Drones for Humanity

1.0

Requirements Document

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1. Introduction

1.1. Overview

This document contains the specifications of how the computer science part of Drone for Humanity will be handled. Within the drone, there will be two components handled by the computer science part of the team, the thermal camera and the Raspberry Pi.

1.2. Scope

The goal of Drones for Humanity is to provide a way to detect forest fires that can cover large areas quickly, is not impeded by terrain, and helps with the response to the forest fire.

1.3 Definitions and Acronyms

NN: Neural Network
CNN: Convoluted Neural Network
Regularization: Methods to reduce overfitting in a NN
Overfitting: When a NN can predict the training images well, but not new information.
Tensor: Similar to a vector, but more general.
Pi: Raspberry Pi

a.4 References

Cs.fit.edu. 2020. [online] Available at: <https://cs.fit.edu/~pkc/classes/seniorProjects/document.html> [Accessed 10 September 2020].

2. Product Description

2.1. Product

Drones for Humanity will have one product. A drone, or possible drone fleet, that can identify forest fires and communicate the location of the fire to a local user.

2.2. Features

Thermal Camera:

a) Identify a region that is hot enough to have fire
b) Identify the size and intensity of the heat. If the size is very small it may be a controlled fire like a bonfire. It is better to train the CNN to have false positives over false negatives. Best case is neither, but false positives come at the cost of some people's time, false negative comes at the cost of a fire going undetected.

GPS Chip:

a) Track the location of the drone (or drones)
b) Send the location of the fire if one is detected
c) Drones can communicate between themselves for response

Simulation Software:

a) Several simulated drones controlled by a main server
b) Drones use their GPS chip to communicate where other drones should check/go

2.3. Additional Information on Features

Thermal Camera:

a) The exact specifications of the CNN have not been decided yet, but the most likely candidate is a generic CNN with a common regularization function. Possible things that will aid in programming the CNN is TensorFlow, sklearn, NumPy, and other common machine learning libraries.
b) There have been many suggestions for addition features for the NN if time is available, such as identifying what is on fire, or if there are structures nearby. The issue with both of these things is there has not been a database of thermal images that track these two sets. If there is available time in the second semester it might be given a try.
c) The thermal camera comes with its own library for integration with the Pi. There should be no issues using them together.

2.4. User Requirements

a) The user will need to receive the signal from the drone
b) The user will need to properly handle the signals from the drone
c) The user will need an area to send and receive the drone from

2.5 Constraints

a) The NN may identify something very warm, but inflammable as a fire
b) The NN may finish training with an accuracy that allows for false negatives
c) The thermal camera may be too low resolution to classify fires from far away