THE PROJECT BLASTOISE - FIRE FIGHTING ROBOT

Telugu Maddileti[1], S Jayanth Reddy[2], Voram Bhavan[3], Shaik Shoiab[4]

Sreenidhi Institute of Science and Technology

[1]Assistant Professor,

[1,2,3]Department of Electronics and Computer Engineering

[4]Department of Mechanical Engineering

Abstract

The destruction caused to nature and human settlements because of forest fire is huge. Deforestation, increase in green house gases because of burning of the woods, damage to the animals living in the forest, resettlement of people living in nearby areas are some problems created because of forest fires. So, making a multipurpose robot which can detect and prevent forest fires would be very much useful. The robot helps us in putting off the fire and sends signals to the concerned authorities in case of a fire outbreak in the jungle. The fire department and the forest department will be able to reach the spot as soon as they can and put off the fire. The robots can cover distance of certain radius in which any fire can be detected by them. Such robots are spread across the forest in order to cover whole forest and hence the greatest treasures of the nature can be saved from vanishing.

I.INTRODUCTION

In many countries all over the world, every one of us has seen many natural calamities creating large disasters in the lives of the mankind. One of them is forest fires. It causes huge loss to living beings, nature and atmosphere also. Each one of us is responsible for protecting the nature from threats like this. This paper will introduce you to "BLASTOISE", a robot which helps us in preventing the spread of fire and warns the concerned authorities when there is a trace of such outbreak. The robot will help us in having a continuous track of events happening inside the wilds. Any unusual event relating to fire happening in the woods will give an immediate warning to the forest department and fire department. Many such robots can be spread across the wild for coverage of larger area. This project explains how technology is a blessing in disguise, which helps humans to have a command on controlling losses caused due to natural calamities.

II. MOTIVATION

The project is inspired from the devastating forest fires of California [1], Amazon and Southern Australian forest which led to loss of rich wildlife heritage and loss of property, many people lost their homes and the infamous loss of the basketball star "Lebron James's house" which made us ponder on a solution to reduce the loss of such scale with "**BLASTOISE**", a unique and mobile robot with high fire extinguishing abilities to reduce risk of human life. Figure 1 shown below contains the statistics of acres of area burned due to forest fires.
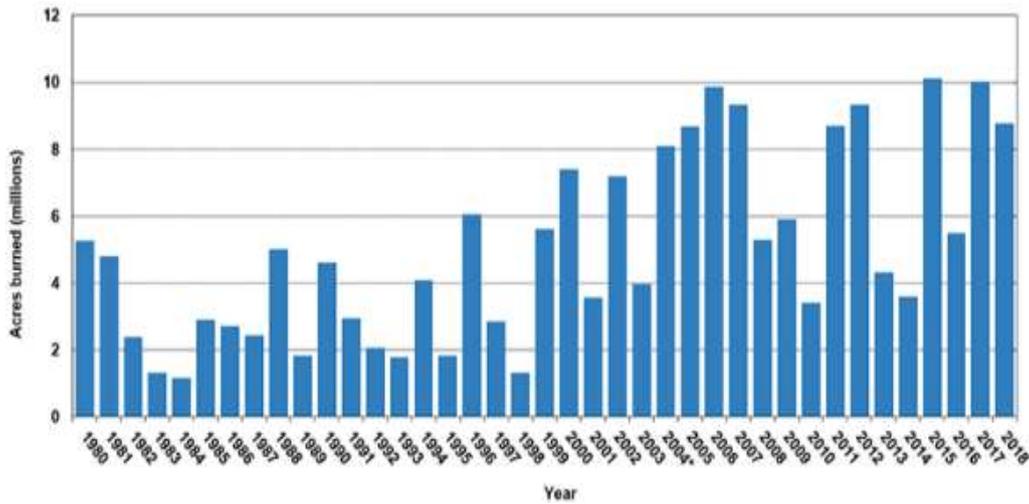
Figure 1. Statistics of acres of area burned

III. Proposed Algorithm

Forest fires cause a lot of damage to the nature. The spread of the fire can be prevented with the help of Blastoise. The robot detects the fire outbreak with the help of camera attached to it. The camera will be rotating 360 degrees so that it can cover radius of certain distance. Image processing is used to detect fire. When RGB values of part of image matches with that of values of fire, a message will be sent to concerned forest & fire departments. The robot also starts sprinkling water to put off fire. The robot will also start ejecting elide balls which will put off fire. It'll check the fire is put-off or not using humidity sensor & sprinkle water if any abnormal temperature is found. By then, the fire department can reach the spot & extinguish it. Such robots can be spread all over the forest to cover maximum area &hence forest fires can be prevented. The lives of various forests can be saved. Figure 2 represents the block diagram of proposed system
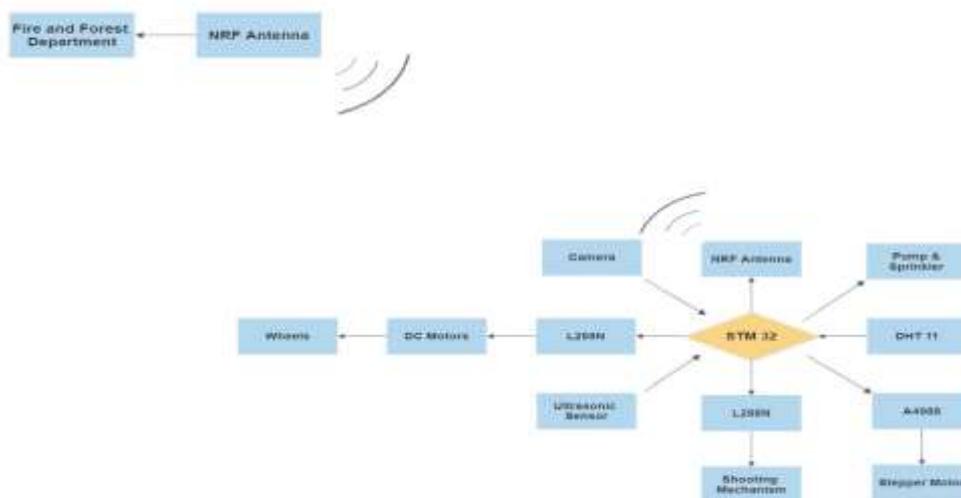

Figure 2- Proposed System

3 .1 Fire detection

The robot monitors the forest and if the fire breaks, then the camera detect the fire [3], for this a Raspberry pi camera is used to detect the fire. RGB color values of the fire are given to the module and with those values it detects fire. The camera is mounted on the stepper motor which is fixed in the front portion of the robot. Stepper motor rotates 360 degrees completely and it moves the camera angle by angle along with it and the camera can also be made to roll around. When the fire is detected, the robot stops. And that is when the shooting and alarm comes into action. Figure 3 contains the proof of fire detected with our image processing algorithm.
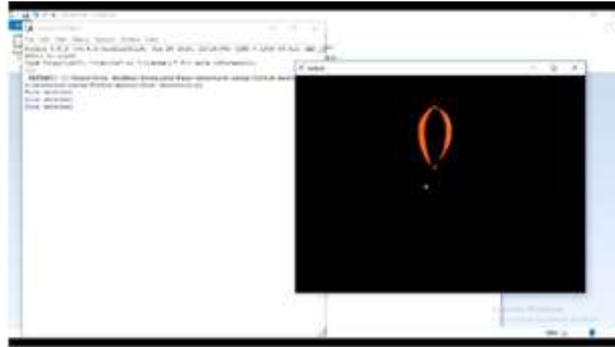

Figure 3. Fire detected with Raspberry pi camera
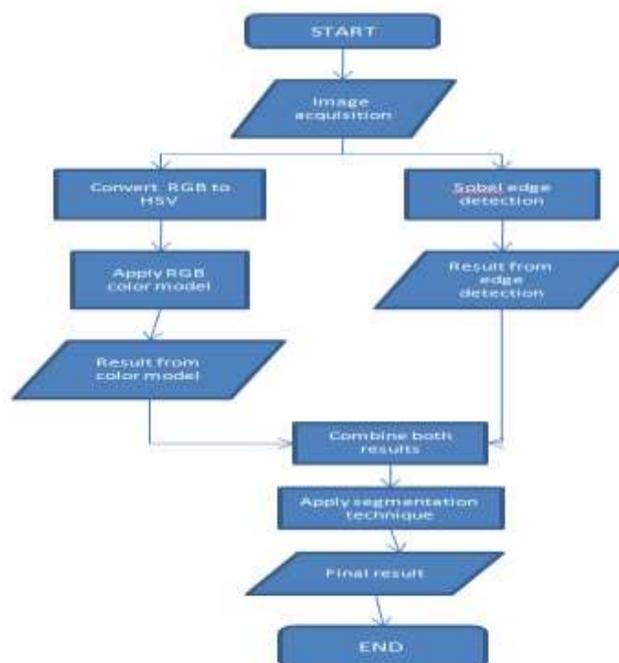
Figure 4. is the flowchart of image processing program.

Figure 4: Flow Chart of Fire Detection Program

3.2 Alarm

After the detection of fire is done, the signals will be transmitted through the NRF Transceiver module to the nearby forest department. This module works as receiver as well as transmitter. This NRF module [4] can work for a range of 1km, when an XBEE pro [5] module is used, it can work for nearly 10 km and hence they can be used for alarm system [6]. Forest officers will be on their way to the destination, then they can prevent the fire by getting intimation that the fire has started, there might be chances of stopping the fire, which otherwise may lead to great disasters. The robot can help us to a great extent by giving information and by shooting the Elide balls [7]. Figure 5 is the circuit diagram of the alarm which is implemented in the project.
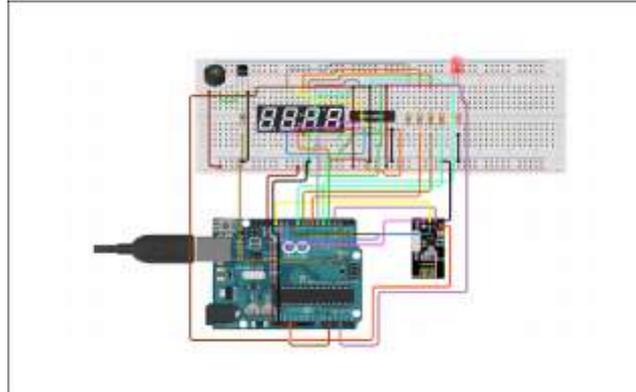

Figure 5- Circuit diagram of Alarm

3.3 Shooting Mechanism

As soon as the fire is detected, the stepper motor rotates [8] the disc which is placed on top of the robot towards direction of the fire. The rack and pinion mechanism is used for shooting balls. A side shaft motor and draw slider is also used. Then the "Elide balls" are shot at the fire. Some more balls are kept as spare so that a small fire can be stopped and the balls get reloaded. These Elide balls are capable of blowing out the fire and these balls when used can cover a region of about 4-5 feet. Each elide ball is around 1.3kg. The fire which was once put-off with elide ball will not start again. Figure 6 contains the picture of shooting mechanism which is used to shoot elide balls.
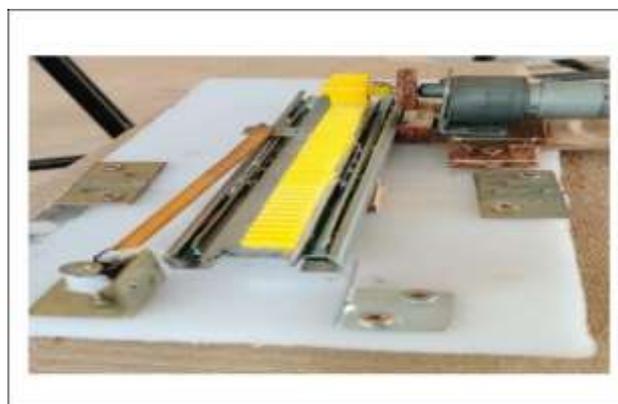

Figure 6- Shooting Mechanism

3.4 Water sprinkler

After shooting the balls towards the fire, if the fire is not stopped or the temperature is still high, a DHT-11 temperature sensor [9] which detects the temperature and humidity. If the temperature is still high, the robot will sprinkle water [10]. This water is stored in a small tank. All these steps are programmed in raspberry pi. Shooting elide balls are completed and water is also sprinkled, by then the Forest Officers will take up the charge to stop the Forest fire. So, this robot helps us stop the fire until its last breath if not the intimation will be sent and they will be on their way to stop the wild fires. Figure 7 shows the image of water sprinkler which is used in the project.

Figure 7- Water Sprinkler

3.5 ROBOT MOVEMENT

Blastoise is an Autonomous robot, and this moves in the forests and checks whether the fire has erupted, extinguishes it in case of eruption and sends signals to the forest department. The robot is equipped with the side shaft motors which give it higher torque and belt mechanism is used with which it can easily move on uneven surfaces. This will help the robot to sustain in forests without getting stuck in the forest. These motors are controlled with the help of the motor driver and the programming is done accordingly. The obstacles are detected by using the ultra-sonic sensors [2], so that it can move away from those obstacles and set a free path. The motion of the motors is also controlled within it; with this the robot thereby can surpass them.

3.6 Total Robot Working

Once the robot detects the fire, it will send signals to forest department which turn on alarm in forest department. After sending signals it will start shooting elide balls where ever the fire is present. Then it will check the surrounding temperature and humidity. If the temperature is still high then robot will sprinkle water in the affected area. So that there won't be any fire further.

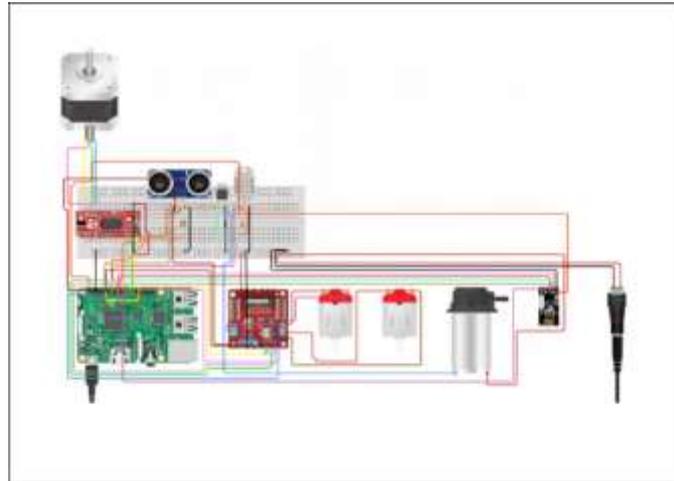Figure 8 contains the circuit diagram of whole project.

Figure 8 - Circuit Diagram
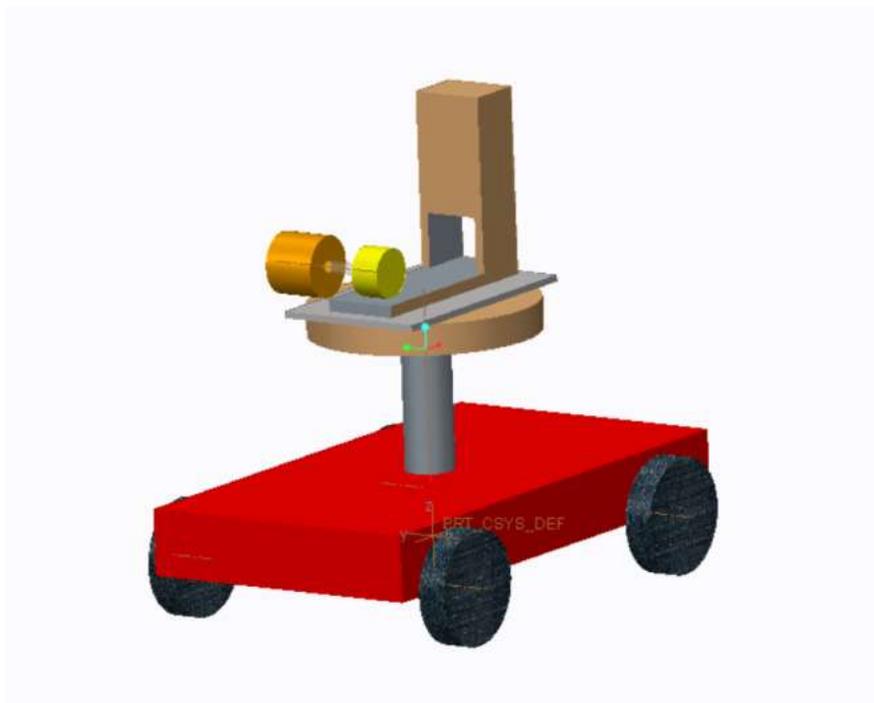
Figure 9 is the CAD design of the robot.

Figure 9- CAD Design of ROBOT

3.7 Algorithm

Following are the steps how the robot works.
Step1: BLASTOISE detects the fire through camera by using image processing.
Step2: After detecting the fire initially, it sends information to the Forest Department and Fire Department.
Step3: The shooting mechanism gets activated and BLASTOISE starts shooting the ELIDE BALLS.

Step4: Later if the fire is not put off then through DHT -11 sensors it senses the surrounding temperature and starts sprinkling the water.
Step5: END. STEP 1 STARTS

IV. RESULTS

The main objective of this project is to build the Robot which helps in predicting and monitoring the forest fires. In this proposed design, the unique fire detection and protection system is being built to save million acres of forests from burning down. Image detection and Shooting mechanism has been used in this project is used for implementation of the project when system gets activated and start shooting Elide balls to extinguish fire.

If system detects fire, Alerts will be sent to rescue departments. It has greater capability to move on un-even surfaces with the concept of continuous tracks has been adopted. The device comprises of both monitoring and controlling features in the supervision and detection. Hence, with the help of this Robot long distances fires can be controlled. Therefore, providing potential solution to the challenge of early detection of fires in the forests. Figure 10 is the basic prototype.
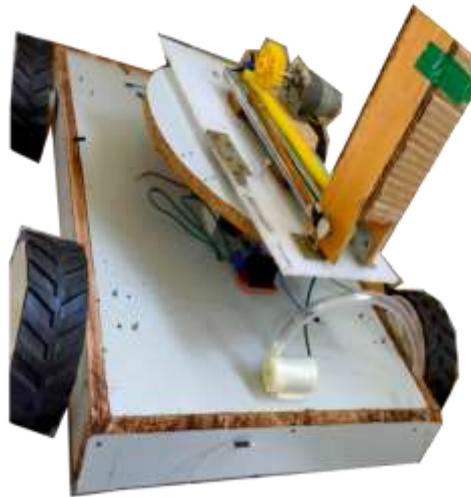

Figure 10 - Prototype

V. CONCLUTION

In this way, many problems caused by wild fires can be solved and can restore the heritage of species living in the woods. This project if implemented in real life will not only help us protecting life of living beings but also save our nature. The treasure we've got in the form of forests is meant to be preserved & protected. This project will hence help us in doing that.

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