

Emerging Methods for Early Detection of Forest Fires

PROJECT REPORT

Submitted by

TEAM ID: PNT2022TMID36539

TEAM MEMBERS

TEAM LEAD : N.S. NITHIKSHA(112619104011)

TEAM MEMBER 1: V. HARINI(112619104005)

TEAM MEMBER 2: S. THEEBAN BABU(112619104014)

TEAM MEMBER 3: M. VIKRAM(112619104016)

TABLE OF CONTENTS

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Project Overview

1.2 Purpose

2. LITERATURE SURVEY

2.1 Existing problem

2.2 References

2.3 Problem Statement Definition

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

3.2 Ideation & Brainstorming

3.3 Proposed Solution

3.4 Problem Solution fit

4. REQUIREMENT ANALYSIS

4.1 Functional Requirements

4.2 Non-Functional Requirements

5. PROJECT DESIGN

5.1 Data Flow Diagrams

5.2 Solution & Technical Architecture

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

6.2 Sprint Delivery Schedule

6.3 Reports from JIRA

7. CODING & SOLUTIONING (Explain the features add in the project along with code)

7.1 Feature 1

7.2 Feature 2

8. TESTING

8.1 Test Cases

8.2 User Acceptance Testing

9. RESULTS

9.1 Performance Metrics

10. ADVANTAGES & DISADVANTAGES

11. CONCLUSION

12. FUTURE SCOPE

13. APPENDIX

1 INTRODUCTION

1.1 PROJECT OVERVIEW

Forest fires are a major environmental issue, creating economic and ecological damage while endangering human lives. There are typically about 100,000 wildfires in the United States every year. Over 9 million acres of land have been destroyed due to treacherous wildfires. Regardless of the reasons for the ignition of the forest fires, they normally cause withering damage to both nature and humans.

Forest fires are also considered as a main contributor to the air pollution, due to the fact that during every fire huge volume of gases and particle matter are released in the atmosphere. To fight forest fires, different solutions were employed throughout the years. They were primarily aimed at the early detection of the fires. The simplest of these solutions is the formation of a network of observance posts - both cheap and easy to accomplish, but also time-consuming for the involved people.

It is difficult to predict and detect Forest Fire in a sparsely populated forest area and it is more difficult if the prediction is done using ground-based methods like Camera or Video-Based approach. Satellites can be an important source of data prior to and also during the Fire due to its reliability and efficiency. The various real-time forest fire detection and prediction approaches, with the goal of informing the local fire authorities.

The constant evolution of the info and communication applied science has led to the debut of a new generation of solutions for early detection and even prevention of forest fires. ICT-based networks of cameras and sensors and even satellite-based solutions were developed and used in the last decades. These solutions have greatly decreased the direct involvement of humans in the forest fire detection process, but have also proven to be expensive and hard to maintain.

1.2 PURPOSE

Detection of forest fire and smoke in wild land areas is done through remote sensing-based methods such as satellites, high-resolution static cameras fixed on the ground, and unmanned aerial vehicles. Optical/thermal cameras deployed on the observation towers together with the other sensors such as smoke, temperature, and humidity sensors might detect the hazards in the closed environment rather than in the open environment as these sensors need vicinity to the fire or smoke.

The information obtained through these sensors is not appropriate. Distance covered by these methods could be limited, and to cover a large area, more sensors have to be deployed that might incur expenses. Through the deployment of UAV, large areas could be covered, and the images with high spatial and temporal resolutions could be captured properly.

2 LITERATURE SURVEY

2.1 EXISTING PROBLEM

Literature survey-1

Different fire detection techniques have been proposed for safety and protection of the people and environment.

- Wavelet based smoke detection-smoke detection in video sequences
- Covariance method - flame detection.
- Neural Network -produces accurate result as it uses temperature, smoke density and CO concentration

Literature survey-2

The proposed system uses YCbCr colour spaces. Because YCbCr colour space separates luminance from chrominance, hence it is robust to changing illumination than other colour spaces like RGB and rgb (normalized RGB). The proposed method not only separates fire flame pixels but also separates high temperature fire centre pixels by taking in to account of statistical parameters of fire image in YCbCr colour space like mean and standard deviation

Literature survey-3

This paper proposes a large-scale monitoring system and deep learning-based forest fire detection model that can detect forest fires from video frames captured by UAV drones. The proposed CNN model successfully detects forest fires with 97.29% accuracy.

2.2 REFERENCES

- 1) Author Name - Ms.Tamil Mathi, Dr.L.Latha - A SURVEY ON FOREST FIRE DETECTION
- 2) Author Name - Priyadarshini Hanamaraddi - A Literature Study on Image Processing for Forest Fire Detection
- 3) Author Name - Abhay Chopde , Ansh Magon , Shreyas Bhatkar - Forest Fire Detection and Prediction from image processing using RCNN

2.3 PROBLEM STATEMENT DEFINITION

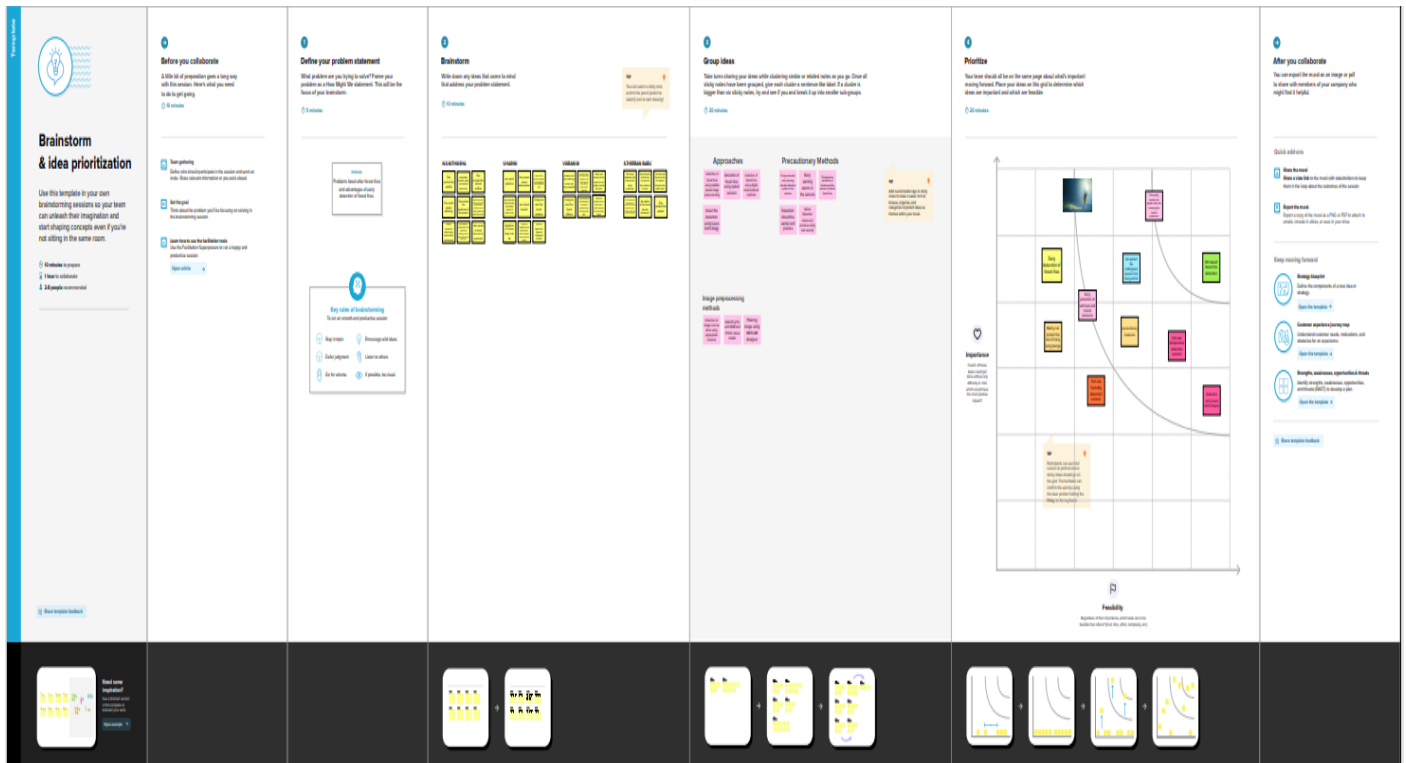
S.No.	Parameter	Description
1.	Problem Statement (problem to be solved)	Forest fires are one of the most vulnerable natural disaster. It affects thousand acres of land and natural resources, which also affects the thousands of living organisms and affects the livelihood of tribes and other forest workers.
2.	Idea / Solution description	<p>The earlier detection of forest fires requires 24/7 monitoring of the forest which is not possible manually. To avoid the delay and manual monitoring</p> <ul style="list-style-type: none">➤ We can use image processing to monitor forest.➤ Use computer vision methods for recognition and detection of smoke or fire, based on the still images or the video input from the drone cameras
3.	Novelty / Uniqueness	<ul style="list-style-type: none">➤ Real time computer detects the forest fires at the earliest before being spread or to occur.➤ Satellite images of forests will be processed for identifying the fire.
4.	Social Impact / Customer Satisfaction	<p>Early detection will helps to</p> <ul style="list-style-type: none">➤ Prevent the loss of natural resources and wildlife.➤ It can prevent the livelihood of the surroundings and the people getting affected after the occurrence of forest fires.
5.	Business Model (Revenue Model)	<ul style="list-style-type: none">➤ The proposed method was implemented using the Python programming language on a Corei3 or greater.➤ The prediction might be right and the can have high reliability.
6.	Scalability of the Solution	<ul style="list-style-type: none">➤ In future we can include machine learning and robotics many other advance technologies to detect the smoke coming from the forest.➤ Computer vision models enable land cover classification and smoke detection from satellite and ground cameras.

3 IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION & BRAINSTORMING:



3.3 PROPOSED SOLUTION:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (problem to be solved)	Forest fires are one of the most vulnerable natural disaster. It affects thousand acres of land and natural resources, which also affects the thousands of living organisms and affects the livelihood of tribes and other forest workers.
2.	Idea / Solution description	The earlier detection of forest fires requires 24/7 monitoring of the forest which is not possible manually. To avoid the delay and manual monitoring <ul style="list-style-type: none">➤ We can use image processing to monitor forest.➤ Use computer vision methods for recognition and detection of smoke or fire, based on the still images or the video input from the drone cameras
3.	Novelty / Uniqueness	<ul style="list-style-type: none">➤ Real time computer detects the forest fires at the earliest before being spread or to occur.➤ Satellite images of forests will be processed for identifying the fire.
4.	Social Impact / Customer Satisfaction	Early detection will helps to <ul style="list-style-type: none">➤ Prevent the loss of natural resources and wildlife.➤ It can prevent the livelihood of the surroundings and the people getting affected after the occurrence of forest fires.
5.	Business Model (Revenue Model)	<ul style="list-style-type: none">➤ The proposed method was implemented using the Python programming language on a Corei3 or greater.➤ The prediction might be right and the can have high reliability.
6.	Scalability of the Solution	<ul style="list-style-type: none">➤ In future we can include machine learning and robotics many other advance technologies to detect the smoke coming from the forest.➤ Computer vision models enable land cover classification and smoke detection from satellite and ground cameras.

3.4 PROBLEM SOLUTION FIT

Define CS, fit into CL	1. CUSTOMER SEGMENT(S) CS Who is your customer? eg. working parents of 0-5 y.o. kids		6. CUSTOMER LIMITATIONS CL EG. BUDGET, DEVICES What limits your customers to act when problem occurs? Spending power, budget, no cash in the pocket? Network connection? Available devices?		5. AVAILABLE SOLUTIONS AS PLUSES & MINUSES Which solutions are available to the customer when he/she is facing the problem? What had he/she tried in the past? Pluses & minuses?		Explore AS, differentiate
Focus on PR, tap into BE, understand RC	2. PROBLEMS / PAINS + ITS FREQUENCY PR Which problem do you solve for your customer? There could be more than one, explore different sides. eg. existing solar solutions for private houses are not considered a good investment (1).		9. PROBLEM ROOT / CAUSE RC What is the root of every problem from the list? eg. People think that solar panels are bad investment right now, because they are too expensive (1.1), and possible changes to the law might influence the return of investment significantly and diminish the benefits (1.2).		7. BEHAVIOR + ITS INTENSITY BE What does your customer do about / around / directly or indirectly related to the problem? eg. directly related: tries different "green energy" calculators in search for the best deal (1.1), usually chooses for 100% green provider (1.2). indirectly related: volunteering work (Greenpeace etc)		Focus on PR, tap into BE, understand RC
Identify strong TR & EM	3. TRIGGERS TO ACT TR What triggers customer to act? eg. seeing their neighbor installing solar panels (1.1), reading about innovative, more beautiful and efficient solution (1.2)		10. YOUR SOLUTION SL If you are working on existing business - write down existing solution first, fill in the canvas and check how much does it fit reality. If you are working on a new business proposition then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.		8. CHANNELS of BEHAVIOR CH ONLINE Extract channels from Behavior block		Extract online & offline CH of BE
	4. EMOTIONS EM BEFORE / AFTER Which emotions do people feel before/after this problem is solved? Use it in your communication strategy. eg. frustration, blocking (can't afford it) > boost, feeling smart, be an example for others (made a smart purchase)				OFFLINE Extract channels from Behavior block and use for customer development		

4 REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

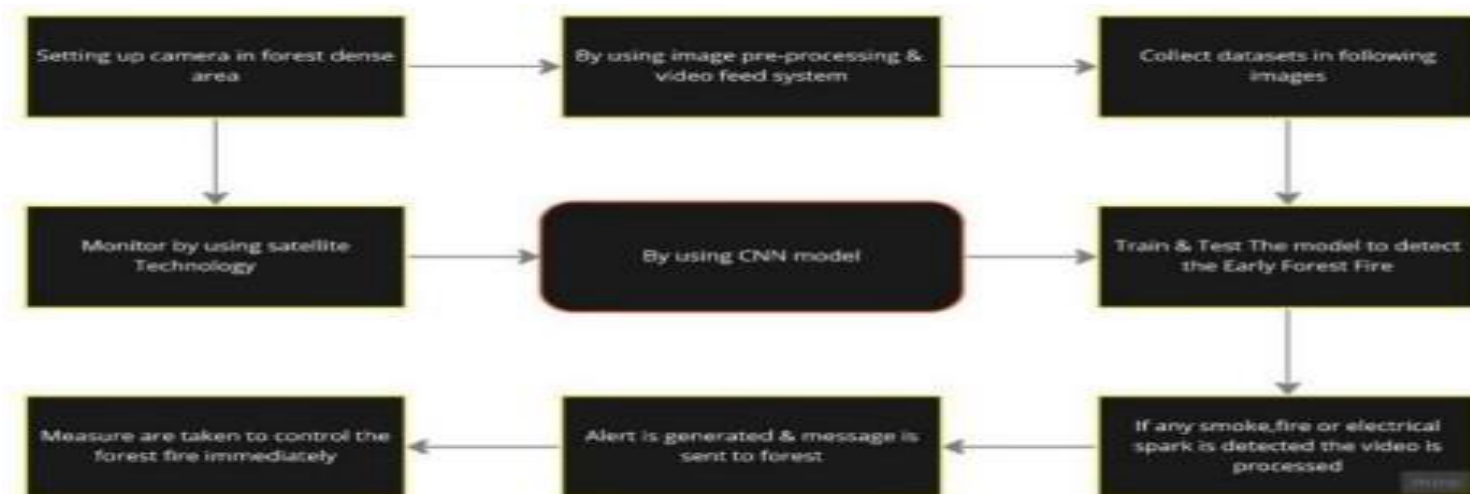
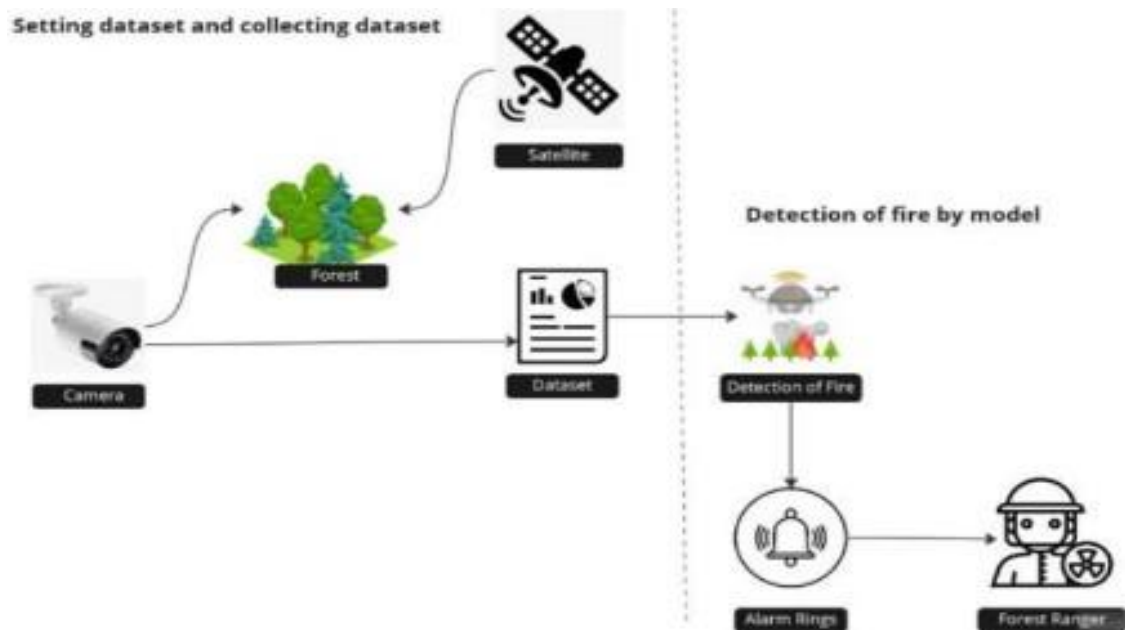
FR. NO.	Functional Requirement	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through wildfire portal.
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Data Prediction	Scientists create computer models to predict wildfire potential under a range of potential climate futures. Using different projections of temperature and downfall, scientists predict where and when wildfires are likely to occur

4.2 NON- FUNCTIONAL REQUIREMENTS

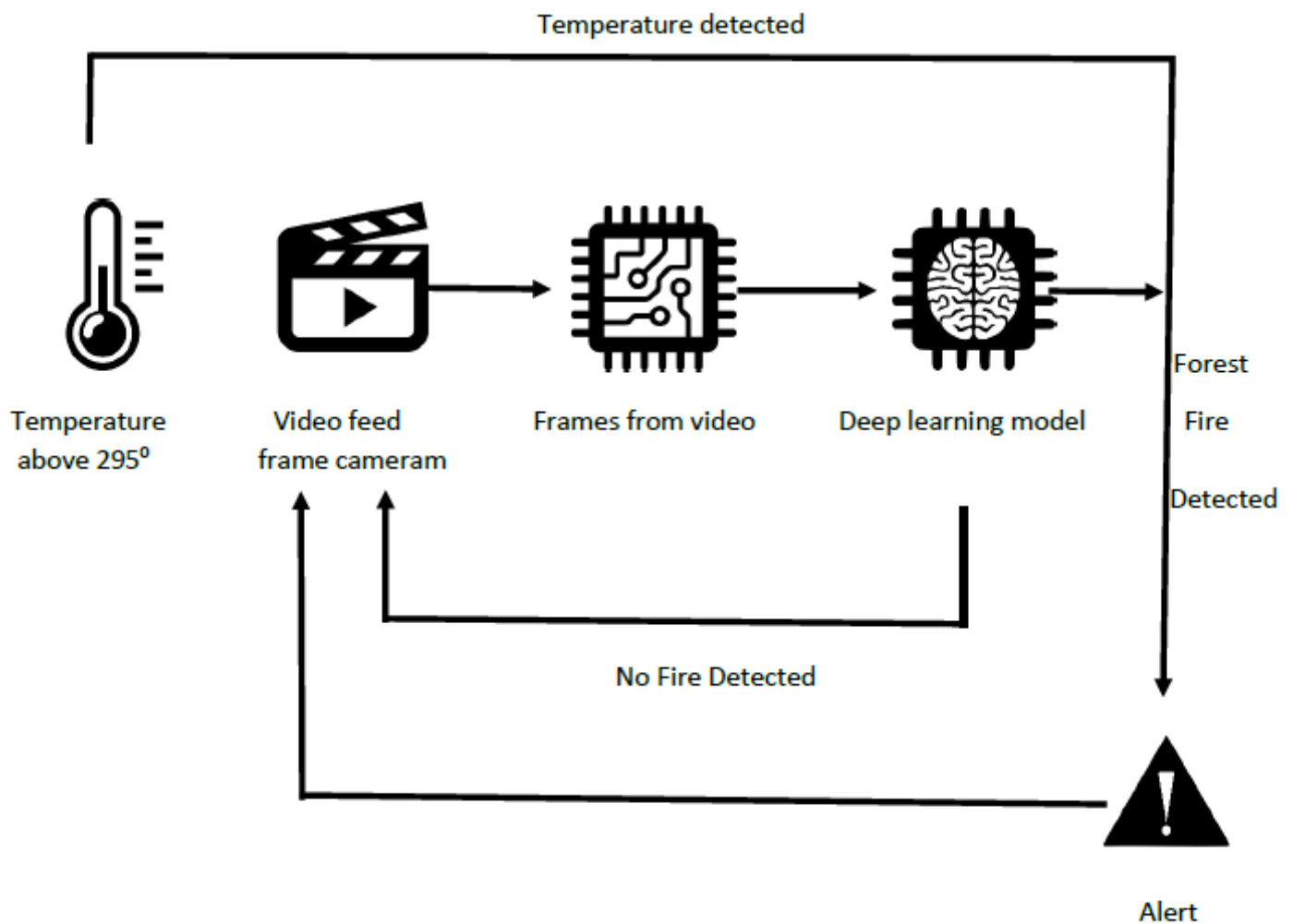
FR. NO.	Non-Functional Requirement	Description
NFR-1	Usability	Many methods have been proposed to detect forest fires, such as camera-based systems, WSN-based systems, and machine learning coating-based systems, with both positive and negative aspects and performance figures of detection.
NFR-2	Protection	We have designed this project to secure the forest from wild fires.
NFR-3	Performance	In the event of a fire, the primary objective of using drones is to gather situational consciousness, which can be used to direct the efforts of the firefighters in locating and controlling hot spots. Just like urban fires, forest fires to require monitoring so that firefighters know what they are dealing with.

5 PROJECT DESIGN

5.1 DATAFLOW DIAGRAMS



5.2 SOLUTION & TECHNICAL ARCHITECTURE



6 PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	DATA COLLECTION	USN-1	Data collected by sensors aboard orbiting satellites, carried aboard aircraft, or installed on the ground provide a wealth of data that can be used to assess conditions before a burn and track the movement of a wildfire in near real-time.	10	High	N.S.NITHIKSHA V.HARINI M.VIKRAM S.THEEBAN BABU

Sprint-1	IMAGE PREPROCESSING	USN-2	Image processing-Image processing technique automatically detect forest fires around the world by using infrared(IR) images sourced from satellites and CNN used for image recognition and tasks that involve the processing of pixel data.	7	Medium	N.S.NITHIKSHA V.HARINI M.VIKRAM S.THEEBAN BABU
Sprint-2	TRAINING AND TESTING	USN-3	The model is trained for detecting the fire by training with real time work and the testing is done according to the accuracy of the model	10	high	N.S.NITHIKSHA V.HARINI M.VIKRAM S.THEEBAN BABU

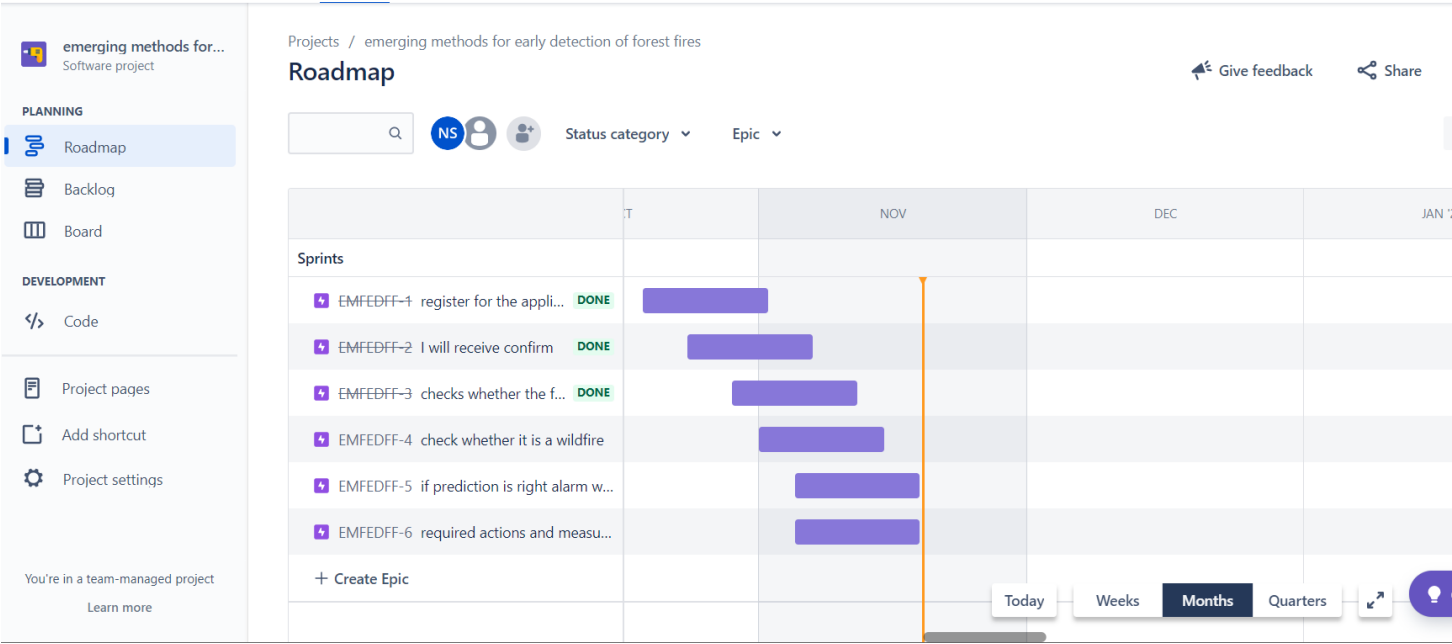
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-3	REVIEWING THE MODEL	USN-4	The main task is to check that the model is efficient to work in real time to ensure there is no error in the model	7	Medium	N.S.NITHIKSHA V.HARINI M.VIKRAM S.THEEBAN BABU
Sprint-4	IMPLEMENTATION	USN-5	After completing every step the model is implemented on the forest and the quick responses are collected from forest organization	10	High	N.S.NITHIKSHA V.HARINI M.VIKRAM S.THEEBAN BABU

6.2 SPRINT DELIVERY SCHEDULE

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	27 Oct 2022	8	27 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	7	08 Nov 2022

Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	8	16 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	7	20 Nov 2022

6.3 REPORT FROM JIRA



7 CODING & SOLUTIONING (EXPLAIN THE FEATURES ADDED IN THE PROJECT ALONG WITH CODE)

7.1 FEATURE 1

```
1  import tensorflow as tf
2  import numpy as np
3  from tensorflow import keras
4  import os
5  import cv2
6  from tensorflow.keras.preprocessing.image import
   ImageDataGenerator
7  from tensorflow.keras.preprocessing import image
8  import matplotlib.pyplot as plt
```



```

9 train = ImageDataGenerator(rescale=1/255)10 test =
    ImageDataGenerator(rescale=1/255)11train_dataset =
train.flow_from_directory("/content/drive/MyDrive/Dataset/train_
    set",target_size=(150,150),batch_size = 32,class_mode =
    'binary')

12 test_dataset = test.flow_from_directory("/content/drive/MyDrive/Dataset/test_set
    ",target_size=(150,150),batch_size =32,class_mode = 'binary')
13 test_dataset.class_indices

14 model = keras.Sequential()
15 model.add(keras.layers.Conv2D(32,(3,3),activation='relu',input_shape=(150,150,3)))
16 model.add(keras.layers.MaxPool2D(2,2))
17 model.add(keras.layers.Conv2D(64,(3,3),activation='relu'))
18 model.add(keras.layers.MaxPool2D(2,2))
19 model.add(keras.layers.Conv2D(128,(3,3),activation='relu'))
20 model.add(keras.layers.MaxPool2D(2,2))
21 model.add(keras.layers.Conv2D(128,(3,3),activation='relu'))
22 model.add(keras.layers.MaxPool2D(2,2))
23 model.add(keras.layers.Flatten())
24 model.add(keras.layers.Dense(512,activation='relu'))
25 model.add(keras.layers.Dense(1,activation='sigmoid'))
26 model.summary()
27 model.compile(optimizer='adam',loss='binary_crossentropy',metrics
    = [ 'accuracy' ])

28 r = model.fit(train_dataset,epochs = 10,validation_data =test_dataset)
29 model.save("forest1.h5")
30 predictions = model.predict(test_dataset)31predictions =
np.round(predictions)
32 predictions
33 print(len(predictions))
34 import matplotlib.pyplot as plt
35 plt.plot(r.history['loss'],label='loss')
36 plt.plot(r.history['val_loss'],label='val_loss')
37 plt.plot(r.history['accuracy'],label='accuracy')
38 plt.legend()
39 plt.plot(r.history['accuracy'],label='accuracy')
40 plt.plot(r.history['val_accuracy'],label='val_accuracy')
41 plt.legend()
42 def predictImage(filename):
43     img1 = image.load_img(filename,target_size=(150,150))
44     plt.imshow(img1)
45     Y = image.img_to_array(img1)
46     X = np.expand_dims(Y,axis=0)
47     val = model.predict(X)

```

```

48     print(val)
49     if val == 1:
50         plt.xlabel("Fire")
51     elif val == 0:
52         plt.xlabel("No Fire")
53 predictImage(r"C:\Users\ELCOT\Desktop\Python\new\Dataset\test_set
    \with fire\599857.jpg")
54 predictImage(r"C:\Users\ELCOT\Desktop\Python\new\Dataset\test_set
    \forest\01_NeilBurnell_Mystical_photoververtical1.jpg")
55 predictImage(r"C:\Users\ELCOT\Desktop\Python\new\Dataset\train_set\with fire\with fire
    (2).jpg")

```

7.2 FEATURE 2

FLASK INTEGRATION

```

1  from __future__ import division, print_function
2  import os
3  import numpy as np
4  import tensorflow as tf
5  from tensorflow.keras.preprocessing import image
6  from tensorflow.keras.models import load_model
7  from flask import Flask, request, render_template
8  from werkzeug.utils import secure_filename
9  from twilio.rest import Client10
11 global graph
12 #graph=tf.get_default_graph()13#
Define a flask app
14 app = Flask(__name__)
15 model=load_model('forest1.h5')16
@app.route('/', methods=['GET'])
19 def index():
20     # Main page
21     return render_template('digital.html')23
24
25 @app.route('/predict', methods=['GET',
'POST'])26 def upload():
27     if request.method == 'POST':
28         # Get the file from post request
29         f = request.files['image']30
31         # Save the file to ./uploads
32         basepath = os.path.dirname(__file__)
33         file_path = os.path.join(
34             basepath, 'uploads', secure_filename(f.filename))
35         f.save(file_path)

```

```

36         img1 = image.load_img(file_path, target_size=(150,150))
37
38         y = image.img_to_array(img1)
39         x = np.expand_dims(y, axis=0)
40         val = model.predict(x)
41         print(val)
42         if val == 1:
43             send_message()
44             result = "Fire"
45         elif val == 0:
46             result = "No Fire"
47         return result
48
49 def send_message():
50     client = Client(account_sid, auth_token)
51     message = client.messages.create(
52         body="Forest Fire detected , Stay safe!!!",
53
54     )
55     print(message.sid)
56     print("Fire Detected")
57     print("SMS Sent!")
58 if __name__ == '__main__':
59     app.run(threaded = False)

```

8 TESTING

8.1 TEST CASES

Test case ID	Feature Type	Component	Test Scenario	Steps To Execute	Test Data	Expected Result	Actual Result	Status	BUG ID	Executed By
HomePage_ TC_O 01	UI	HomePage	Display the Emerging Methods of Forest Fires	Enter URL(http://127.0.0.1:5000)	http://127.0.0.1:5000	Displaying the Home Page	Home Page displayed	Pass	-	N.S.Nithiksha V.Harini
HomePage_ TC_O 02	UI	HomePage	Displayed the Prediction Forest Fires	1.Enter URL(http://127.0.0.1:5000) 2.Content of the Home Page should be Displayed	http://127.0.0.1:5000	Displaying the content of Home page	Content of Home page is displayed	Pass	-	N.S.Nithiksha S.Theeban babu

HomePage_TC_OO3	Functional	Home	Checks whether the Drop the Image Here! Button is visible	1. Enter URL(http://127.0.0.1:5000) 2. Content of the Home Page should be Displayed 3.Click Drop the Image Here! Button	http://127.0.0.1:5000	Displays the Button	Drop the Image Here! Button is pops up.	Pass	-	S.Theeban V.Harini
PredictedPage_TC_OO4	Functional	Predicted page	Display the Prediction Page and Choose Image Button	1. Enter URL(http://127.0.0.1:5000) 2. Content of the Home Page should be Displayed 3.Click Drop the Image Here! Button 4.Click Choose Image	http://127.0.0.1:5000	Displays the Prediction Page and the Choose Image Button	Predicti on page displayed. Choose image button was clicked.	Pass	-	M.Vikram N.S.Nithiksha
PredictedPage_TC_OO4	Functional	Predicted page	Select the Image and Click the Predict Button	1.Enter URL(http://127.0.0.1:5000) 2.Content of the Home Page should be Displayed 3.Click Drop the Image Here! Button 4.Click ChooseImage 5.Choose the Image and Click Predict	http://127.0.0.1:5000	Displays e the selected Image	Displays the Selected Imag	Pass	-	N.S.Nithiksha S.Theeban

8.2 USER ACCEPTANCE TESTING

DEFECT ANALYSIS

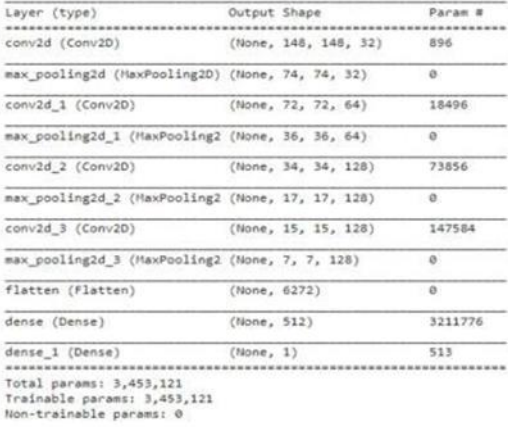

Resolution	severity 1	severity 2	severity 3	badness 4	subtotal
By Design	1	1	2	0	4
Duplicate	0	0	0	0	0
External	0	0	2	1	3
Fixed	4	2	4	1	11
Not Reproduced	0	0	0	0	0
Skipped	0	0	1	1	2
Won't Fix	0	0	0	1	1
Totals	5	3	9	4	21

TEST CASE ANALYSIS

Section	Total Cases	Not tested	Fail	Pass
Client Application	10	0	0	10
Security	2	0	0	2
Performance	2	0	0	2
Exception Reporting	2	0	0	2
Final Report Output	3	0	0	3

9 RESULTS

9.1 PERFORMANCE METRICES

S. No	Parameter	Values	Screenshot
1.	Model Summary	3,453,121	 <pre> Layer (type) Output Shape Param # ----- conv2d (Conv2D) (None, 148, 148, 32) 896 max_pooling2d (MaxPooling2D) (None, 74, 74, 32) 0 conv2d_1 (Conv2D) (None, 72, 72, 64) 18496 max_pooling2d_1 (MaxPooling2 (None, 36, 36, 64) 0 conv2d_2 (Conv2D) (None, 34, 34, 128) 73856 max_pooling2d_2 (MaxPooling2 (None, 17, 17, 128) 0 conv2d_3 (Conv2D) (None, 15, 15, 128) 147584 max_pooling2d_3 (MaxPooling2 (None, 7, 7, 128) 0 flatten (Flatten) (None, 6272) 0 dense (Dense) (None, 512) 3211776 dense_1 (Dense) (None, 1) 513 ----- Total params: 3,453,121 Trainable params: 3,453,121 Non-trainable params: 0 </pre>
2.	Accuracy	Training Accuracy - 0.9665 Validation Accuracy -0.9833	 <pre> Epoch 1/10 14/14 [=====] - 96s 7s/step - loss: 0.5717 - accuracy: 0.6552 - val_loss: 0.1085 - val_accuracy: 0.8750 Epoch 2/10 14/14 [=====] - 84s 6s/step - loss: 0.3366 - accuracy: 0.8434 - val_loss: 0.1193 - val_accuracy: 0.9667 Epoch 3/10 14/14 [=====] - 74s 5s/step - loss: 0.1247 - accuracy: 0.9127 - val_loss: 0.1184 - val_accuracy: 0.9590 Epoch 4/10 14/14 [=====] - 75s 5s/step - loss: 0.1682 - accuracy: 0.9425 - val_loss: 0.0206 - val_accuracy: 1.0000 Epoch 5/10 14/14 [=====] - 82s 5s/step - loss: 0.1173 - accuracy: 0.9610 - val_loss: 0.0021 - val_accuracy: 0.9967 Epoch 6/10 14/14 [=====] - 76s 5s/step - loss: 0.0925 - accuracy: 0.9741 - val_loss: 0.0169 - val_accuracy: 1.0000 Epoch 7/10 14/14 [=====] - 80s 5s/step - loss: 0.0884 - accuracy: 0.9714 - val_loss: 0.0194 - val_accuracy: 1.0000 Epoch 8/10 14/14 [=====] - 72s 5s/step - loss: 0.1030 - accuracy: 0.9682 - val_loss: 0.0435 - val_accuracy: 0.9833 Epoch 9/10 14/14 [=====] - 70s 5s/step - loss: 0.1032 - accuracy: 0.9676 - val_loss: 0.0044 - val_accuracy: 1.0000 Epoch 10/10 14/14 [=====] - 92s 6s/step - loss: 0.1144 - accuracy: 0.9685 - val_loss: 0.0007 - val_accuracy: 0.9833 </pre>

10 ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- > The proposed system detects the forest fire at a faster rate compared to existing system. It has enhanced data collection feature.
- > The major aspect is that it reduces false alarm and also has accuracy due to various sensors present.
- > It minimises the human effort as it works automatically. This is very low-cost due to which can be easily accessed.
- > The main objective of our project is to receive an alert message through an app to the respective user.

DISADVANTAGE:

- > The electrical interference diminishes the potency of radio receiver.
- > The main drawback is that it has less coverage range areas.

11 CONCLUSION

This type of system is the first of its kind to ensure no further damage is then to forests when there is fire breakout and instantly a message is sent to the user through the App. Immediate response or early warning to a fire breakout is mostly the only ways to avoid losses and biology, cultural heritage damages to a great extent. Therefore, the most important goals in fire surveillance are quick and authentic detection of fire. It is so much easier to suppress fire while it is in its early stages. Info about progress of fire is highly valuable for managing fire.

During all its stages. Based on this data the firefighting staff can be guided on target to block fire before it reaches cultural heritage sites and to suppress it quickly by utilise required firefighting equipment and vehicles. With further research and invention, this project can be implemented in various forest areas so that we can save our forests and maintain great environs.

12 FUTURE SCOPE

This project is far from complete and there is a lot of room for betterment. Some of the betterment that can be made to this project are as follows:

Additional pump can be added so that it automatically sends water when there is a fire breakout. Also industrial sensors can be used for better ranging and accuracy.

This project has endless potential and can always be enhanced to become better. Enforce this concept in the real world will benefit several industries and reduce the workload on many workers, enhancing overall work efficiency.

13 APPENDIX

SOURCE CODE

```
1 import tensorflow as tf
2 import numpy as np
3 from tensorflow import keras
4 import os
5 import cv2
6 from tensorflow.keras.preprocessing.image import ImageDataGenerator
7 from tensorflow.keras.preprocessing import image
8 import matplotlib.pyplot as plt
```

```
1 train = ImageDataGenerator(rescale=1/255)
2 test = ImageDataGenerator(rescale=1/255)
3
4 train_dataset =
    train.flow_from_directory("/content/drive/MyDrive/Dataset/train_set",
        ",
5                                     target_size=(150,150),
6                                     batch_size = 32,
7                                     class_mode = 'binary')
8
9 test_dataset =
    test.flow_from_directory("/content/drive/MyDrive/Dataset/test_set",
10                            target_size=(150,150),
11                            batch_size =32,
12                            class_mode = 'binary')

test_dataset.class_indices
```

```

1 model = keras.Sequential()
2 model.add(keras.layers.Conv2D(32, (3,3), activation='relu', input_shape
  =(150,150,3)))
3 model.add(keras.layers.MaxPool2D(2,2))
4 model.add(keras.layers.Conv2D(64, (3,3), activation='relu'))
5 model.add(keras.layers.MaxPool2D(2,2))
6 model.add(keras.layers.Conv2D(128, (3,3), activation='relu'))
7 model.add(keras.layers.MaxPool2D(2,2))
8 model.add(keras.layers.Conv2D(128, (3,3), activation='relu'))
9 model.add(keras.layers.MaxPool2D(2,2))
10 model.add(keras.layers.Flatten())
11 model.add(keras.layers.Dense(512, activation='relu'))
12 model.add(keras.layers.Dense(1, activation='sigmoid'))

```

```

1 model.compile(optimizer='adam', loss='binary_crossentropy', metrics=['
  accuracy'])

```

```

1 r = model.fit(train_dataset,
2               epochs = 10,
3               validation_data = test_dataset)

```

```

1 predictions

print(len(predictions))

```

```

1 import matplotlib.pyplot as plt
2 plt.plot(r.history['loss'], label='loss')
3 plt.plot(r.history['val_loss'], label='val_loss')
4 plt.plot(r.history['acc'], label='acc')
5 plt.legend()

1 plt.plot(r.history['acc'], label='acc')
2 plt.plot(r.history['val_acc'], label='val_acc')
3 plt.legend()

```

```

1  def predictImage(filename):
2      img1 = image.load_img(filename,target_size=(150,150))
3      plt.imshow(img1)
4      Y = image.img_to_array(img1)
5      X = np.expand_dims(Y,axis=0)
6      val = model.predict(X)
7      print(val)
8      if val == 1:
9          plt.xlabel("Fire",fontsize=30)
10     elif val == 0:
11         plt.xlabel("No Fire",fontsize=30)

predictImage("/content/drive/MyDrive/Dataset/test_set/
with fire/19464620_401.jpg")

predictImage('/content/drive/MyDrive/Dataset/test_set/forest/0.480072
00_1530881924_final_forest.jpg')

predictImage('/content/drive/MyDrive/Dataset/train_set/with
fire/withfire (101).jpg')

predictImage('/content/drive/MyDrive/Dataset/test_set/forest/0.480072
00_1530881924_final_forest.jpg')

predictImage('/content/drive/MyDrive/Dataset/test_set/
with fire/19464620_401.jpg')

```

GITHUB & PROJECT DEMO LINK

GITHUB LINK

[IBM-EPBL/IBM-Project-31285-1660198652](#)

PROJECT DEMO LINK

https://drive.google.com/file/d/1-S2I2zGDTYGBLFLOBwzZMyZdMCqICPJU/view?usp=share_link