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"Project Report"

"EMERGING METHODS FOR EARLY DETECTION OF FOREST FIRES"

Team ID

PNT2022TMID52514

Submitted by,

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PROJECT REPORT

Project Title: EMERGING METHODS FOR EARLY DETECTION OF FOREST FIRES

Team I'd: PNT2022TMID52514

1. INTRODUCTION

PROJECT OVERVIEW

Fire can cause major hazards in this hectic world. All buildings and vehicles used in public transportation have fire prevention and fire protection systems due to the accelerated number in the fire incidents. Also, many of the firms conduct a mock fire drill every occurrence of months to protect their employees from the fire. This would help them to understand what to do or what not to do when a fire situation happens. Forests are one of the main factors in balancing the ecology. It is very harmful when a fire occurs in a forest. But most of the time, the detection of forest fire happens when it spreads over a wide region. Sometimes, it could not be possible to stop the fire. As a result, the damage to the environment is higher than predictable. The emission of large amounts of carbon dioxide (CO2) from forest fires damages the environment. As well as it would lead to complete disappearance of rare species in the world. Also, it can have an impact on the weather, and this causes major issues like earthquakes, heavy rains, floods and so on.

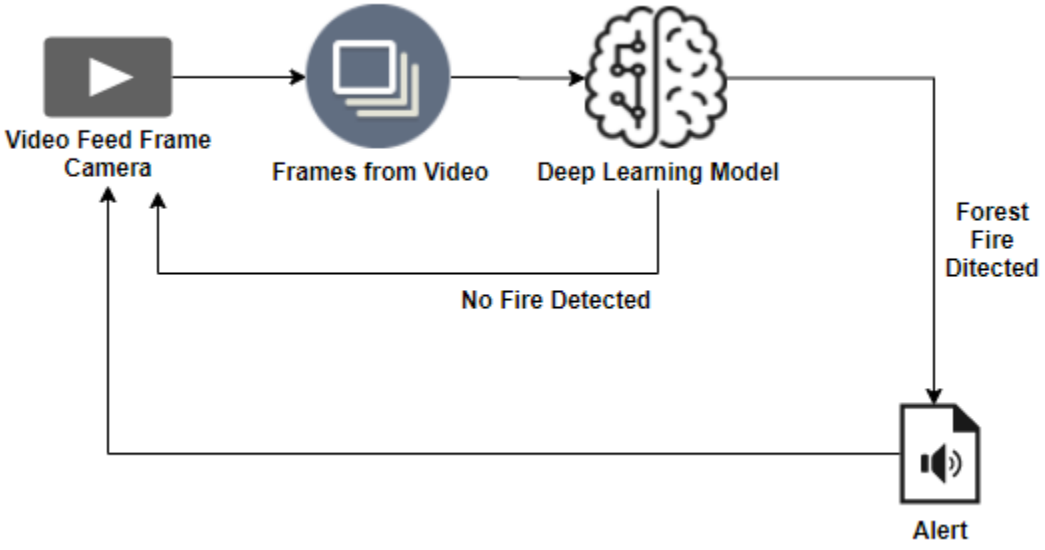
A research study shows an automatic fire detection can be divided into three groups: aerial, ground and borne detection. The ground-based systems use several staring black and white video cameras that are used in fire detection which detect the smoke and compare it with the natural smoke. The main benefit of using this system is high temporal resolution and spatial resolution. So, the detection is easier.2 But these mechanisms still have some drawbacks in detecting the early stage of the fire. So, it is highly important to introduce a system to detect the fire as early as possible.

Moreover, information regarding the seat of the hearth is invaluable for the rapid deployment of fire- fighters. Therefore, early detection, containment at the primary stages and extinguishment of a fireplace before it spreads are crucial for wildfire Management.

1.2. Purpose

Forest fires as of late have been annihilating both for the normal biological system, biodiversity and woodland economy. With expanding populace weight and change in worldwide atmosphere situation, there is an expansion in level of fires that are a significant reason for declining Indian woodlands. As indicated by the woodland study report of India, 50 % of backwoods regions in the nation are fire inclined (going from 50 to 90 % in certain conditions of the nation). Around 6 % of the woods are inclined to extreme fire harms. The reason for this planned framework is to manufacture a dependable fire location framework so as to know dynamic status of backwoods temperature in specific conditions. It is about the sensors and dynamic checking framework to dodge a significant fire and genuine harm to woods.

Technical Architecture:



2. LITERATURE SURVEY

Abstract: Continuous monitoring open space is of the utmost importance for the protection of forests against fire. Collected data in real time provides fast intervention of relevant services to extinguish the fire. Timely information about the appearance of fire reduces the number of areas affected by this fire and thereby minimizes the costs of fire extinguishing and the damage caused in the woods. The current way of detecting fire in an open area in Serbia is not in real time, and due to this, it is necessary to implement modern technology of collecting data related to early detection of fires. This paper presents an integral project of forest-fire protection on the territory of Serbia in order to provide the reference for the application of terrestrial automated systems for early detection and prediction of forest fires. An Automated system could consist of infrared and high-resolutionTV camera surveillance, covering a large part of the forest area and forestland.

INTRODUCTION:

2.1 Existing Problem:

Serbia is faced with a high risk of forest fires. Statistical data indicate a high number of forest fires and the area affected by these phenomena, whereas losses are shown in terms of property damage and other benefits the forest.Forest fires usually occur in areas remote from populated places, so that their detection at a nearly stage and timely reports to the competent services are of extreme importance.Early Fire Detection Reduces The Extinction Time requires fewer executors and fire-fighting equipment,thus increasing the efficiency and reducing the damage to the lowest possible level. Due to the importance of forest ecosystems, the goal is to prevent forest fires at an early stage. There is no developed and efficient system for early forest-fire detection in Serbia, which is considered as an effective way of minimizing forest fire damage. Present method for detecting forest fires, which is based on human surveillance and transmission of information to the competent authorities, is often untimely and unreliable. An organized human surveillance requires a large number of subjects whose monitoring will cover only the area within the scope of observation. Automatic control and automatic early fire warning are certainly more advanced approaches in forest-fire protection. The duty operator at a particular center uses infrared and TV cameras placed at various locations, and he is able to observe much larger space and to emergently notify the authorized services. Such surveillance provides a clear image with the contours of the fire-affected areas, directional movement of flame front and other details, which can be used to choose the fire fighting tactics.

FIRE DETECTION SYSTEMS:

Modern fire detection systems used worldwide today can be divided into three groups: satellite, aerial and terrestrial detection systems. Each of these systems has certain advantages and disadvantages. Satellite systems implemented in developed countries are extremely efficient in detection of forest fires. The Shortcomings are signal delay,and unreliability of detection in case of cloud cover.Some Of The Commercial satellite systems are FIRE - M3 (Canada) and FUEGO (Europe). Air systems are used to cover large areas of forest by applying technically equipped aircraft for this purpose.The disadvantage of this method for early fire detection is the reliability in case of strong winds or low cloudiness. Some of the systems in commercial use are BOMEN (Canada) and GerINTRADAN (Denmark). Terrestrial systems use the cameras in the visible and infrared part of the spectrum which transmit the signal to the command operations center from the peripheral observation stations. The characteristic of this system is the continuity of information delivery from a

particular area, with the possibility to provide other data(mini weather station)relevant competent fire protection services.The signal can be transferred from the transmitter to the Operations Center by wired or wireless network, with the possibility of receiving a signal on an event from several peripheral observation stations. Some of the commercial terrestrial systems are: BOSQUE(BAZAN-FABASpain),SR-10- (ALENIA,Italy),FireWatch(Germany),FireHawk(South Africa), FireV (England), UraFire (France) and others[10].

THE AUTOMATIC EARLY FIRE DETECTION SYSTEM ARCHITECTURE:

An early fire detection system consists of several interrelated independent subsystems, namely:

- observation subsystem,
- analytical subsystem,
- information subsystem,and
- communication subsystem.

Observation subsystems consist of a network of sensor stations and a central station that are interconnected by telecommunications network. Sensory stations transfer the data from the cameras to the central station for further analysis.The operator in the command operations center checks the signal obtained from thermal (infrared) and TV (video) cameras. After checking the signal, a duty operator forwards the information to the authorized services. Sensory stations are placed on elevated locations with good visibility.TV cameras are equipped with a zoom lens that allows the operator to make a more realistic assessment of the location and the type of fire. Infrared sensors can detect a fire area of 6 m^2 and the presence of smoke at 10m height at a distance of 10 km, so that the maximum signal coverage area of an observation station is about 314km^2.

The communication unit transmits the images from the infrared and the video camera from the surveillance station to the operational command center. A specialty of the package in the communication protocol-ALARM package - has been introduced with the aim to provide a reliable detection of an alarm event. In this way, the critical events of great importance to protection of forests against fire can be signaled.

The system topology is one of the standard topology computer networks, so-called Star Topology .Figure1 presents the architecture of the system,consisting of peripheral surveillance stations (PSS) and command operations center (COC).

In addition to automatic mode, there is a manual mode in case of additional verification events and control certain locations.

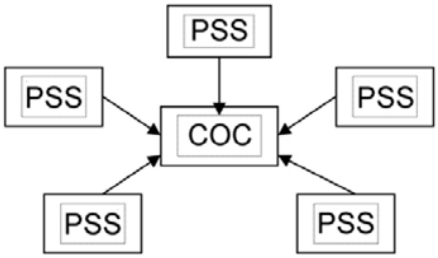


Figure 1. *The architecture of early forest-fire detection systems*

Other Subsystems Are Used For Collecting,modeling,storing, analyzing and visualizing information received from surveillance stations.

Figures-2 and 3 provide an illustration of a system and a camera for fire detection.

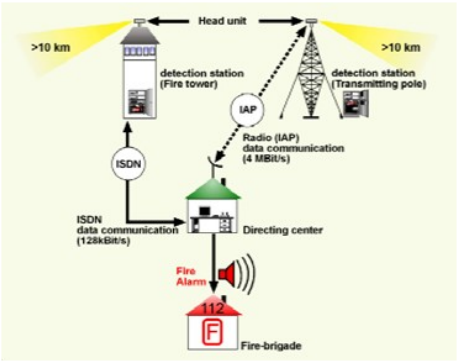


Figure 2.The components of FIRE-WATCH system

Figure3.*FIRE-WATCHcamera*

OBSERVATION SYSTEM OF EARLY FIRE DETECTION IN SERBIA:

Serbia is located in Southeastern Europe between 18°49¢13¢i23°00¢43¢¢East Longitude And 41°51¢05¢i46°11¢25¢ North latitude. The territory of the Republic of Serbia is 88361km^2 with 6164 inhabited areas and 7,120.666 people per 2011 census. The average density of population in Serbia is 91.92 inhabitants per km^2. The forest area in Serbia is about 2.3 million hectares,not including the wooded region of the AutonomousProvince of Kosovo and Metohija; 51% is state-owned and managed by public companies, whereas about 49% are privately owned and managed by the owners of forests. According to the type, deciduous forests are prevailing.Coniferous forests, which are particularly sensitive to the effects of fire, occupy about 10.8% of the forest area. Fire-affected forest areas and forest lands vary from year to year, Figure4.

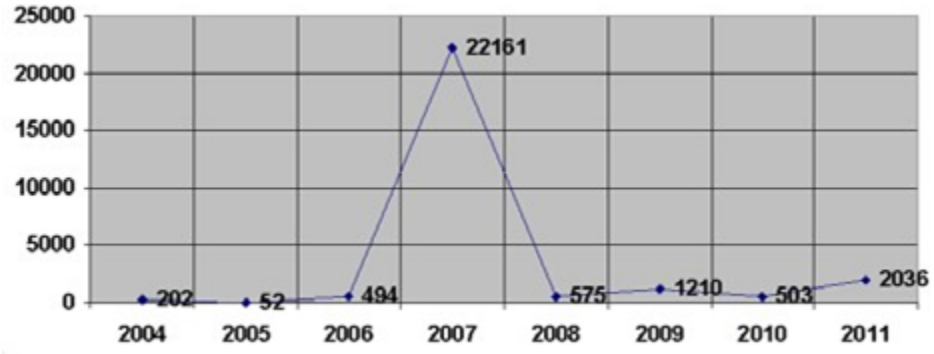


Figure 4. *Fire-affected forest areas on the territory of Serbia,in 2004-2011 period (in he)*

Orographic characteristics of Serbia indicate that the plains up to 200 m above sea level occupy 36.83% of the total area [1]. Gently sloping lands, with sea level between 200 and 500m, occupy 24.70%ofSerbia'sterritory. The altitudes higher than 500m occupy less than 40% of the territory of Serbia. The mean height of land above sea level is 470. On the elevated locations, there are a number of facilities that are used as receivers and transmitters of TV signals, as well as mobile phone masts. The Sector for Emergency Situations of theMinistry of Internal Affairs of the Republic of Serbia has anti-hail protection radar centers. The list of radar centers,their locations,elevations(above sea levels)and surface coverage are shown in Figure 5 and Table 1. Professional staff is taking care of these radar centers which are networked with regional fire-rescue units. There is a regular supply of electricity, as well as backup sources of electricity ensuring continuity of supply of energy tothedevicesandsystems.The Current number of radar centers with an installed early fire detection system can cover about 4.6% of the territory of Serbia. The facilities within radar centers can be used for operational command centers and surveillance stations.

Figure 5.The *network of radar center sin Serbia*

CONCLUSION*:*

Fires threaten forests which results in enormous material and environmental damage. Protection of forests against fire is based on a variety of preventive measures and measures for fighting against forest fires, in order to minimize the total damage. In addition to other preventive measures, early detection and fire extinguishing in the initial stage are important in the protection of forests against biotic and abiotic factors.The existing surveillance of forest areas is unreliable and inefficient; therefore, forest fires are a serious threat to the development of forestry. There is justification and necessity to apply a modern system of early detection and prediction of the spread of the fires on the territory of Serbia.

Figure 6. *The network of transmitters owned by PE Broadcasting Equipment and Communications*

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[14] http://webrzs.stat.gov.rs 03.05.2013.[15]http:/www.rts.rs/,04.05.2013.

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2.3. PROBLEM STATEMENT DEFINITION

Problem statement	To do	But	So	Feeling to that instant
Forest fire sparks on the following area.so steps to be taken.	Please make sure the firemans on their place	Time may lag .so till that system of people should be set there for precaution	Problem occurrence is less	Getting feared and helpful fast action
Satellite detection	Make a sense by sensor to make alarm frequency level up to certain diameter	As per to that alarm beep sounds ..further requirmental will be provided	No problem occurence	Gets energized and has hope feel

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas:

What do they THINK AND FEEL?

What really counts
Major preoccupations
Worries & aspirations

- Will it replace the existing fire detection methods?
- Will it be efficient?
- How does the system work?
- Will it guarantee the accuracy of prediction?
- Can we trust the model?
- Will it minimize the extent of fire?

What do you SEE?

Environment

Friends

What the market offers

- Can it satisfy all the needs of the people?
- Instant solution to problems
- UAV flying everywhere
- Model with visualization
- Want something at lowest cost
- Cameras,smoke and fog sensors

What do they SAY AND DO?

Attitude in public
Appearance
Behavior towards others

- Build using latest technology
- Decide what to include
- More research on existing works and their drawbacks
- Make smart decisions without second thoughts
- Alert people as well as animals
- User friendly app with updates on nearest fire zone area

What do they HEAR?

What friends say
What boss say
What influencers say

- Incorporation of low-cost infrared detectors will be cover vast area
- Fire alarm when there is fire
- Prepare wisely to reduce huge loss
- Will summer not cause forest fires?
- Used at specific fire prone regions
- It reduces the complexity of existing methods

PAIN

Fears
Frustrations
Obstacles

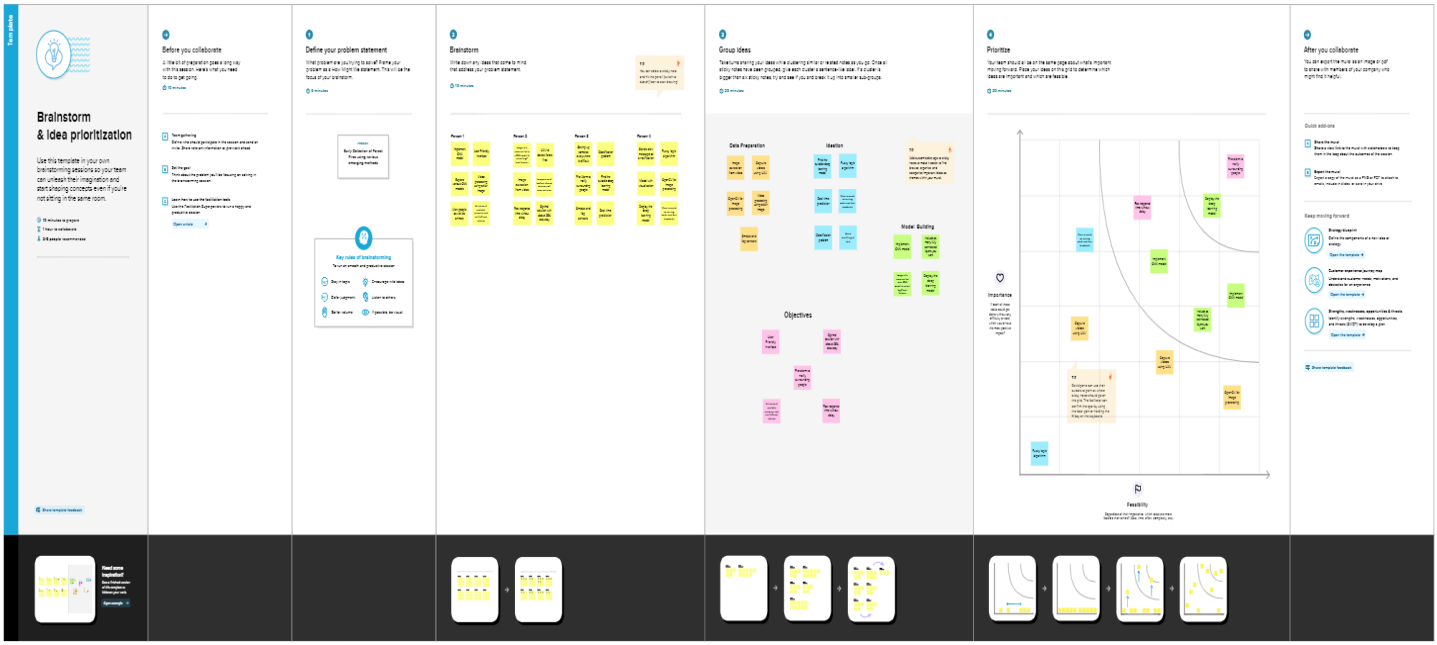
- Wastage of resources
- Is it reliable?
- It may lead to the wrong Predictions
- Setting up cameras everywhere is difficult
- Not accurate at all the times due to smoke and fog

GAIN

“wants”/needs
Measures of success
Obstacles

- Predicts the forest fire correctly
- Early detection due to test response time
- Mitigate
- Optimal solution above 95% accuracy
- Reduce the quantity of loss

3.2 Ideation & Brainstorming:

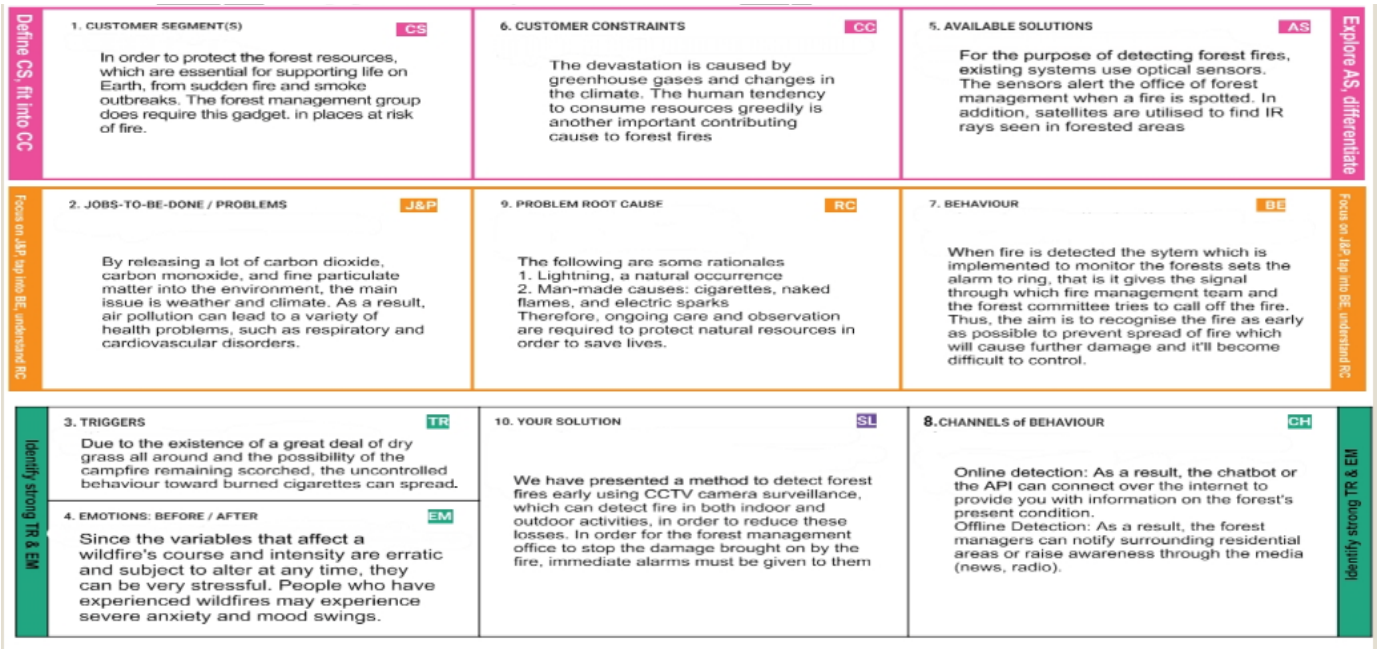


3.3 Proposed Solution:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Forests are one of the main factors in balancing the ecology.Forest fires are one of the most worrisome natural disasters,destroying thousands of acres of forests and nearby urban zones,affecting plant,animals and human life.So, the fire detection is important in this scenario. Finding of the exact location of the fire and sending notification to the fire authorities soon after the occurrence of fire can make a positive impact.
2.	Idea / Solution description	Our solution aims at collecting the dataset to test and train the model . The damage and the cost for distinguish fire because of forest fire can be reduced when the fire detected early as possible. So, the fire detection is important in this scenario. Finding of the exact location of the fire and sending notification to the fire authorities soon after the occurrence of fire can make a positive impact. We have implemented a fire detection system to detect fire by capturing images. The system uses CNN(convolutional neural network), and image processing techniques.

3.	Novelty / Uniqueness	Real time computer program detect forest fire in earliest before it spread to larger area. Our proposed system depends on using AI to make it cheaper and easier for the forest management. Accuracy and timely prediction using AI, CNN and API made it possible.
4.	Social Impact / Customer Satisfaction	The destroying homes, wildlife habitat and timber, and polluting the air with emissions harmful to human health. The proposed solution fulfills the satisfaction requirements of the customer as it provides instant alerts on fire detection which helps the forest officer to take action as soon as possible.
5.	Business Model (Revenue Model)	• A working model in which mini cameras continuously monitor the forest area and capture live images from satellites is a trained model that automatically detects fire or smoke. • This proposed model can detect the exact location of the fire and can be activated by SMS.The fire officer can implement quick responses and preventive measures.
6.	Scalability of the Solution	✓ The device should be compatible with a minimum of 4GB RAM and WINDOWS 10 (x64 bit) and 100 GB ROM to support usage of various software like PYTHON 3.6.5. ✓ Testing and training undergo using latest technology like KERAS ,TENSORFLOW ,NUMPY and PILLOW.

3.4 Problem Solution Fit:



4. REQUIREMENT ANALYSIS

4.1 Functional Requirement:

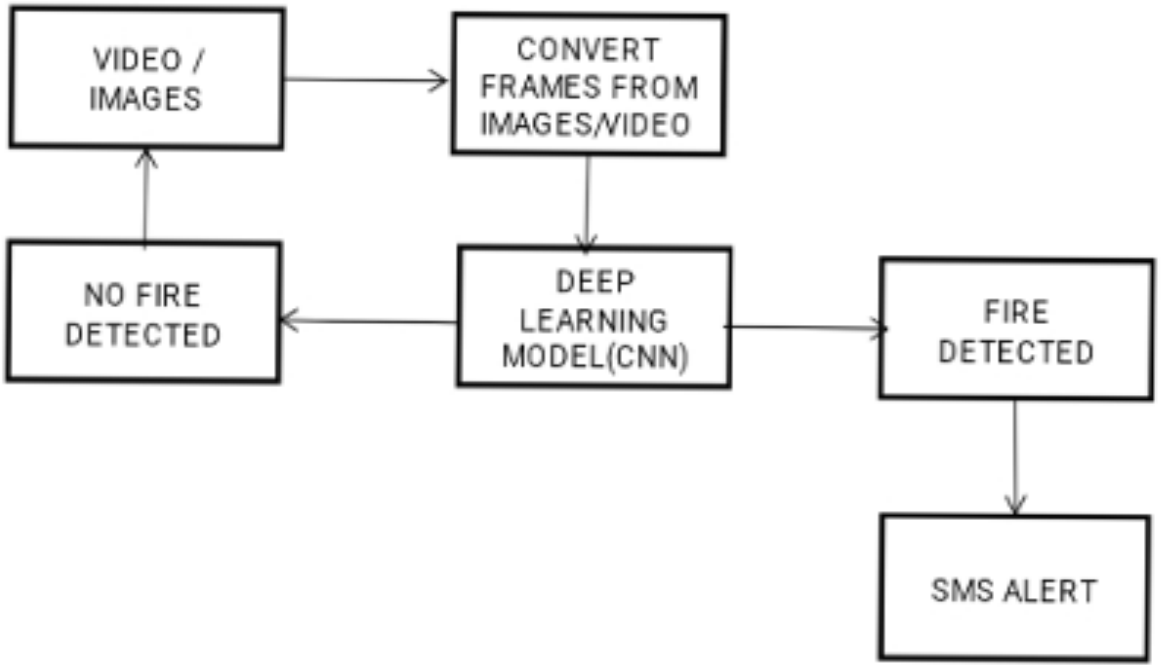
FR No.	FunctionalRequirement(Epic)	Sub Requirement (Story/Sub-Task)
FR -1	Images surveillance start	Start surveillance from satellites is a trained model
FR -2	Image processing is being used to monitor the fire	Exact location monitoring through camera
FR -3	Detect the fire	Fire is detected through CNN model
FR -4	Alert	sending notification to the fire authorities

4.2. Non-Functional Requirement:

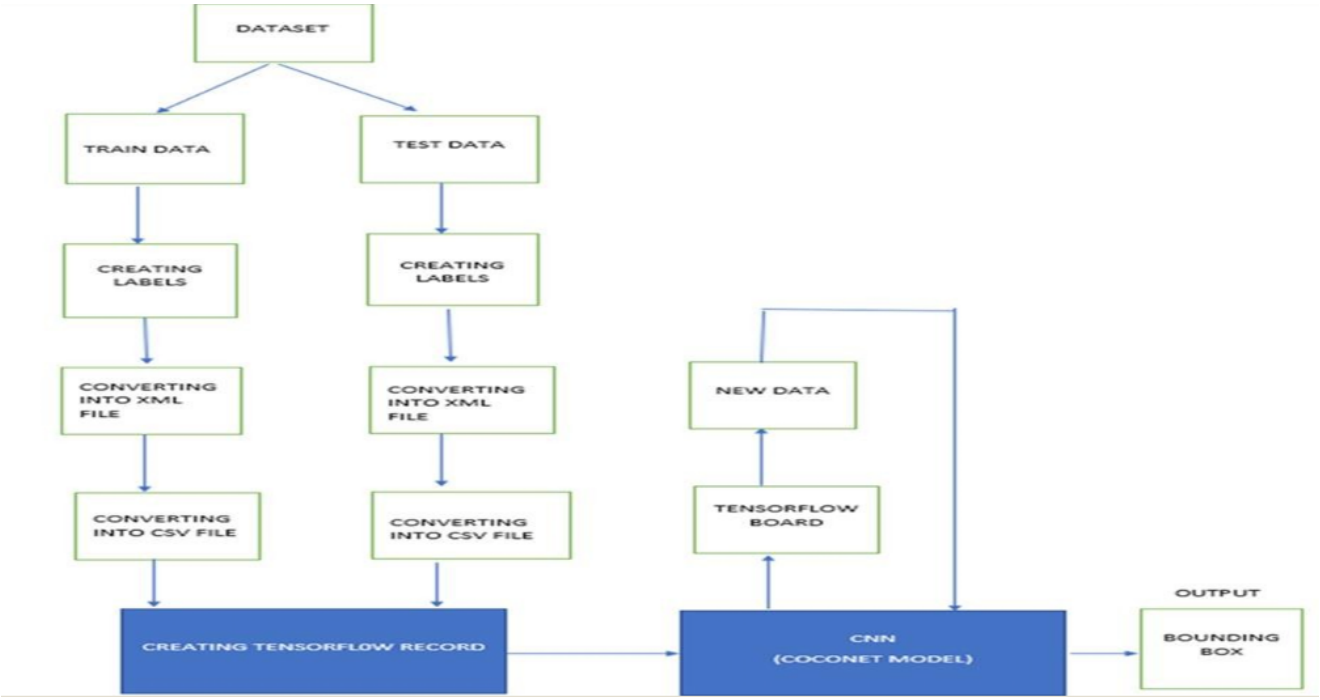
NFr.no	Non-functional requirement	Description
Nfr-1	Usability	Usability is a unique and significant perspective to analyse user requirements, which can further improve the design quality, according to AI devices with machine learning.
Nfr-2	Security	▪ HD and powerful CCTV cameras are used. ▪ The fire is found using image processing and 24-hour monitoring.
Nfr-3	Reliability	A real-time and dependable fire detection method for an early warning system is required to ensure an effective response to an incident.
Nfr-4	Performance	• The system is intended to monitor forest fires through image processing via a camera. • CCTV cameras are used to process images and detect forest fires. • The twilio module is used to send the forest officer an alert message.
Nfr-5	Availability	o By progressing to a more advanced system that uses real-time CCTV cameras to detect and alert on fires. o The convolutional neural network algorithm is extremely useful for detecting fire in captured images.
Nfr-6	Scalability	By detecting forest fires early, we can prevent loss of life as well as resource damage while decreasing air pollution, landslides, soil erosion, and Emission emissions into the environment.

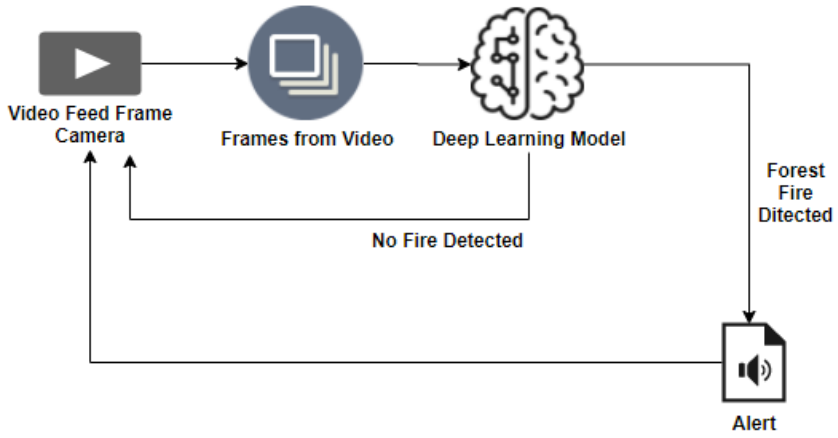
5. PROJECT DESIGN

5.1. Data Flow Diagram:



5.2. Solution & Technical Architecture:





5.3. User Stories:

User Story Number: USN-1:

As a user, I can register for the application by entering my email,password, and confirming my password.

User Story Number: USN-2:

As a user, I will receive confirmation email once I have registered for the application usage.

User Story Number: USN-3:

Whenever the fire is detected, the information is given to the database.

User Story Number: USN-4:

When there is a wildfire then the alarm system is activated.

User Story Number: USN-5:

And the alarm was also sent to the corresponding departments and made them know that the wildfire had erupted.

User Story Number: USN-6:

Required actions will be taken in order to control erupted wildfire by reaching as possible to the destination with the help of detecting systems.

6. PROJECT PLANNING & SCHEDULING

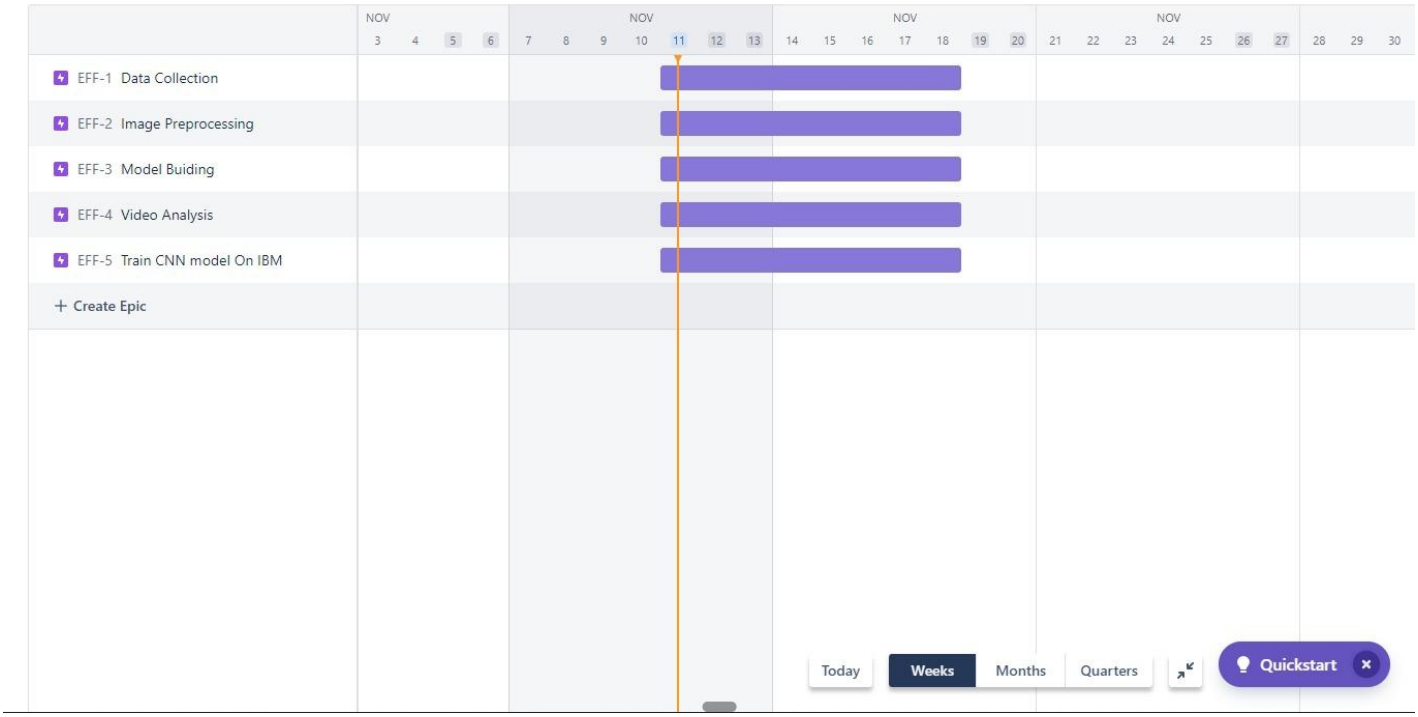
6.1. Sprint Planning & Estimation:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	20	High	Sushilnandas S S Amala Ajin Karthick T K Santhiya K Sherlinfrancis
Sprint-1		USN-2	As a user, I will receive confirmation emailonce I	20	High	Sushilnandas S S Amala Ajin Karthick T K Santhiya K
			have registered for the application usage.			Sherlinfrancis
Sprint-2	Input	USN-3	Whenever the fire is detected, the information is given to the database.	20	High	Sushilnandas S S Amala Ajin Karthick T K Santhiya K Sherlinfrancis

Sprint-2		USN-4	When it is the wildfire then the alarming system is activated.	20	High	Sushilnandas S S Amala Ajin Karthick T K Santhiya K Sherlinfrancis
Sprint-3	Output	USN-5	And the alarm also sent to the corresponding departments and made them know that the wildfire is erupted.	20	High	Sushilnandas S S Amala Ajin Karthick T K Santhiya K Sherlinfrancis
Sprint-4	Action	USN-6	Required actions will be taken in order to control erupted wildfire by reaching as earlyas possible to the destination with thehelp of detecting systems.	20	High	Sushilnandas S S Amala Ajin Karthick T K Santhiya K Sherlinfrancis

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	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.2. Sprint Delivery Schedule:



6.3 Reports from JIRA

JIRA has categorized reports in four levels, which are

1.6.1. Agile

1.6.2. Issue Analysis

1.6.3. Forecast & Management

1.6.4. Others

7. CODING & SOLUTIONING

(Explain the features added in the project along with code)

7.1. Feature 1:

```
import pandas as pd

import numpy as np
import tensorflow
from tensorflow.keras.models import Sequential
from tensorflow.keras import layers
from keras.layers import Dense
from keras.layers import Conv2D
from keras.layers import MaxPooling2D,Dropout
from keras.layers import Flatten

model=Sequential()

model.add(Conv2D(32, (3,3), activation = "relu", input_shape =
(64,64,3)))

model.add(MaxPooling2D(pool_size=(2,2)))

model.add(Flatten())

model.add(Dense(units=128, activation='relu'))

model.add(Dense(units=46, activation='softmax'))

model.summary()

Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d_1 (Conv2D)           (None, 62, 62, 32)        896

 max_pooling2d_1 (MaxPooling  (None, 31, 31, 32)       0
 2D)

 flatten_1 (Flatten)         (None, 30752)             0

 dense_2 (Dense)             (None, 128)               3936384

 dense_3 (Dense)             (None, 46)                5934

=================================================================
Total params: 3,943,214
Trainable params: 3,943,214
Non-trainable params: 0
_________________________________________________________________

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

from keras.preprocessing.image import ImageDataGenerator
```

```
train_datagen =
ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horiz
ontal_flip=True)
test_datagen = ImageDataGenerator(rescale=1./255)

x_train = train_datagen.flow_from_directory(r"C:\Users\Naren Karthick\
Desktop\Dataset\train_set",target_size=(64,64),batch_size=32,
color_mode="rgb",class_mode="sparse")
x_test = test_datagen.flow_from_directory(r"C:\Users\Naren Karthick\
Desktop\Dataset\test_set",target_size=(64,64),batch_size=32,
color_mode="rgb",class_mode="sparse")

Found 436 images belonging to 2 classes.
Found 121 images belonging to 2 classes.

model.fit(x_train, epochs=20, steps_per_epoch=len(x_train))

Epoch 1/20
14/14 [==============================] - 45s 3s/step - loss: 1.2970 -
accuracy: 0.6560
Epoch 2/20
14/14 [==============================] - 33s 2s/step - loss: 0.3180 -
accuracy: 0.8761
Epoch 3/20
14/14 [==============================] - 32s 2s/step - loss: 0.1810 -
accuracy: 0.9106
Epoch 4/20
14/14 [==============================] - 31s 2s/step - loss: 0.1526 -
accuracy: 0.9404
Epoch 5/20
14/14 [==============================] - 36s 3s/step - loss: 0.1545 -
accuracy: 0.9220
Epoch 6/20
14/14 [==============================] - 32s 2s/step - loss: 0.1391 -
accuracy: 0.9381
Epoch 7/20
14/14 [==============================] - 32s 2s/step - loss: 0.1280 -
accuracy: 0.9404
Epoch 8/20
14/14 [==============================] - 30s 2s/step - loss: 0.1139 -
accuracy: 0.9587
Epoch 9/20
14/14 [==============================] - 30s 2s/step - loss: 0.1605 -
accuracy: 0.9312
Epoch 10/20
14/14 [==============================] - 31s 2s/step - loss: 0.1202 -
accuracy: 0.9427
Epoch 11/20
14/14 [==============================] - 33s 2s/step - loss: 0.1381 -
accuracy: 0.9404
Epoch 12/20
```

```
14/14 [==============================] - 31s 2s/step - loss: 0.1018 -
accuracy: 0.9702
Epoch 13/20
14/14 [==============================] - 32s 2s/step - loss: 0.0819 -
accuracy: 0.9656
Epoch 14/20
14/14 [==============================] - 32s 2s/step - loss: 0.0972 -
accuracy: 0.9610
Epoch 15/20
14/14 [==============================] - 30s 2s/step - loss: 0.0723 -
accuracy: 0.9725
Epoch 16/20
14/14 [==============================] - 30s 2s/step - loss: 0.0658 -
accuracy: 0.9794
Epoch 17/20
14/14 [==============================] - 30s 2s/step - loss: 0.0733 -
accuracy: 0.9771
Epoch 18/20
14/14 [==============================] - 31s 2s/step - loss: 0.1335 -
accuracy: 0.9312
Epoch 19/20
14/14 [==============================] - 30s 2s/step - loss: 0.1192 -
accuracy: 0.9472
Epoch 20/20
14/14 [==============================] - 30s 2s/step - loss: 0.1397 -
accuracy: 0.9404

<keras.callbacks.History at 0x23451db2850>

ls

 Volume in drive C has no label.
 Volume Serial Number is 5CC8-3212

 Directory of C:\Users\Naren Karthick

12-11-2022  18:08    <DIR>          .
04-09-2022  04:43    <DIR>          ..
11-11-2022  17:52    <DIR>          .conda
22-09-2022  13:54                25 .condarc
22-09-2022  13:53    <DIR>          .continuum
12-11-2022  17:24    <DIR>          .ipynb_checkpoints
11-11-2022  19:17    <DIR>          .ipython
12-11-2022  13:32    <DIR>          .jupyter
11-11-2022  18:44    <DIR>          .keras
11-11-2022  18:19    <DIR>          .matplotlib
11-11-2022  17:03    <DIR>          anaconda3
11-11-2022  19:14       326,807,773 archive.zip
04-09-2022  04:27    <DIR>          Contacts
12-11-2022  17:21    <DIR>          Desktop
05-09-2022  08:10    <DIR>          Documents
```

```
12-11-2022  17:21    <DIR>          Downloads
04-09-2022  04:27    <DIR>          Favorites
12-11-2022  17:53        47,353,024 forestfire.h5
11-11-2022  19:18               740 Image Preprocessing .ipynb
11-11-2022  21:19            15,356 Image Preprocessing1.ipynb
12-11-2022  17:11             2,044 Image preprocessing2.ipynb
04-09-2022  04:27    <DIR>          Links
12-11-2022  18:08            14,120 Model Building .ipynb
04-09-2022  04:27    <DIR>          Music
10-11-2022  23:17    <DIR>          OneDrive
21-10-2022  18:06    <DIR>          Pictures
04-09-2022  04:27    <DIR>          Saved Games
04-09-2022  04:43    <DIR>          Searches
11-11-2022  00:03    <DIR>          Videos
               7 File(s)    374,193,082 bytes
              22 Dir(s)  384,470,372,352 bytes free
```

```
pwd
```

```
'C:\\Users\\Naren Karthick'
```

```
model.save("forestfire.h5")
```

```
ls
```

```
 Volume in drive C has no label.
 Volume Serial Number is 5CC8-3212

 Directory of C:\Users\Naren Karthick

12-11-2022  18:10    <DIR>          .
04-09-2022  04:43    <DIR>          ..
11-11-2022  17:52    <DIR>          .conda
22-09-2022  13:54                25 .condarc
22-09-2022  13:53    <DIR>          .continuum
12-11-2022  17:24    <DIR>          .ipynb_checkpoints
11-11-2022  19:17    <DIR>          .ipython
12-11-2022  13:32    <DIR>          .jupyter
11-11-2022  18:44    <DIR>          .keras
11-11-2022  18:19    <DIR>          .matplotlib
11-11-2022  17:03    <DIR>          anaconda3
11-11-2022  19:14       326,807,773 archive.zip
04-09-2022  04:27    <DIR>          Contacts
12-11-2022  17:21    <DIR>          Desktop
05-09-2022  08:10    <DIR>          Documents
12-11-2022  17:21    <DIR>          Downloads
04-09-2022  04:27    <DIR>          Favorites
12-11-2022  18:14        47,353,048 forestfire.h5
11-11-2022  19:18               740 Image Preprocessing .ipynb
11-11-2022  21:19            15,356 Image Preprocessing1.ipynb
12-11-2022  17:11             2,044 Image preprocessing2.ipynb
```

```
04-09-2022  04:27    <DIR>          Links
12-11-2022  18:10            14,630 Model Building .ipynb
04-09-2022  04:27    <DIR>          Music
10-11-2022  23:17    <DIR>          OneDrive
21-10-2022  18:06    <DIR>          Pictures
04-09-2022  04:27    <DIR>          Saved Games
04-09-2022  04:43    <DIR>          Searches
11-11-2022  00:03    <DIR>          Videos
               7 File(s)    374,193,616 bytes
              22 Dir(s)  384,469,266,432 bytes free
```

```
from keras.models import load_model
```

```
from tensorflow.keras.preprocessing import image
```

```
import numpy as np
```

```
!pip install opencv-python
```

```
Collecting opencv-python
  Using cached opencv_python-4.6.0.66-cp36-abi3-win_amd64.whl (35.6
MB)
Requirement already satisfied: numpy>=1.17.3 in c:\users\naren
karthick\anaconda3\lib\site-packages (from opencv-python) (1.20.1)
Installing collected packages: opencv-python
Successfully installed opencv-python-4.6.0.66
```

```
import cv2
```

```
model = load_model("forestfire.h5")
```

```
img = image.load_img(r'C:\Users\Naren Karthick\Desktop\Data Set\
Dataset\Dataset\test_set\with fire\
b2683a16be44f230a90f50bb944315e994b43042e43df798bb4feaf27e0f8bc8.jpg')
x = image.img_to_array(img)
res = cv2.resize(x,dsize=(128,128),interpolation=cv2.INTER_CUBIC)
```

```
img
```

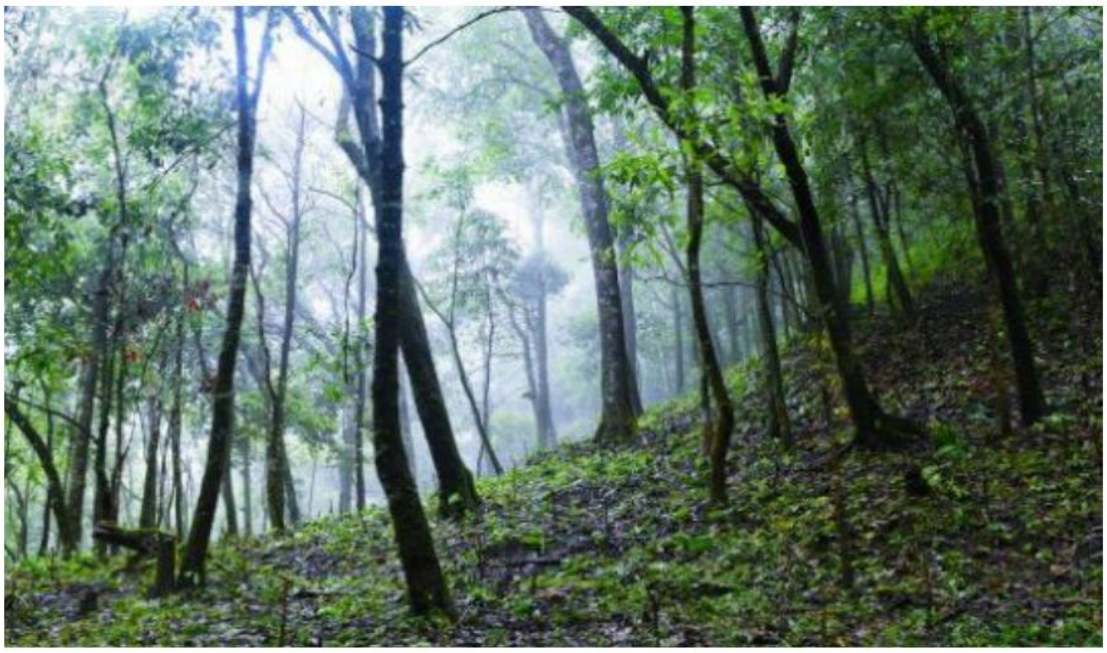
```
x = np.expand_dims(x,axis = 0)
pred = model.predict(x_train)
pred
```

```
14/14 [==============================] - 45s 3s/step

array([[1.0000000e+00, 6.7479867e-12, 7.5567395e-19, ..., 3.5867293e-
15,
        6.2255773e-16, 3.2628154e-15],
       [9.9994636e-01, 2.6501093e-05, 1.2889150e-08, ..., 4.2572020e-
07,
        2.1382685e-07, 5.8927327e-07],
       [9.9965549e-01, 2.8003295e-04, 8.8186844e-08, ..., 7.6502948e-
07,
        5.7591427e-07, 9.2841850e-07],
       ...,
       [7.5766561e-03, 9.9242181e-01, 6.5295012e-08, ..., 1.9949618e-
09,
        1.4114412e-08, 1.7105979e-09],
       [1.1927463e-04, 9.9988031e-01, 5.1217466e-08, ..., 5.0179766e-
10,
        3.1853780e-09, 2.4303284e-10],
       [1.1197172e-01, 8.8801783e-01, 2.0486947e-07, ..., 2.0454452e-
08,
        8.1707476e-08, 1.7954127e-08]], dtype=float32)
```

```
img = image.load_img(r'C:\Users\Naren Karthick\Desktop\Data Set\
Dataset\Dataset\train_set\forest\with_fire (261).jpg')
x = image.img_to_array(img)
res = cv2.resize(x,dsize=(128,128),interpolation=cv2.INTER_CUBIC)

img
```



```
ls

 Volume in drive C has no label.
 Volume Serial Number is 5CC8-3212

 Directory of C:\Users\Naren Karthick

12-11-2022  18:38    <DIR>          .
04-09-2022  04:43    <DIR>          ..
11-11-2022  17:52    <DIR>          .conda
22-09-2022  13:54                25 .condarc
22-09-2022  13:53    <DIR>          .continuum
12-11-2022  17:24    <DIR>          .ipynb_checkpoints
11-11-2022  19:17    <DIR>          .ipython
12-11-2022  13:32    <DIR>          .jupyter
11-11-2022  18:44    <DIR>          .keras
11-11-2022  18:19    <DIR>          .matplotlib
11-11-2022  17:03    <DIR>          anaconda3
11-11-2022  19:14       326,807,773 archive.zip
04-09-2022  04:27    <DIR>          Contacts
12-11-2022  17:21    <DIR>          Desktop
05-09-2022  08:10    <DIR>          Documents
12-11-2022  17:21    <DIR>          Downloads
```

```
04-09-2022  04:27    <DIR>          Favorites
12-11-2022  18:14        47,353,048 forestfire.h5
11-11-2022  19:18               740 Image Preprocessing .ipynb
11-11-2022  21:19            15,356 Image Preprocessing1.ipynb
12-11-2022  17:11             2,044 Image preprocessing2.ipynb
04-09-2022  04:27    <DIR>          Links
12-11-2022  18:38         3,977,927 Model Building .ipynb
04-09-2022  04:27    <DIR>          Music
10-11-2022  23:17    <DIR>          OneDrive
21-10-2022  18:06    <DIR>          Pictures
04-09-2022  04:27    <DIR>          Saved Games
04-09-2022  04:43    <DIR>          Searches
11-11-2022  00:03    <DIR>          Videos
               7 File(s)    378,156,913 bytes
              22 Dir(s)  384,367,251,456 bytes free
```

```
pred
```

```
array([[1.0000000e+00, 6.7479867e-12, 7.5567395e-19, ..., 3.5867293e-
15,
        6.2255773e-16, 3.2628154e-15],
       [9.9994636e-01, 2.6501093e-05, 1.2889150e-08, ..., 4.2572020e-
07,
        2.1382685e-07, 5.8927327e-07],
       [9.9965549e-01, 2.8003295e-04, 8.8186844e-08, ..., 7.6502948e-
07,
        5.7591427e-07, 9.2841850e-07],
       ...,
       [7.5766561e-03, 9.9242181e-01, 6.5295012e-08, ..., 1.9949618e-
09,
        1.4114412e-08, 1.7105979e-09],
       [1.1927463e-04, 9.9988031e-01, 5.1217466e-08, ..., 5.0179766e-
10,
        3.1853780e-09, 2.4303284e-10],
       [1.1197172e-01, 8.8801783e-01, 2.0486947e-07, ..., 2.0454452e-
08,
        8.1707476e-08, 1.7954127e-08]], dtype=float32)
```

```
!pip install twilio
!pip install playsound
```

```
Collecting twilio
  Using cached twilio-7.15.2-py2.py3-none-any.whl (1.4 MB)
Requirement already satisfied: pytz in c:\users\naren karthick\
anaconda3\lib\site-packages (from twilio) (2021.1)
Requirement already satisfied: requests>=2.0.0 in c:\users\naren
karthick\anaconda3\lib\site-packages (from twilio) (2.25.1)
Collecting PyJWT<3.0.0,>=2.0.0
  Downloading PyJWT-2.6.0-py3-none-any.whl (20 kB)
Requirement already satisfied: chardet<5,>=3.0.2 in c:\users\naren
karthick\anaconda3\lib\site-packages (from requests>=2.0.0->twilio)
```

```
(4.0.0)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\naren
karthick\anaconda3\lib\site-packages (from requests>=2.0.0->twilio)
(2020.12.5)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in c:\users\naren
karthick\anaconda3\lib\site-packages (from requests>=2.0.0->twilio)
(1.26.4)
Requirement already satisfied: idna<3,>=2.5 in c:\users\naren
karthick\anaconda3\lib\site-packages (from requests>=2.0.0->twilio)
(2.10)
Installing collected packages: PyJWT, twilio
Successfully installed PyJWT-2.6.0 twilio-7.15.2
Collecting playsound
  Using cached playsound-1.3.0.tar.gz (7.7 kB)
Building wheels for collected packages: playsound
  Building wheel for playsound (setup.py): started
  Building wheel for playsound (setup.py): finished with status 'done'
  Created wheel for playsound: filename=playsound-1.3.0-py3-none-
any.whl size=7026
sha256=c7fc3b7e9ad6c0f4544b587a58566bf2d179398837bb6e54ca32f4c355663e0
e
  Stored in directory: c:\users\naren karthick\appdata\local\pip\
cache\wheels\73\cd\cf\
9750b618d54bd81c20e4c34fb24a423a5b095920367cdb3f71
Successfully built playsound
Installing collected packages: playsound
Successfully installed playsound-1.3.0
```

```
import cv2
import numpy as np
from keras.preprocessing import image
from keras.models import load_model
from twilio.rest import Client
from playsound import playsound

model = load_model(r'forestfire.h5')

video = cv2.VideoCapture(0)

name = ['forest','with fire']

ls

 Volume in drive C has no label.
 Volume Serial Number is 5CC8-3212

 Directory of C:\Users\Naren Karthick

12-11-2022  18:44    <DIR>          .
04-09-2022  04:43    <DIR>          ..
11-11-2022  17:52    <DIR>          .conda
```

```
22-09-2022  13:54                25 .condarc
22-09-2022  13:53    <DIR>          .continuum
12-11-2022  17:24    <DIR>          .ipynb_checkpoints
11-11-2022  19:17    <DIR>          .ipython
12-11-2022  13:32    <DIR>          .jupyter
11-11-2022  18:44    <DIR>          .keras
11-11-2022  18:19    <DIR>          .matplotlib
11-11-2022  17:03    <DIR>          anaconda3
11-11-2022  19:14       326,807,773 archive.zip
04-09-2022  04:27    <DIR>          Contacts
12-11-2022  18:45    <DIR>          Desktop
05-09-2022  08:10    <DIR>          Documents
12-11-2022  18:48    <DIR>          Downloads
04-09-2022  04:27    <DIR>          Favorites
12-11-2022  18:14        47,353,048 forestfire.h5
11-11-2022  19:18               740 Image Preprocessing .ipynb
11-11-2022  21:19            15,356 Image Preprocessing1.ipynb
12-11-2022  17:11             2,044 Image preprocessing2.ipynb
04-09-2022  04:27    <DIR>          Links
12-11-2022  18:44         3,984,212 Model Building .ipynb
04-09-2022  04:27    <DIR>          Music
10-11-2022  23:17    <DIR>          OneDrive
21-10-2022  18:06    <DIR>          Pictures
04-09-2022  04:27    <DIR>          Saved Games
04-09-2022  04:43    <DIR>          Searches
11-11-2022  00:03    <DIR>          Videos
               7 File(s)    378,163,198 bytes
              22 Dir(s)  384,339,755,008 bytes free
```

7.2 Feature 2:

```
!pip install tensorflow
!pip install opencv-python
!pip install opencv-contrib-python
import tensorflow as tf
import numpy as np
from tensorflow import keras
import os
import cv2
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.preprocessing import image
```

```
Requirement already satisfied: tensorflow in c:\users\naren karthick\
anaconda3\lib\site-packages (2.10.0)
Requirement already satisfied: libclang>=13.0.0 in c:\users\naren
karthick\anaconda3\lib\site-packages (from tensorflow) (14.0.6)
Requirement already satisfied: packaging in c:\users\naren karthick\
anaconda3\lib\site-packages (from tensorflow) (20.9)
Requirement already satisfied: absl-py>=1.0.0 in c:\users\naren
karthick\anaconda3\lib\site-packages (from tensorflow) (1.3.0)
Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.23.1 in
c:\users\naren karthick\anaconda3\lib\site-packages (from tensorflow)
(0.27.0)
Requirement already satisfied: wrapt>=1.11.0 in c:\users\naren
karthick\anaconda3\lib\site-packages (from tensorflow) (1.12.1)
Requirement already satisfied: tensorboard<2.11,>=2.10 in c:\users\
naren karthick\anaconda3\lib\site-packages (from tensorflow) (2.10.1)
Requirement already satisfied: tensorflow-estimator<2.11,>=2.10.0 in
c:\users\naren karthick\anaconda3\lib\site-packages (from tensorflow)
(2.10.0)
Requirement already satisfied: h5py>=2.9.0 in c:\users\naren karthick\
anaconda3\lib\site-packages (from tensorflow) (2.10.0)
Requirement already satisfied: opt-einsum>=2.3.2 in c:\users\naren
karthick\anaconda3\lib\site-packages (from tensorflow) (3.3.0)
Requirement already satisfied: keras-preprocessing>=1.1.1 in c:\users\
naren karthick\anaconda3\lib\site-packages (from tensorflow) (1.1.2)
Requirement already satisfied: grpcio<2.0,>=1.24.3 in c:\users\naren
karthick\anaconda3\lib\site-packages (from tensorflow) (1.50.0)
Requirement already satisfied: gast<=0.4.0,>=0.2.1 in c:\users\naren
karthick\anaconda3\lib\site-packages (from tensorflow) (0.4.0)
Requirement already satisfied: typing-extensions>=3.6.6 in c:\users\
naren karthick\anaconda3\lib\site-packages (from tensorflow) (3.7.4.3)
Requirement already satisfied: flatbuffers>=2.0 in c:\users\naren
karthick\anaconda3\lib\site-packages (from tensorflow) (22.10.26)
Requirement already satisfied: keras<2.11,>=2.10.0 in c:\users\naren
karthick\anaconda3\lib\site-packages (from tensorflow) (2.10.0)
Requirement already satisfied: astunparse>=1.6.0 in c:\users\naren
karthick\anaconda3\lib\site-packages (from tensorflow) (1.6.3)
Requirement already satisfied: six>=1.12.0 in c:\users\naren karthick\
anaconda3\lib\site-packages (from tensorflow) (1.15.0)
Requirement already satisfied: google-pasta>=0.1.1 in c:\users\naren
```

```
karthick\anaconda3\lib\site-packages (from tensorflow) (0.2.0)
Requirement already satisfied: setuptools in c:\users\naren karthick\
anaconda3\lib\site-packages (from tensorflow) (52.0.0.post20210125)
Requirement already satisfied: numpy>=1.20 in c:\users\naren karthick\
anaconda3\lib\site-packages (from tensorflow) (1.20.1)
Requirement already satisfied: termcolor>=1.1.0 in c:\users\naren
karthick\anaconda3\lib\site-packages (from tensorflow) (2.1.0)
Requirement already satisfied: protobuf<3.20,>=3.9.2 in c:\users\naren
karthick\anaconda3\lib\site-packages (from tensorflow) (3.19.6)
Requirement already satisfied: wheel<1.0,>=0.23.0 in c:\users\naren
karthick\anaconda3\lib\site-packages (from astunparse>=1.6.0-
>tensorflow) (0.36.2)
Requirement already satisfied: google-auth<3,>=1.6.3 in c:\users\naren
karthick\anaconda3\lib\site-packages (from tensorboard<2.11,>=2.10-
>tensorflow) (2.14.1)
Requirement already satisfied: google-auth-oauthlib<0.5,>=0.4.1 in c:\
users\naren karthick\anaconda3\lib\site-packages (from
tensorboard<2.11,>=2.10->tensorflow) (0.4.6)
Requirement already satisfied: tensorboard-data-server<0.7.0,>=0.6.0
in c:\users\naren karthick\anaconda3\lib\site-packages (from
tensorboard<2.11,>=2.10->tensorflow) (0.6.1)
Requirement already satisfied: markdown>=2.6.8 in c:\users\naren
karthick\anaconda3\lib\site-packages (from tensorboard<2.11,>=2.10-
>tensorflow) (3.4.1)
Requirement already satisfied: werkzeug>=1.0.1 in c:\users\naren
karthick\anaconda3\lib\site-packages (from tensorboard<2.11,>=2.10-
>tensorflow) (1.0.1)
Requirement already satisfied: requests<3,>=2.21.0 in c:\users\naren
karthick\anaconda3\lib\site-packages (from tensorboard<2.11,>=2.10-
>tensorflow) (2.28.1)
Requirement already satisfied: tensorboard-plugin-wit>=1.6.0 in c:\
users\naren karthick\anaconda3\lib\site-packages (from
tensorboard<2.11,>=2.10->tensorflow) (1.8.1)
Requirement already satisfied: rsa<5,>=3.1.4 in c:\users\naren
karthick\anaconda3\lib\site-packages (from google-auth<3,>=1.6.3-
>tensorboard<2.11,>=2.10->tensorflow) (4.9)
Requirement already satisfied: cachetools<6.0,>=2.0.0 in c:\users\
naren karthick\anaconda3\lib\site-packages (from google-
auth<3,>=1.6.3->tensorboard<2.11,>=2.10->tensorflow) (5.2.0)
Requirement already satisfied: pyasn1-modules>=0.2.1 in c:\users\naren
karthick\anaconda3\lib\site-packages (from google-auth<3,>=1.6.3-
>tensorboard<2.11,>=2.10->tensorflow) (0.2.8)
Requirement already satisfied: requests-oauthlib>=0.7.0 in c:\users\
naren karthick\anaconda3\lib\site-packages (from google-auth-
oauthlib<0.5,>=0.4.1->tensorboard<2.11,>=2.10->tensorflow) (1.3.1)
Requirement already satisfied: importlib-metadata>=4.4 in c:\users\
naren karthick\anaconda3\lib\site-packages (from markdown>=2.6.8-
>tensorboard<2.11,>=2.10->tensorflow) (5.0.0)
Requirement already satisfied: zipp>=0.5 in c:\users\naren karthick\
anaconda3\lib\site-packages (from importlib-metadata>=4.4-
```

```
>markdown>=2.6.8->tensorboard<2.11,>=2.10->tensorflow) (3.4.1)
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in c:\users\naren
karthick\anaconda3\lib\site-packages (from pyasn1-modules>=0.2.1-
>google-auth<3,>=1.6.3->tensorboard<2.11,>=2.10->tensorflow) (0.4.8)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\naren
karthick\anaconda3\lib\site-packages (from requests<3,>=2.21.0-
>tensorboard<2.11,>=2.10->tensorflow) (2020.12.5)
Requirement already satisfied: idna<4,>=2.5 in c:\users\naren
karthick\anaconda3\lib\site-packages (from requests<3,>=2.21.0-
>tensorboard<2.11,>=2.10->tensorflow) (2.10)
Requirement already satisfied: charset-normalizer<3,>=2 in c:\users\
naren karthick\anaconda3\lib\site-packages (from requests<3,>=2.21.0-
>tensorboard<2.11,>=2.10->tensorflow) (2.1.1)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in c:\users\naren
karthick\anaconda3\lib\site-packages (from requests<3,>=2.21.0-
>tensorboard<2.11,>=2.10->tensorflow) (1.26.12)
Requirement already satisfied: oauthlib>=3.0.0 in c:\users\naren
karthick\anaconda3\lib\site-packages (from requests-oauthlib>=0.7.0-
>google-auth-oauthlib<0.5,>=0.4.1->tensorboard<2.11,>=2.10-
>tensorflow) (3.2.2)
Requirement already satisfied: pyparsing>=2.0.2 in c:\users\naren
karthick\anaconda3\lib\site-packages (from packaging->tensorflow)
(2.4.7)
Requirement already satisfied: opencv-python in c:\users\naren
karthick\anaconda3\lib\site-packages (4.6.0.66)
Requirement already satisfied: numpy>=1.14.5 in c:\users\naren
karthick\anaconda3\lib\site-packages (from opencv-python) (1.20.1)
Collecting opencv-contrib-python
  Downloading opencv_contrib_python-4.6.0.66-cp36-abi3-win_amd64.whl
(42.5 MB)
Requirement already satisfied: numpy>=1.17.3 in c:\users\naren
karthick\anaconda3\lib\site-packages (from opencv-contrib-python)
(1.20.1)
Installing collected packages: opencv-contrib-python
Successfully installed opencv-contrib-python-4.6.0.66
```

```
train=ImageDataGenerator(rescale=1./255,
                                 shear_range=0.2,
                                 rotation_range=180,
                                 zoom_range=0.2,
                                 horizontal_flip=True)
train = ImageDataGenerator(rescale=1/255)
test = ImageDataGenerator(rescale=1/255)

train_dataset = train.flow_from_directory(r"C:\Users\Naren Karthick\
Desktop\Dataset\train_set",
                                          target_size=(128,128),
                                          batch_size = 32,
                                          class_mode = 'binary' )

Found 436 images belonging to 2 classes.
```

```
Epoch 4/5
14/14 [==============================] - 52s 4s/step - loss: 0.2369 -
accuracy: 0.9197 - val_loss: 0.0972 - val_accuracy: 0.9587
Epoch 5/5
14/14 [==============================] - 51s 4s/step - loss: 0.1540 -
accuracy: 0.9381 - val_loss: 0.0341 - val_accuracy: 1.0000

predictions = model.predict(test_dataset)
predictions = np.round(predictions)

4/4 [==============================] - 16s 3s/step

predictions

array([[1.],
       [1.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
       [1.],
       [1.],
       [0.],
       [0.],
       [1.],
       [0.],
       [0.],
       [1.],
       [0.],
       [1.],
       [0.],
       [1.],
       [1.],
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       [0.],
       [0.],
       [0.],
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       [0.],
       [0.],
       [0.],
       [0.],
       [1.],
       [0.],
       [1.],
       [0.],
```

```
       [1.],
       [0.],
       [0.],
       [1.],
       [0.],
       [0.],
       [1.],
       [1.],
       [0.],
       [1.],
       [0.],
       [0.],
       [0.],
       [0.],
       [0.],
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       [0.],
       [0.],
       [1.],
       [1.],
       [1.],
       [0.],
       [0.],
       [1.],
       [0.],
       [1.],
       [1.],
       [0.],
       [1.],
       [1.],
       [0.],
       [0.]], dtype=float32)
```

```
print(len(predictions))
```

```
121
```

```
model.save("forestfire.h5")
```

```
ls
```

```
 Volume in drive C has no label.
 Volume Serial Number is 5CC8-3212

 Directory of C:\Users\Naren Karthick

13-11-2022  18:59    <DIR>          .
04-09-2022  04:43    <DIR>          ..
11-11-2022  17:52    <DIR>          .conda
```

```
  if val == 1:
    print(" fire")
  elif val == 0:
      print("no fire")

predictImage(r"C:\Users\Naren Karthick\Desktop\Dataset\test_set\with
fire\forestfire.jpg")
```

```
1/1 [==============================] - 1s 717ms/step
[[1.]]
 fire
```

```
!pip install twilio
```

```
Requirement already satisfied: twilio in c:\users\naren karthick\
anaconda3\lib\site-packages (7.15.2)
Requirement already satisfied: pytz in c:\users\naren karthick\
anaconda3\lib\site-packages (from twilio) (2021.1)
Requirement already satisfied: PyJWT<3.0.0,>=2.0.0 in c:\users\naren
karthick\anaconda3\lib\site-packages (from twilio) (2.6.0)
Requirement already satisfied: requests>=2.0.0 in c:\users\naren
karthick\anaconda3\lib\site-packages (from twilio) (2.28.1)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in c:\users\naren
karthick\anaconda3\lib\site-packages (from requests>=2.0.0->twilio)
(1.26.12)
Requirement already satisfied: idna<4,>=2.5 in c:\users\naren
karthick\anaconda3\lib\site-packages (from requests>=2.0.0->twilio)
(2.10)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\naren
karthick\anaconda3\lib\site-packages (from requests>=2.0.0->twilio)
(2020.12.5)
Requirement already satisfied: charset-normalizer<3,>=2 in c:\users\
naren karthick\anaconda3\lib\site-packages (from requests>=2.0.0-
>twilio) (2.1.1)
```

```
!pip install playsound
```

```
Requirement already satisfied: playsound in c:\users\naren karthick\
anaconda3\lib\site-packages (1.3.0)
```

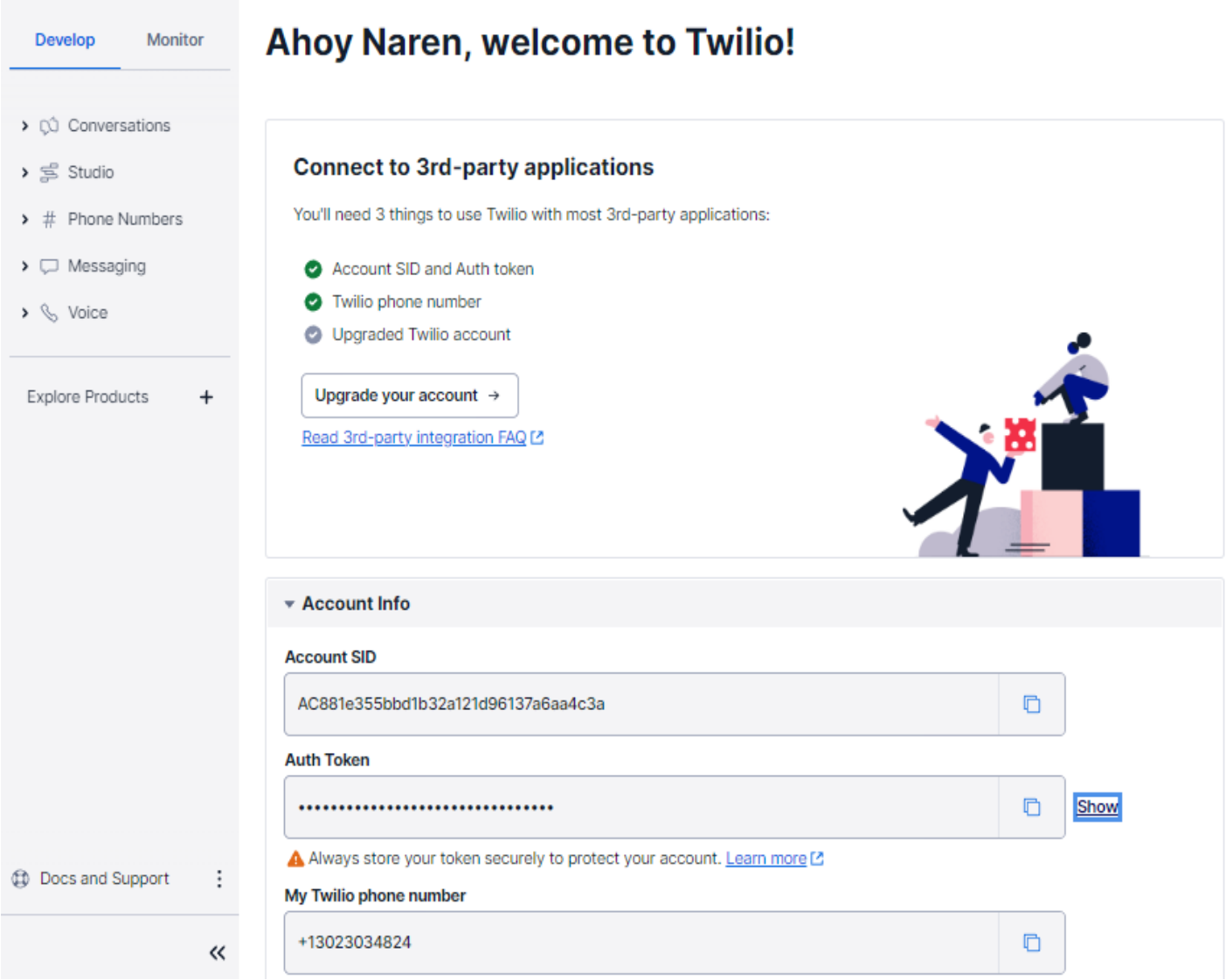
```
import cv2

import numpy as np

from keras.preprocessing import image

from keras.models import load_model

from twilio.rest import Client
```

```
model = load_model(r'forestfire.h5')

video = cv2.VideoCapture(r'C:\Users\Naren Karthick\Desktop\Forest
Fire.mp4')

name = ['forest','with forest']

account_sid = 'AC881e355bbd1b32a121d96137a6aa4c3a'
auth_token = '7fa9e1d4490f3cefe09b223fad130f04'
client = Client(account_sid, auth_token)

message = client.messages \
    .create(
         body='Forest fire is detected , stay alert',
         from_='+13023034824',
         to='+=918778227402'
     )

print(message.sid)

SMf73b13bb50f6ad3df8a2a3dff2113a7c

import cv2
import numpy as np
from keras_preprocessing import image
from keras.models import load_model
from  twilio.rest import Client
from playsound import playsound

#load the saved model
model = load_model(r'forestfire.h5')
video = cv2.VideoCapture(r'C:\Users\Naren Karthick\Desktop\Forest
Fire.mp4')
name = ['forest','with forest']

ls

 Volume in drive C has no label.
 Volume Serial Number is 5CC8-3212

 Directory of C:\Users\Naren Karthick

13-11-2022  19:21    <DIR>          .
04-09-2022  04:43    <DIR>          ..
11-11-2022  17:52    <DIR>          .conda
22-09-2022  13:54                25 .condarc
22-09-2022  13:53    <DIR>          .continuum
13-11-2022  18:40    <DIR>          .ipynb_checkpoints
11-11-2022  19:17    <DIR>          .ipython
```

```
12-11-2022  13:32    <DIR>          .jupyter
11-11-2022  18:44    <DIR>          .keras
11-11-2022  18:19    <DIR>          .matplotlib
13-11-2022  14:11               116 .node_repl_history
11-11-2022  17:03    <DIR>          anaconda3
11-11-2022  19:14       326,807,773 archive.zip
13-11-2022  17:49        43,115,882 B3_IBM_model.tar.gb
04-09-2022  04:27    <DIR>          Contacts
13-11-2022  17:03            40,484 Deployment (1).ipynb
13-11-2022  17:52            41,849 Deployment.ipynb
13-11-2022  19:12    <DIR>          Desktop
05-09-2022  08:10    <DIR>          Documents
13-11-2022  17:11    <DIR>          Downloads
04-09-2022  04:27    <DIR>          Favorites
13-11-2022  18:58         2,483,648 forestfire.h5
13-11-2022  16:33        43,115,882 forestfire-classification.tgz
11-11-2022  19:18               740 Image Preprocessing .ipynb
11-11-2022  21:19            15,356 Image Preprocessing1.ipynb
12-11-2022  17:11             2,044 Image preprocessing2.ipynb
04-09-2022  04:27    <DIR>          Links
12-11-2022  18:54         3,986,428 Model Building .ipynb
04-09-2022  04:27    <DIR>          Music
12-11-2022  20:13        30,683,136 node-v18.12.1-x64.msi
13-11-2022  18:25    <DIR>          OneDrive
13-11-2022  19:21            26,235 OpenCv.ipynb
21-10-2022  18:06    <DIR>          Pictures
12-11-2022  19:06       396,601,896 pycharm-community-2022.2.3.exe
04-09-2022  04:27    <DIR>          Saved Games
04-09-2022  04:43    <DIR>          Searches
11-11-2022  00:03    <DIR>          Videos
              15 File(s)    846,921,494 bytes
              22 Dir(s)  381,040,427,008 bytes free
```

8. TESTING

8.1. Test Cases:



TWILIO ACCOUNT

```
account_sid = 'AC881e355bbd1b32a121d96137a6aa4c3a'
auth_token = '7fa9e1d4490f3cefe09b223fad130f04'
client = Client(account_sid, auth_token)
message = client.messages \
.create(
body='Forest fire is detected , stay alert',
from_='+13023034824',
to='+=918778227402'
)
print(message.sid)
```

8.2. User Acceptance Testing:

2. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	5	5	5	5	20
Duplicate	0	0	0	0	0
External	5	5	0	1	11
Fixed	10	10	5	6	31
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	0	0	0	0
Totals	20	20	12	13	64

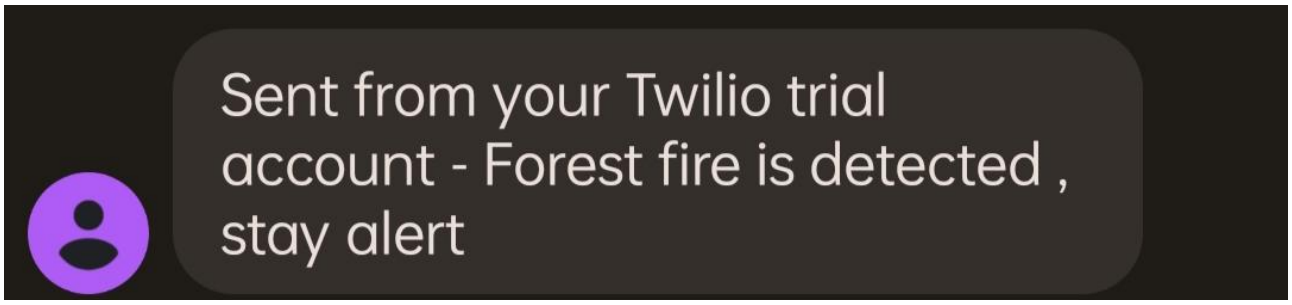
3. Test Case Analysis

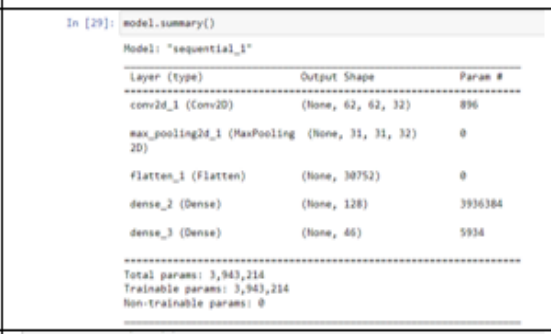
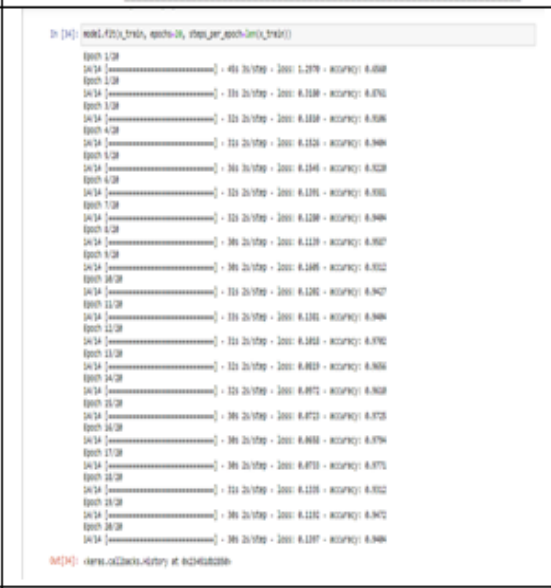
This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Client Application	5	0	0	5
Security	5	0	0	5
Video Capture	2	0	0	2
Image Classifier	2	0	0	2

9. RESULTS

9.1 Performance Metrics:



S.No	Parameter	Values	Screenshot
1.	Model Summary	**Total programs: 896** **Training Params: 896** **Non-Training Params: 0**	
2.	Accuracy	Training Accuracy - 65.60 Validation Accuracy – 94.04	
3.	Confidence Score (Only Yolo Projects)	Class Detected - NA Confidence Score - NA	----------

10. ADVANTAGES & DISADVANTAGES

Advantages:

It refreshes the habitat zones: Fire clears out plants and trees to make more natural resources available to the habitat. Fewer trees mean more water becomes available for the remaining plants and animals that call the area their home. New grass and shrubs are food sources for a number of animals as well. A ground cover that comes back after a fire becomes a new micro-habitat. Everything is refreshed with a fire.

Low-intensity fires don't usually harm trees: The bark of a tree is like an armored shell against fire, pests, and other things that could damage them. Most forest fires burn at low- temperature levels when conditions are optimal and this causes minimal damage to the trees of the forest when it occurs. The end result is a clearing of the ground floor of the forest while the trees are able to continue standing majestically.

Decreases the Wastes on Forests: Forests have a lot of waste that ends up building up over time and these wastes can help create wildfires. If a large wildfire breaks out it might take weeks to control it and the damage it can cause is just too extensive to understand for us. Waste such as dead leaves on the ground can be pretty useful for wildfires to feed on and small forest fires just deal with these wastes properly without going out of control.

Disadvantages:

A forest fire sets up the potential for soil erosion to occur: Forest fires clear the underbrush away and encourage new growth, but there is a period of time between the fire and the new growth where the forest is vulnerable.

Forest fires always bring death in some form: Maybe it's just the weak plants of the forest that are killed during a fire, but there is always some sort of death that happens when a fire occurs. Sometimes it is the firefighters who are tasked with stopping the fire. It could be animals or pets.

Uncontrolled fires can cause localized air pollution: Despite the amount of global development that has occurred, there are many forests that are difficult or nearly impossible to reach. Fires in these areas are left to burn in an uncontrolled fashion and

this creates air pollution which can affect the local environment and make it difficult to breathe.

11. CONCLUSION

This project will help in early detection of forest fire and the prevention. It also involves the risk factor of analyzing the drone images of affected areas using a machine learning algorithm which overcomes the existing project. This system detects the fire conditions in a short time before any fire accidents spreads over the forest area. The scope of using video frames in the detection of fire using machine learning is challenging as well as innovative. If this system with less error rate can be implemented at a large scale like in big factories, houses, forests, it is possible to prevent damage and loss due to random fire accidents by making use of the Surveillance System.

12. FUTURESCOPE

Future Scope In future, we are planning to install smart water tank system in dense forest where reachability of resources and firefighters is difficult. In addition to that we will be updating the system with more features and reliability. We will also include a high pitch sound system that will keep away the animals from the site of fire.The proposed system can be developed to a more advanced system by integrating wireless sensors with CCTV for added protection and precision. The algorithm shows great promise in adapting to various environments.

13. Appendix

Github and Demo Link:

Github Link:

https://github.com/sushilnandas/Emerging-Methods-of-Forest-Fire

Demo Link:

https://drive.google.com/file/d/1w_WJwOvxaFlOOTTrjlZQFlK5rPlLveCs/view?usp=share_link