files/grey{i}.jpg',grey)
        i+=1
    k= cv2.waitKey(1)
    if k % 256 == 27 or k ==ord('q'):
        cv2.destroyAllWindows()
        break
    elif k % 256 == 32 or k == ord('s'):
        cv2.imwrite('new capture.png',image)
cv2.destroyAllWindows()
```

4.2.3 THERMAL IMAGE PROCESSING

```
import serial, time
import datetime as dt
import numpy as np
import cv2

# function to get Emissivity from MCU
def get_emissivity():
    ser.write(serial.to_bytes([0xA5,0x55,0x01,0xFB]))
    read = ser.read(4)
    return read[2]/100

# function to get temperatures from MCU (Celsius degrees x 100)
def get_temp_array(d):

    # getting ambient temperature
    T_a = (int(d[1540]) + int(d[1541])*256)/100

    # getting raw array of pixels temperature
    raw_data = d[4:1540]
    T_array = np.frombuffer(raw_data, dtype=np.int16)

    return T_a, T_array

# function to convert temperatures to pixels on image
```

```python
def td_to_image(f):
    norm = np.uint8((f/100 - Tmin)*255/(Tmax-Tmin))
    norm.shape = (24,32)
    return norm

########################### Main cycle #################################
# Color map range
Tmax = 40
Tmin = 20

print ('Configuring Serial port')
ser = serial.Serial ('/dev/serial0')
ser.baudrate = 115200

# set frequency of module to 4 Hz
ser.write(serial.to_bytes([0xA5,0x25,0x01,0xCB]))
time.sleep(0.1)

# Starting automatic data colection
ser.write(serial.to_bytes([0xA5,0x35,0x02,0xDC]))
t0 = time.time()

try:
    while True:
        # waiting for data frame
        data = ser.read(1544)

        # The data is ready, let's handle it!
        Ta, temp_array = get_temp_array(data)
        ta_img = td_to_image(temp_array)

        # Image processing
        img = cv2.applyColorMap(ta_img, cv2.COLORMAP_JET)
        img = cv2.resize(img, (320,240), interpolation = cv2.INTER_CUBIC)
        img = cv2.flip(img, 1)

        text = 'Tmin = {:+.1f} Tmax = {:+.1f} FPS = {:.2f}'.format(temp_array.
min()/100, temp_array.max()/100, 1/(time.time() - t0))
        cv2.putText(img, text, (5, 15), cv2.FONT_HERSHEY_SIMPLEX, 0.45, (0, 0,
 0), 1)
        cv2.imshow('Output', img)

        # if 's' is pressed - saving of picture
        key = cv2.waitKey(1) & 0xFF
        if key == ord("s"):
            fname = 'pic_' + dt.datetime.now().strftime('%Y-%m-%d_%H-%M-
%S') + '.jpg'
            cv2.imwrite(fname, img)
```

```
            print('Saving image ', fname)

        t0 = time.time()

except KeyboardInterrupt:
    # to terminate the cycle
    ser.write(serial.to_bytes([0xA5,0x35,0x01,0xDB]))
    ser.close()
    cv2.destroyAllWindows()
    print(' Stopped')

# just in case
ser.close()
cv2.destroyAllWindows()
```

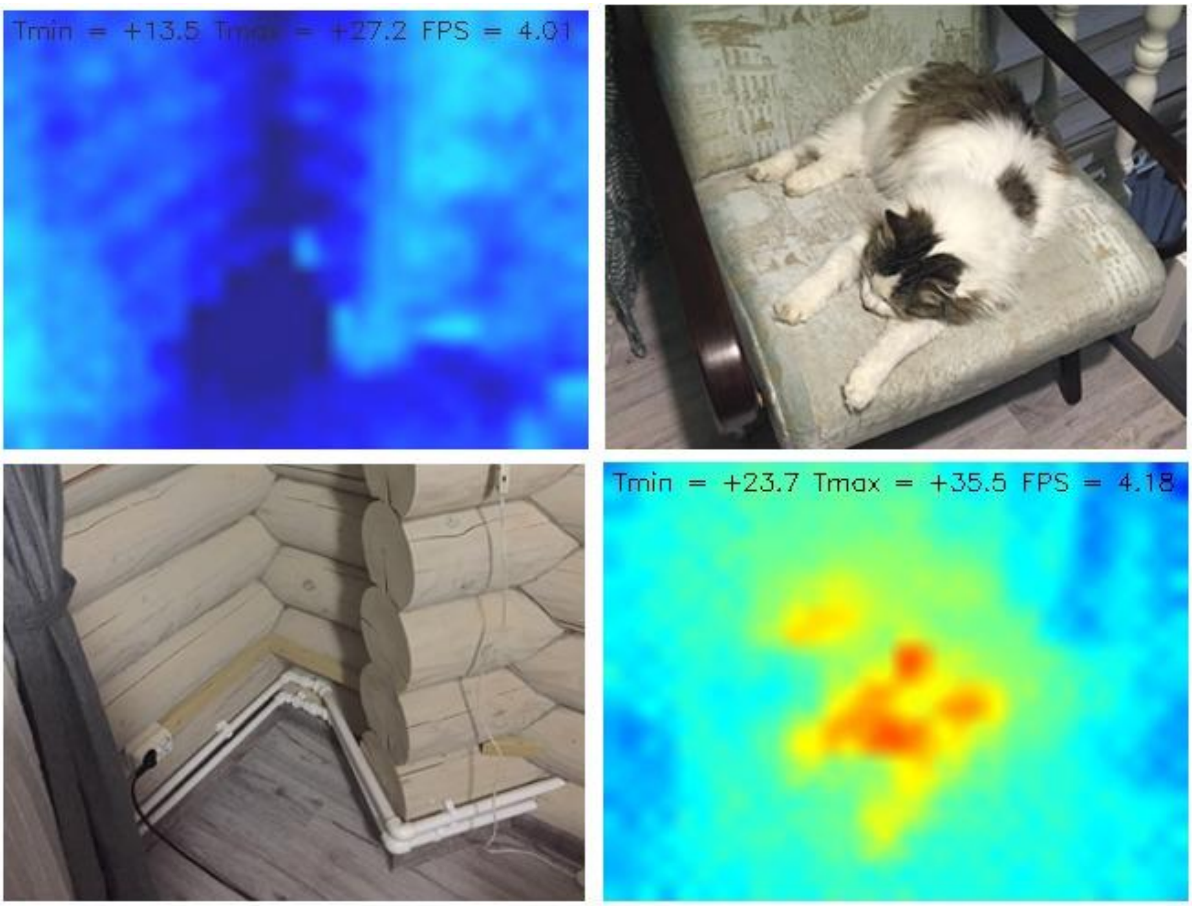


Fig.4. 13 Thermal Camera Output

CHAPTER 5

WORKING

The project aims at creating an Unmanned Ariel Vehicle proficient in assisting rescue missions due to natural calamities. The drone will be able to stream the feed live into the server and find positions of people. The UAV achieves lift from the thrust provided by the motors according to the instructions from the base station. The base station can remotely control the Vehicle. The flight controller also handles the alert for low battery and is capable of bringing it back to base. The cameras are turned on when it reaches the predetermined height to scan an area assigned to it from the base station. The Raspberry-pi process the obtained data from which it identifies the heat signatures and transfers the obtained feed to the base station. Then the location coordinates of the people found are sent via the GPS for a quick response. Authorized personnel who would want to see the operations can access them through the website.

CHAPTER 6

COST ESTIMATION

Components	Quantity	Amount
KK 2.1.5 Flight Control Module	1	₹ 1,649.00
Raspberry pi 4	1	₹ 7,069.00
FlySky CT6B 2.4 GHZ 6CH transmitter and receiver	1	₹ 2,969.00
A2212 10T 1400KV BLDC Motor	4	₹ 2,066.00
1045 Propellers CC + CW	4	₹ 494.00
2200mAh, 11.1v, 30C, 3S Li-Po Battery	1	₹ 3,499.00
30A ESC	4	₹ 1,680.00
Q450 Quadcopter body	1	₹ 1,010.00
MLX90640 Thermal Camera	1	₹ 28,822.00
5mp Camera with CSi	1	₹ 624.00
GPS Module	1	₹ 2,181.00
Total	**20**	**₹ 52,063.00**

Table 4. 12 Cost Estimation

CHAPTER 7

CONCLUSION

The project aims at creating a new eye for the search and rescue authorities in the face of a natural disaster with the help of a thermal imaging sensor. This reduces the uncertainty and confusion during the rescue after or during the disaster. The drones could reduce the time, work, and desperation during an operation. The project aims at making effective communication links between the field operatives and higher authorities, as they can make many effective decisions with help of a live feed. Thus we hope that our project will make a huge difference in search rescue operations.

CHAPTER 8

FUTURE SCOPE

- To make a design which is more autonomous in nature using Artificial Intelligence and Machine Learning.
- A database to store the details of the people recovered using FIND
- The system can be used for surveillance of borders for illegal immigrants.
- System which consist of automated management and tilt angle control based on the distribution of energy from the sun.

CHAPTER 9

BIBLIOGRAPHY

[1] C. H. Shen, F. Y. C. Albert, C. K. Ang, D. J. Teck and K. P. Chan,” Theoretical development and study of take-off constraint thrust equation for a drone,” 2017 IEEE 15th Student Conference on Research and Development (SCOReD), Putrajaya, 2017, pp. 18-22, DOI: 10.1109/SCORED.2017.8305428.

[2] Kumar, O.V.P.R. Siva et al. “Drone (Unmanned Aerial Vehicle) using KK 2.1.5 board for surveillance.” International Journal of Advance Research, Ideas and Innovations in Technology 4 (2018): 1417-1423.

[3] Bhatkhande, Pranav and Timothy C. Havens. “Real time fuzzy controller for quadrotor stability control.” 2014 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE) (2014): 913919.

[4] Rabah, Mohamed Rohan, Ali Talha, Muhammad Nam, Kang-Hyun Kim, Sung. (2018). Autonomous Vision-based Target Detection and Safe Landing for UAV. International Journal of Control, Automation and Systems. 10.1007/s12555-018-0071x.

[5] M. Hamza, A. Jehangir, T. Ahmad, A. Sohail and M. Naeem,” Design of surveillance drone with X-ray camera, IR camera and metal detector,” 2017 Ninth International Conference on Ubiquitous and Future Networks (ICUFN), Milan, 2017, pp. 111-114, DOI: 10.1109/ICUFN.2017.7993757.

[6] H. Kayan, R. Eslampanah, F. Yeganli and M. Askar,” Heat leakage detection and surveiallance using aerial thermography drone,” 2018 26th Signal Processing and Communications Applications Conference (SIU), Izmir, 2018, pp. 1-4, DOI: 10.1109/SIU.2018.8404366.

[7] W. K. Wong, P. N. Tan, C. K. Loo and W. S. Lim,” An Effective Surveillance System Using Thermal Camera,” 2009 International Conference on Signal Acquisition and Processing, Kuala Lumpur, 2009, pp. 13-17, DOI: 10.1109/ICSAP.2009.12.

[8] A. L. P. S. Renduchintala, A. Albehadili and A. Y. Javaid,” Drone Forensics: Digital Flight Log Examination Framework for Micro Drones,” 2017 International Conference on Computational Science and Computational Intelligence (CSCI), Las Vegas, NV, 2017, pp. 91-96, DOI: 10.1109/CSCI.2017.15.