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# Artificial Intelligent based Wild Fire Fighting Machine Using Internet of Things

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**Abstract.** The WildFire is the most alarming threat in the ecosystem. Wildfire is one of the human-made or nature-made hazards. There is no such kind of propulsion methods involved in reducing this effect. The proposed system aims to resolve this problem by constructing a Fire fighting machine with an AI-based assistant model. It is now constructed as a field trial. The main aim of the Machine is to produce artificial rains through the drones which will be having the sodium bicarbonate for frosting the cloud to produce rain droplets and reduce the advent of the fire. Thus the data will be automatically be captured and stored in the cloud-based system through the Internet of Things. In this method, we are using Tensorflow for assisting the drones. According to the IoT cloud, the Think speaks is used because it is the open-source platform for accessing data module sets. It is the most efficient and reliable cloud database. The data stored in the cloud are used for providing the AI machines to train themselves with appropriate data to resolve the problem more accurately. The sensors are fixed in the soils and in the trees that tend to provide constant data's about the change in the ecosystem so that the fire can be easily identified once it starts over.

**Keywords:** AI-based machines, Forest Fighter, Tensorflow, Sensors, Internet of things, Cloud database.

# INTRODUCTION

The Forest is the main ecosystem for all the livings starting from the Humans and the animals. It is the main livelihood for all the beings on the earth. Most of the forests are afforested by humans for the woods and other medicinal values of the planktons that are available in the forest. On the other contrary, these forests are deployed by the WildFire due to the unavailability of the proper rain and inadequate maintenance of the ecosystem balance. The forest starts to adhere to catch fore due to the winds and the thorn leaves that are available everywhere in the forest. Thus most cases the Wild Fires are also a greater threat to humankind. People from all the stages get affected by the WildFire. A survey conducted in 2020, proved these disasters are made up due to the summer evacuations and the drought prevailing around the forest that made the WildFire spread around the fore so fast. The survey proved to alleviate such type of condition we have should reinforce the acts such as afforestation is mandatory to reduce this kind of accidents. There are many different types of Wild Fires they are,

- Crown fires-caused due to the lightning and combustion of the oxygen in the dry air, it is the most intense type of wildfire as they burn the trees up to their whole length.
- Surface fires- It is caused by the humans because they are actually due to the campfires or other processes of lilting by the humans unknowingly and this can be easily destroyed once identified. They cause the least disaster to the forest life and ecosystem.
- Ground fires- It occurs naturally due to the drought and needs more time to put off the fire and this will spread slowly as it is due to the dead vegetation's and the dry dust in the ground but there are possibilities of this type of fire to be evolved as the crown fire. So we should be very careful about all these types of fires. We have discussed the forest area by region 2020 as shown in figure 1.
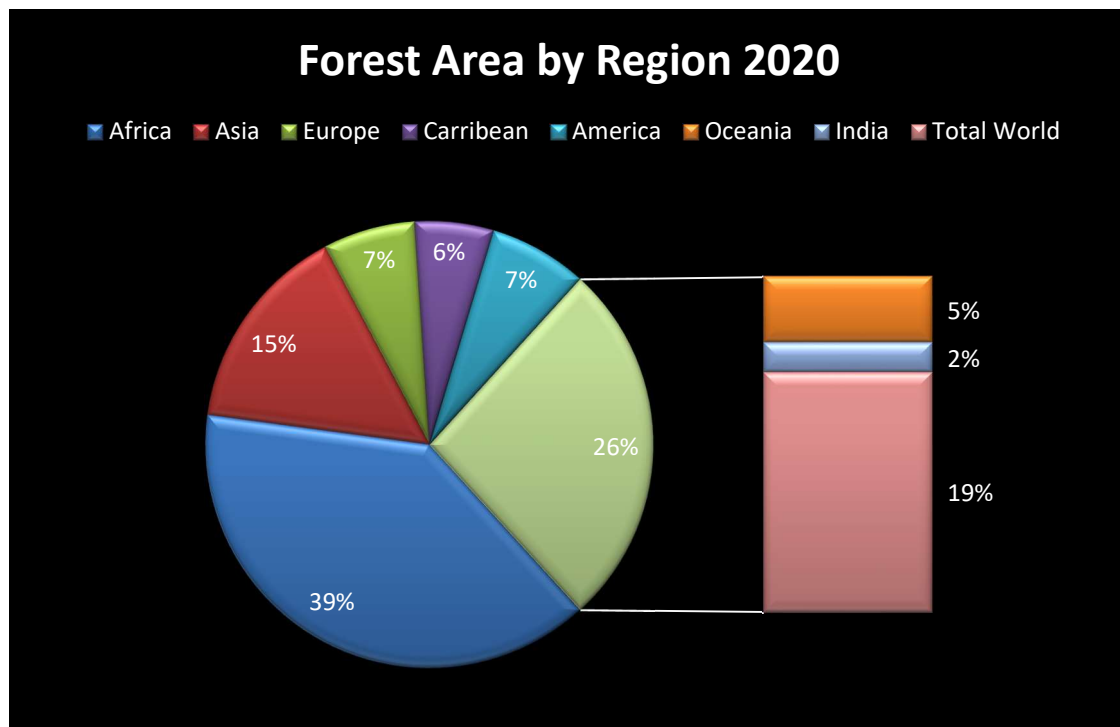


**FIGURE 1**. Forest area by Region (%)

# RELATED WORK

The Wild Fires occur due to natural calamities and the manmade process, the Wildfires are abruptly changed the ecosystem nature. When there is the outbreak of the WildFire the animals and the other living organisms get affected and most of the soil nourishment nutrients also get divested due to the ash deposits after the fire [1-3]. In recent decades many different types of fire fighting machines were designed to reduce the effect of the WildFire. But everything is going in vain. Most of the Machines are made of Quadcopters which are advancements in technology. They also use the Internet of Things technology in their perceptual point of view for data communication. They are heavy in their construction and also cannot fly over a strong distance [4]. The quadcopters are filled with the liquids or powders to be refilled manually and that is showered on the victim places where the fire is high, but in such cases, these copters get damaged due to the fire. The wings even get damaged due to heavy smog in the area, so that the copter controller will not be able to see the clear view of the forest and so that he may land the copter in the wrong place. The copter is water and fire-resistant [5-6]. They are lavishly filled with fire-reducing chemicals and reagents, they should be manually filled by the user and the chemicals may be more toxic to human skins and they also damage their limbs or others on direct contact with the chemicals. Thus the manual power may get weaker or damaged [7].

**TABLE 1.** Deforestation for Various purposes

| S.No | Deforestation for | Areas (million hectares) |
|------|-------------------|--------------------------|
| 1 | Agriculture purposes | 3.652 |
| 2 | River Valley projects | 0.620 |
| 3 | Industrial projects and Townships | 0.146 |
| 4 | Transmission lines and roads | 0.052 |
| 5 | Miscellaneous | 1.008 |
| 6 | WildFire by human and nature | 1.025 |

The deforestation of various purposes is discussed in the avbove table.1 any of the companies are working on IoT-based machines to control some of the processes, the web-based development, and control of the machines are now prevailing in all the fields. The sensors are used to control all the works. Thus they become interactive with each other [8-9]. The main of the IoT is to make everything take in an automated manner and the communication protocols that prevail around them are to communicate wirelessly is the main aim of the IoT. The data sets are exchanged among the unique ID provided by the host thus all the users can access the cloud through the specific IDs provided to them [10-11]. The sensor-based technology and the WSN models were made to rehabilitate the sessions and make them more relevant through the machine performance and the control mechanism of the data manipulation of the data. The communication protocols are defined in the destined values and cannot be accessed without any intervention it needs prior authentication [12]. The AI-based technology works with most of the systems nowadays and people want everything to be automated and want their works to be easily done without any interruption and they all need ease of access to the work they are working with.The AI-based system is created with the bots to work with the control mechanism so that they interact with each other and can be easily automated on the users' end and nothing false will happen. Tensorflow is one of the best open-access software that can be easily updated with the data sets [13-14]. Even with the think speak the modules can be detailed and can be easily accessed to the range of accuracy. The data manipulation and cloud-based protocols are defined and the behavior of the machines is processed according to the codes that they are embedded with. All of these are coordinated with the software protocols [15]. The hardware is just an implementation of the system but the implemented system should work properly with the predefined software protocols. Global forest distributions by major ecological zones is illustrated in figure 2
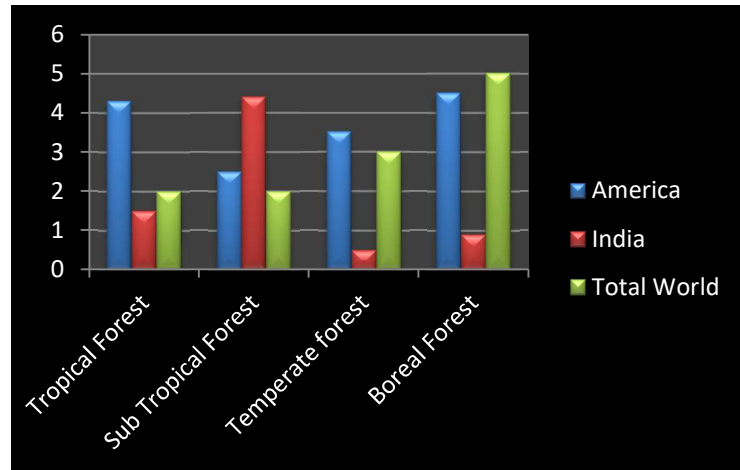
**FIGURE 2.** Global forest distributions by major Ecological zones

## METHODOLOGY

The WildFire is caused by many reasons but there is no proper reason or the outbreak of the fire cannot be identified. Fire is the most cause of destruction and thus this destruction is the dangerous one than deforestation as such the recovery stage takes more than 10 years to recover to its stage of fact.
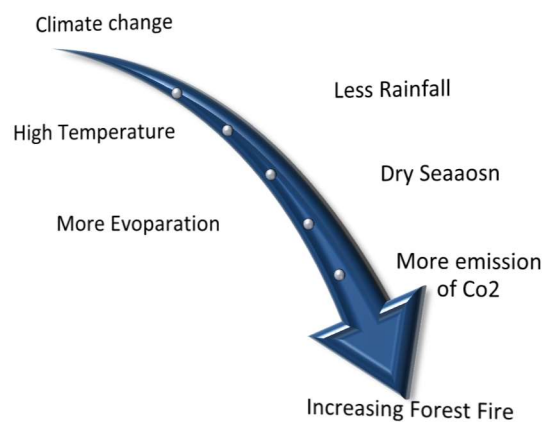


**FIGURE 3.** Impacts of Forest Fire

Thus the forest fighting machine is designed with a solid range of equipment that contains a processor and control units. The proposed system is used to extinguish the fire in the forest. The Wild fire fighting machine is constructed with a Sensor and processor in the Middle end and a cloud for storing and actuating the drones in the higher end and an AI bot to steer control of the working of the Drone in the lower end. All these combined to form a proper working model. The MWIR (Infrared sensor) is used for identifying the fire evolution in the forest. The Impacts of forest fire is shown in figure 3.These sensors fixed Bots will be roaming here and there inside the forest during the summer and the mid-summer days, accordingly for about three months. The sensor-fixed bots are likely to be

roaming in the area at a range of about 10 hectares of land. For every 10 hectares of land, there will be a bot roaming in its outline to check there are any issues. These bots are likely to be roaming in the high drought places and the places where we can see the highest number of dry planktons and the dry trees.
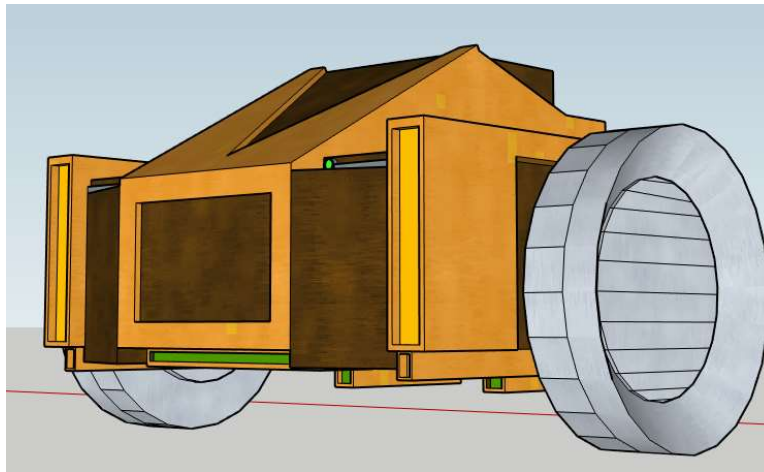


**FIGURE 4.** Rolling Bots

Thus these bots are fitted with a camera module to capture the events (if needed) as depicted in figure 4. If there is an alarming range of smog or the visibility range of the Sensor increases the bots give an alert to the drones which will be residing in the places nearby. A drone station is been constructed at the range of one drone station on 100 hectares of land. Thus when the drone station receives the ground signal, it automatically turns on the loaded drones which are been having Sodium bicarbonate cylinders weighing up to 15-kilo liters are sent to the destined location through the WSN modules fitted in the bots. The drones start relinquishing the sodium bicarbonate liquid over the trees that started firing and fixing the problem as shown in figure 5. After the completion of the process, the drones get back to the primary stations where they can be refilled with the Sodium bicarbonate solution manually.
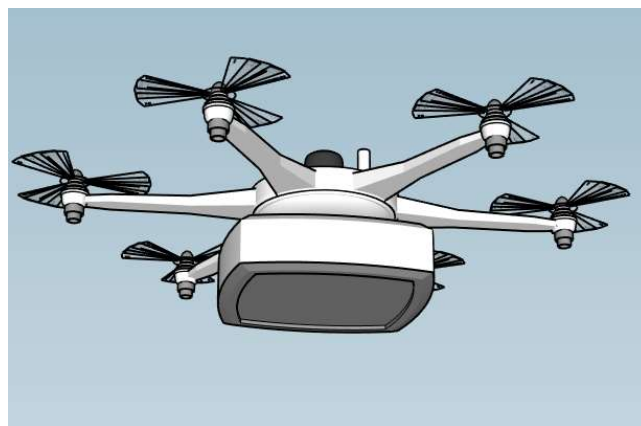


**FIGURE 5.** Drones with Sodium Bicarbonate tanks

Thus these primary stations as shown in figure.6 will be located near the local towns. The drones are monitored by a server and can be operated manually. The drones are solar-charged-based systems that can easily get charged when owing to the destined duty. Thus there will be no manual intervention and any deviation in the purpose of work. The AI-based drones are coded with the help of TensorFlow to work properly. Tensorflow is open source software used to work with AI-based systems.They capture the target image and process them and copy the captured image into

the IoT cloud then process the data into the input as the images are taken from the bots that are revolving in the ground. These processed images are then fed into the Tensorflow as data sets are trained to get more accurate results from the system is detailed in figure 7 & 8.
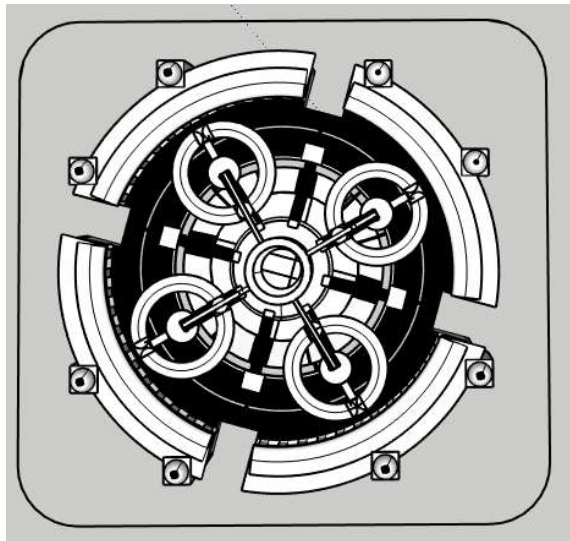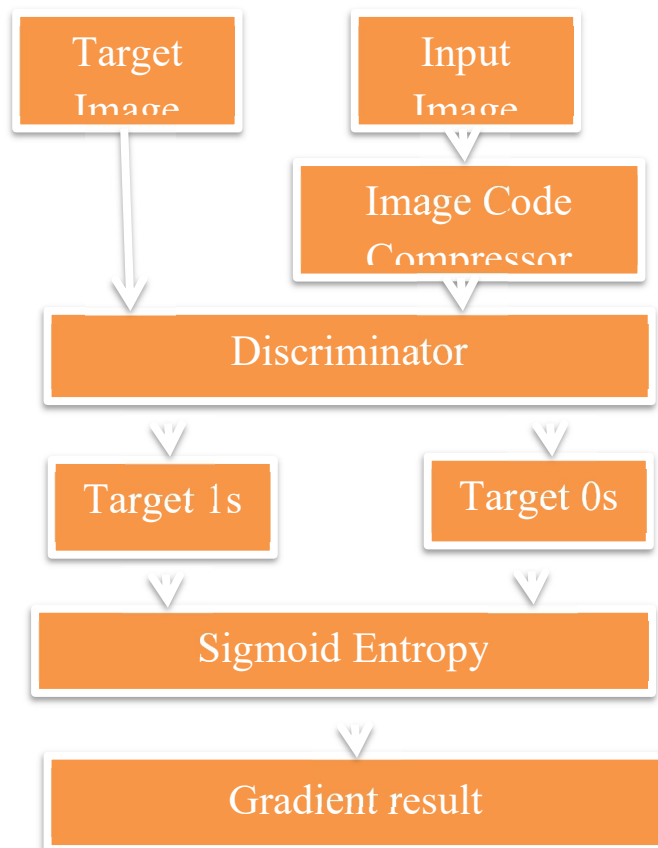


**FIGURE 6.** Drone Stations



**FIGURE 7.** Flow chart for working of the AI system

| Input_Image: Input Layer | Input: {0, 256,253,1} | Target Image: Output Layer |
|---|---|---|
| | Output: {0, 256,253,1} | |

| Concatenate_Concotenate:12 | Input: | {1.256,253.254} |
|---|---|---|
| | Output: | {0,10,256,256} |

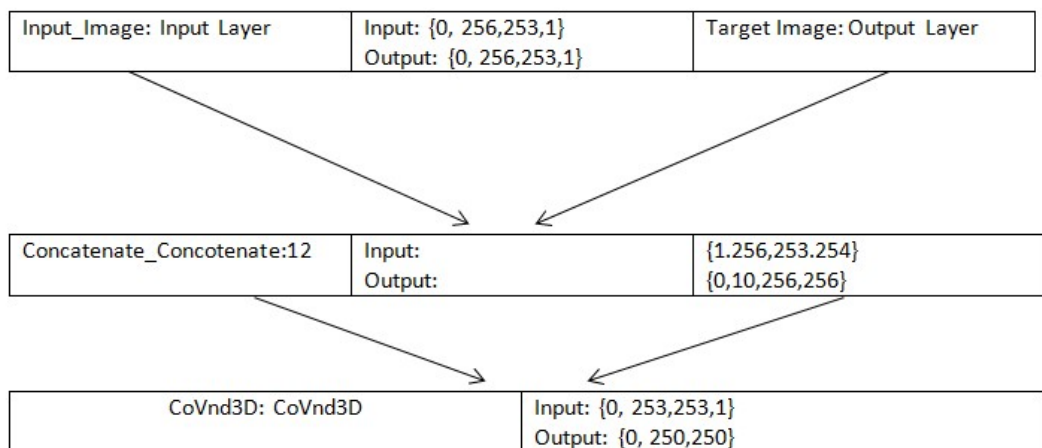| CoVnd3D: CoVnd3D | Input: {0, 253,253,1} |
|---|---|
| | Output: {0, 250,250} |

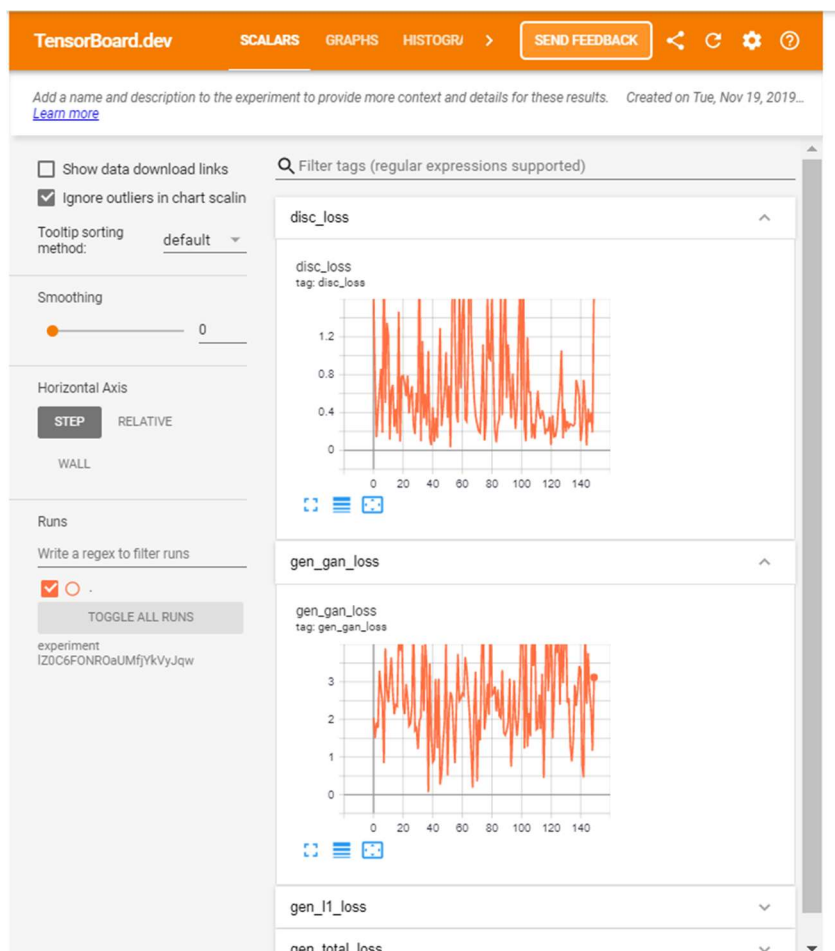**FIGURE 8.** Layers of the AI Protocols



**FIGURE 9.** Tensorflow showing the accurate results of the dissemination of the output.

# CONCLUSION

The Wild Fire fighting machines are designed to stop the enhancement of the fire in the forest. It has the eminent power to stop the fire from spreading out lavishly. Automated vehicles are used to reduce fire automatically without human intervention through the Internet of things and Artificial Intelligent systems. Thus they revolutionize the world in the automation trends. Thus this proposed model produces a good result in the forest fire can be pulled out easily in the early stages without any loss in the ecosystem and produces accurate results. This proposed system provides a better place for the forest to live without any burnt days. It produces an accuracy of about 85% during the trial period.

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