AGNI SHAMAK YANTRA

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What?

- **It is basically a kind of prediction and detection based robot that detects the forest fires and extinguish it.**
- **Prediction of area burnt which can further also classify the fire into big and small.**
- **A good replacement of fireman in national parks and sanctuaries.**

Why?

- **The most common hazard in the forests of Amazon, California and other national parks is the forest fires.**
- **Forest fire causes imbalances in nature and endangers biodiversity by reducing faunal and floral wealth.**

INTRODUCTION

Forests play an important role for supporting the human Environment.Forest fires are among the largest dangers in forest preservation. Data compiled by the Forest Survey of India (FSI) shows that forest fire incidents in the country have risen 49.32% in the past three years. These incidents raise to approx 24000 in 2016, 35000 in 2017 and 37000 in 2018. So that's why we are introducing this device which will predict the fire in the forest areas and extinguish it with the help of automated fire extinguish device.

Abstract

The main goal of this project is to predict the fire probability in the forest areas using Machine Learning algorithm and make a device to find and extinguish fire remotely through Bluetooth and IoT modules in an event of any major fire hazard particularly in national parks and sanctuaries. Thousands of people have lost their lives in such mishaps. Therefore, this project is enhanced to predict and control fire through a robotic vehicle.

Objective

- **To make a device which is more cost effective.**
- **To decrease the work load on human beings.**
- **To make it more reliable.**

Requirements

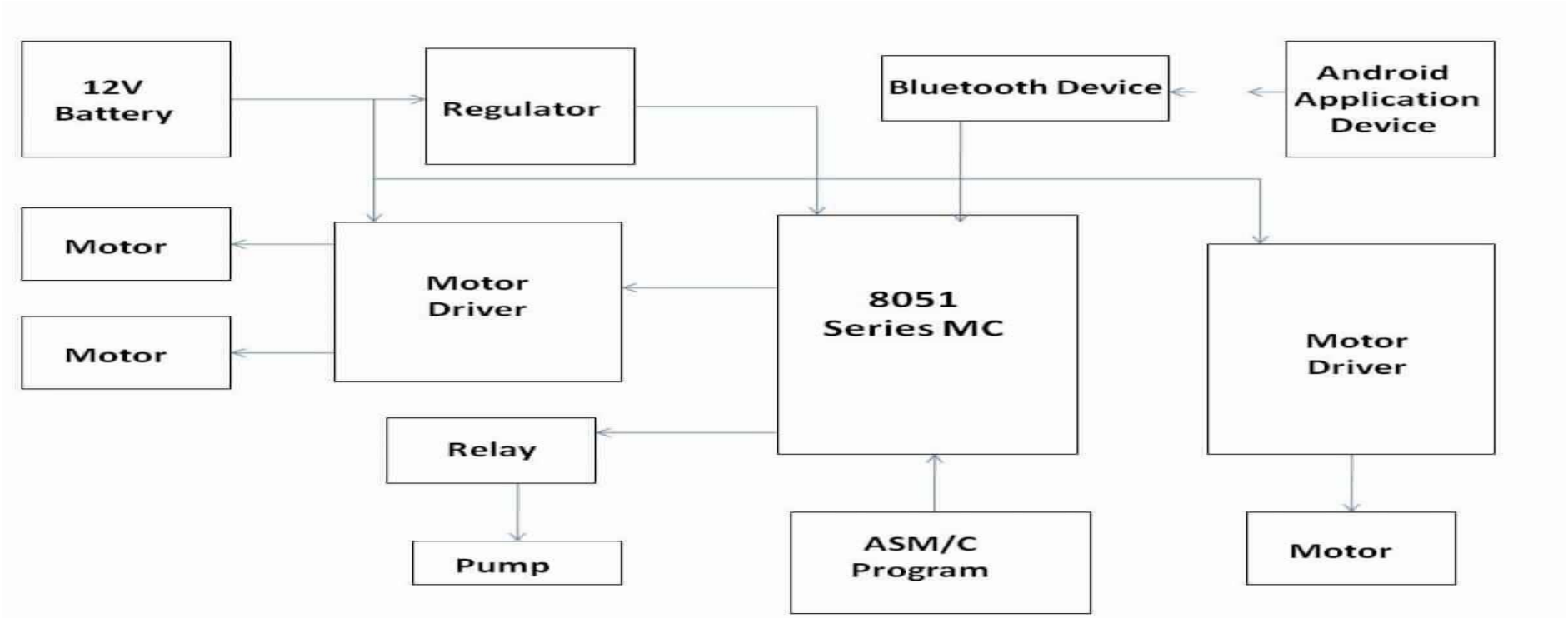
Hardware Requirements:-

- **Arduino UNO**
- **Node MCU**
- **Buzzer**
- **Relay**
- **DC Motor**
- **Temperature Sensor**
- **WiFi Module**
- **HC-05 Bluetooth**
- **Rechargeable batteries**

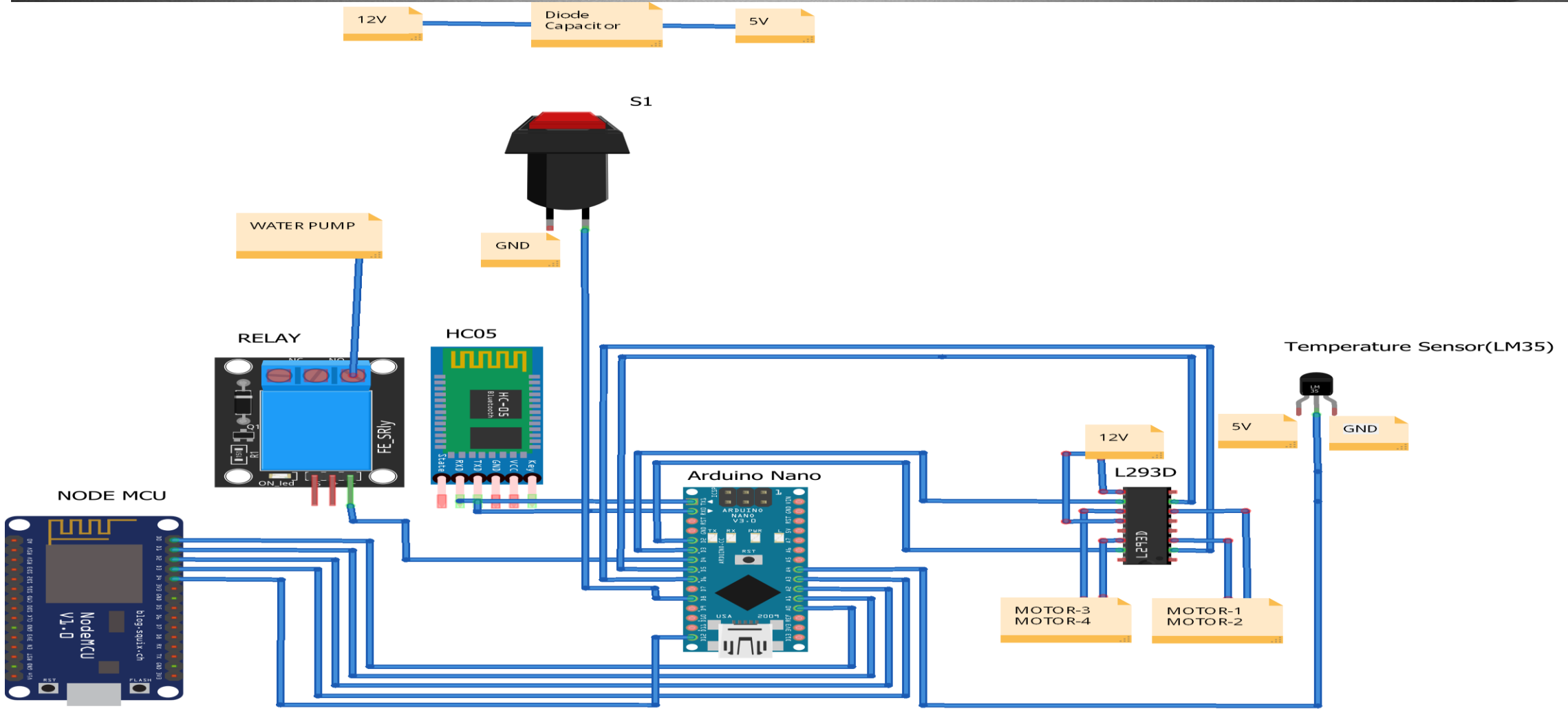
Software Technologies :-

- **IOT**
- **Embedded C**
- **Jupyter-Notebook**
- **Machine Learning**
- **Python**

Block Diagram



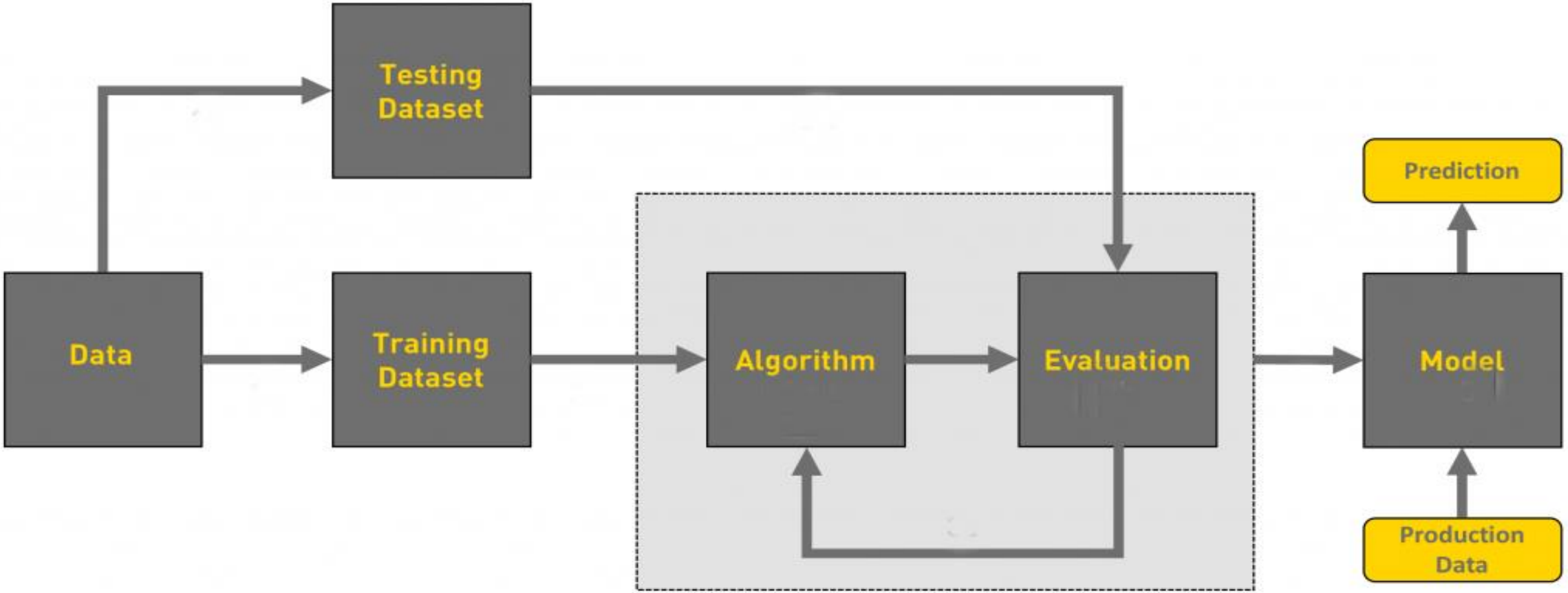
Circuit Diagram



Components Description

- **LM 35 Temperature sensors- used for detection of temperature at site of fire.**
- **HC05 Bluetooth module- For communication between android app, firemen and robot.**
- **L293 D Motor driver- It is used to drive the motors.**
- **Relay circuit- it is used for controlling water pumps.**
- **Node MCU (WIFI- ESP8266)-It provides mobility to the robot.**
- **Arduino nano- it is used for make our robot operational and give the commands to our robot.**
- **Filter capacitor- it is used for smoothing voltages.**

ML WORKING FLOWCHART



Working Methodology(prediction based)

- **This project has two parts first is forest fire prediction using the Machine Learning and second is the device which will extinguish the fire of the forest areas and other areas.**

Forest Fire Prediction:-

- **It is the forest fire prediction using the Meteorological Data with the help of machine learning algorithms. (SVR, Random Forest, Decision tree and Deep Neural Networks).**
- **The forest Fire Weather Index (FWI) is the Canadian system for rating fire danger and it includes six components (Figure 1) [24]: Fine Fuel Moisture Code (FFMC), Duff Moisture Code (DMC), Drought Code (DC), Initial Spread Index (ISI), Buildup Index (BUI) and FWI.**

Working Methodology

- **Robot continuously monitors the surrounding area using temperature sensors.**
- **Whenever temperature exceeds a limit value and flame sensors detected , MCU identifies there is fire and operate the water pump.**
- **Sprinkler starts sprinkling water when it detects fire.**
- **Voltage of 12v battery is transferred to capacitors and finally transfer of 5v to the circuit.**
- **Analog to digital converter used for temperature sensor too.**
- **MCU operates the relay through relay interface.**
- **ANDROID app is used to control the movements of device it is voice controlled as well as works manually.**

Fire Weather Index Structure

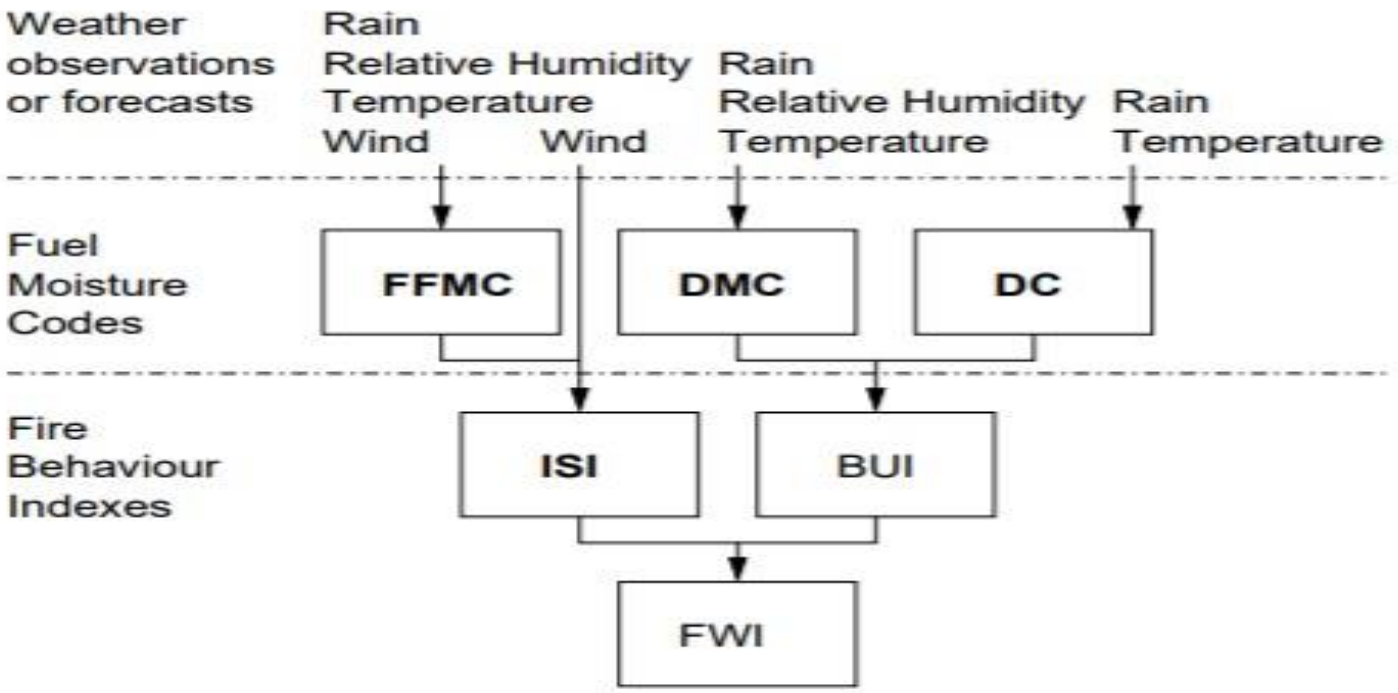
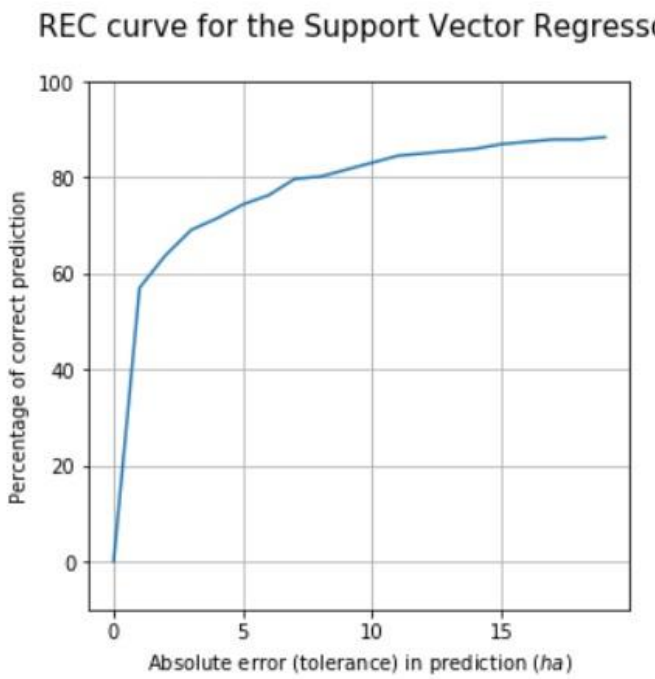
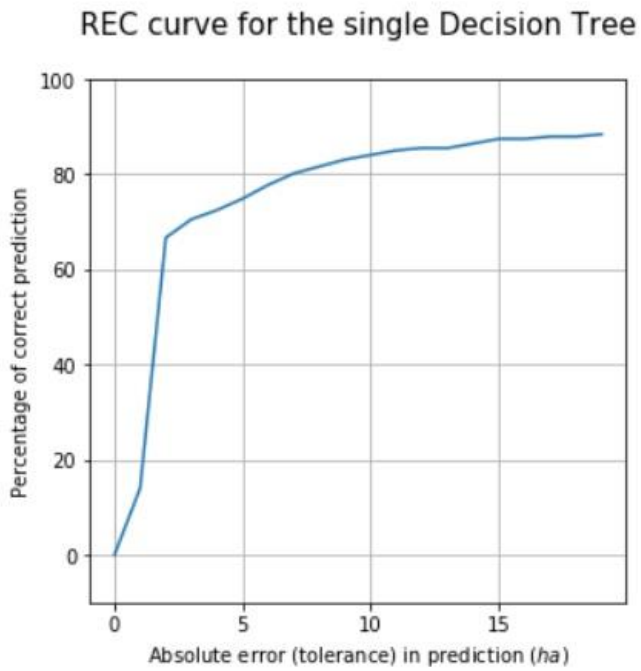
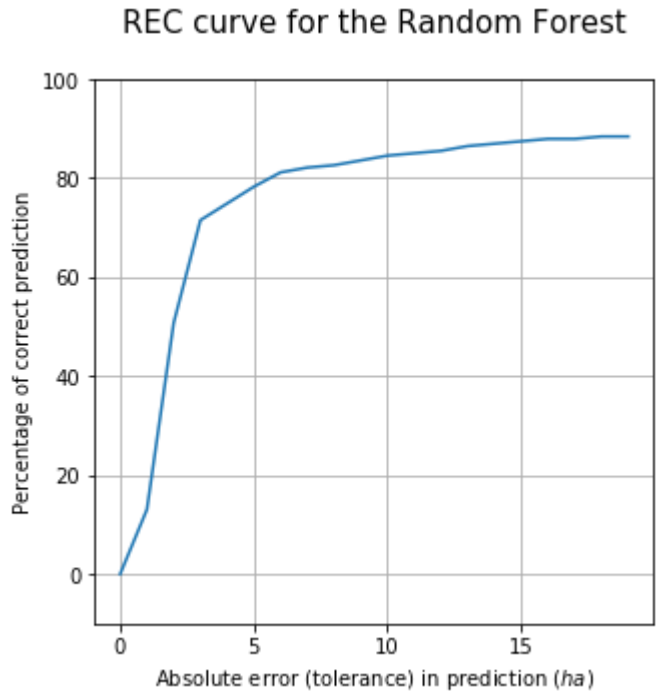


Fig. 1. The Fire Weather Index structure

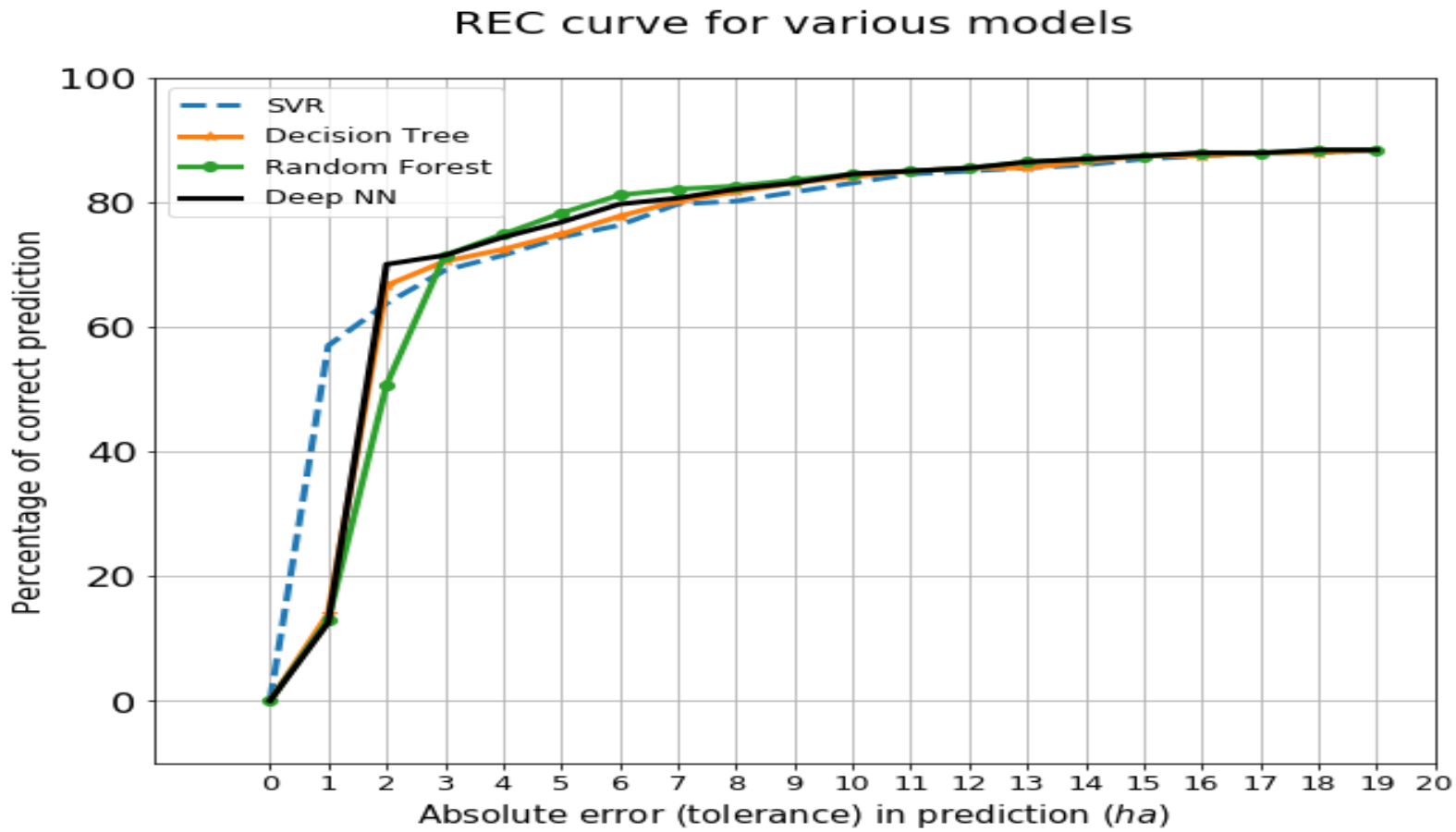
Results


REC curve for the Support Vector Regressor
Percentage of correct prediction
Absolute error (tolerance) in prediction (ha)
0
20
40
60
80
100
0
5
10
15


REC curve for the single Decision Tree
Percentage of correct prediction
Absolute error (tolerance) in prediction (ha)
0
20
40
60
80
100
0
5
10
15


REC curve for the Random Forest
Percentage of correct prediction
Absolute error (tolerance) in prediction (ha)
0
20
40
60
80
100
0
5
10
15

REC Curves Comparision



AgniShamakYantra Display

Conclusion

- **The database included spatial, temporal, components from the Canadian Fire Weather Index (FWI) and four weather conditions. This problem was modeled as a regression task, where the aim was the prediction of the burned area. Five different DM algorithms, including Support Vector Machines (SVM), and four feature selections (using distinct combinations of spatial, temporal, FWI elements and meteorological variables) were tested.**
- **This device is useful in national parks and natural calamity areas.**
- **If fire is detected with the help of sensors, MCU Operates the water pump mechanism through relay circuit.**

Future scope

- **Complete and automatic control of robot.**
- **Camera and video transmission can be added.**
- **Improve weight capacity of robot.**
- **Make it eye, voice and manually controlled device**
- **Further use of some more algorithms.**

THANK YOU