UTILIZATION OF ALGORITHM, DYAMIC PROGRAMMING, OPTIMIZATION

Introduction

The predominant limitation is that the satellites cover only a limited area and require a preprocessing time before the resurvey of the same region. The other limitations such as the shortage of real-time data and inadequate precision are inapt for persistent monitoring. There is a need for the infrastructure in advance if WSNs are deployed . There is more chance for the destruction of the sensors during the fire, and this might lead to more expensive restoration of the sensors.

Related Work

The limitations of the satellites are described as follows:

- Images that are captured through the satellites have poor resolution, and hence, it becomes difficult to detect the particular area.
- Continuous information about the status of the forest could not be obtained due to the restrictions in the monitoring of forests.
- Weather might not be stable in all situations as it might vary, and thus, it results in the collection of noisy images

Proposed Methodology

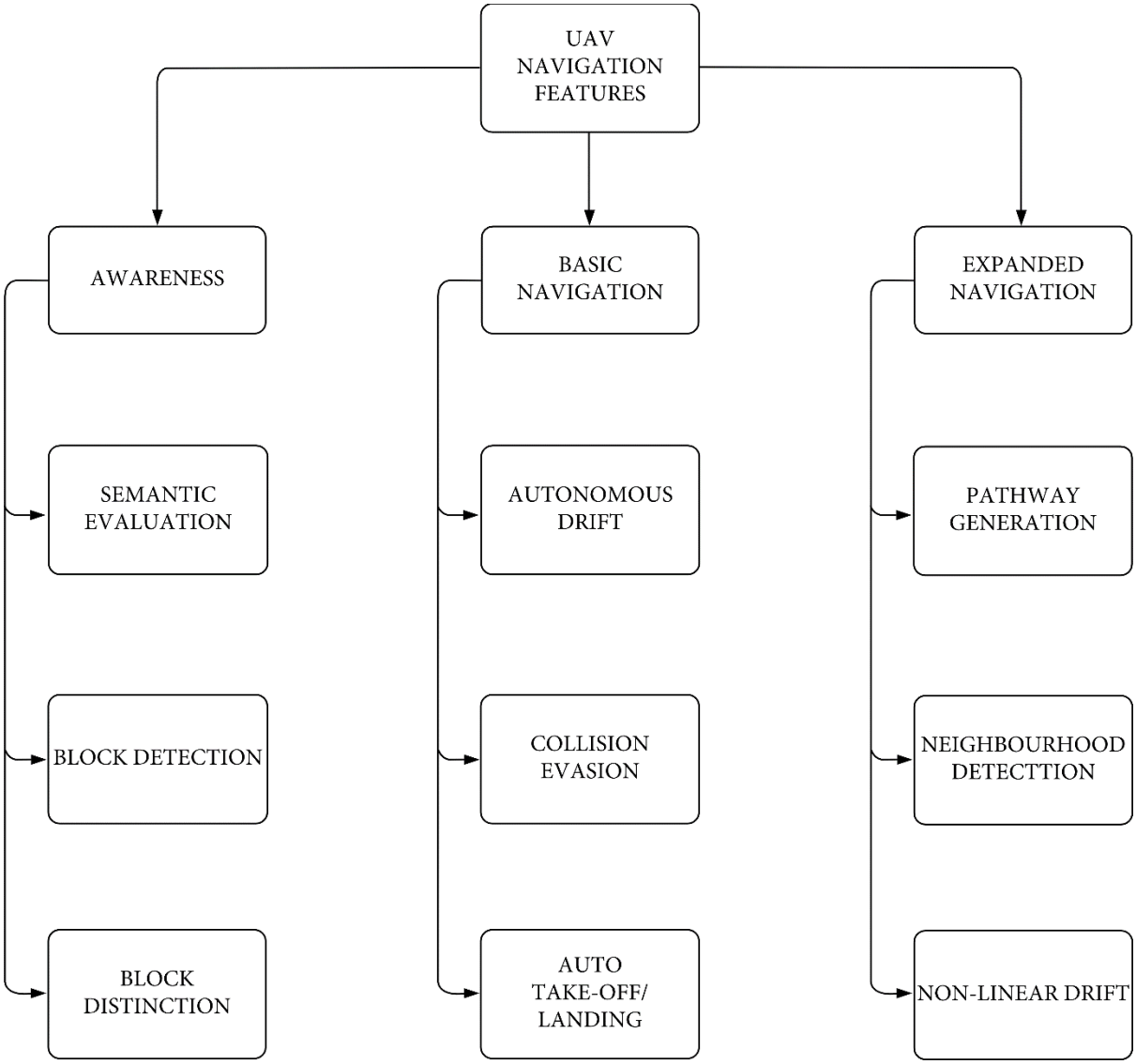
The video input is captured from the camera, and the other inputs such as wind speed, wind directions, and IR image sensing are calculated using the sensors mounted on the UAV for navigation

Drone Moment to the Target

(i)Awareness: This provides details about UAV's neighbourhood obstacles. The data is collected using internal sensors.

(ii)Basic Navigation: Collisions are avoided, and the obstacles such as birds, trees, poles, and so on in the forest farms are detected.

(iii)Expanded Navigation: Advanced features such as pathway planning and depth deployment are included and play a crucial role in autonomous navigation.



Step 1. The location of the fire is requested, and it is captured through the (YOLOv4 tiny-bounding box of fire). If the fire is detected, go for step 2.

Step 2. Calculate the step size depending on the location of the bounding box of fire that is relative to the midpoint of the frame, along with the direction.

Step 3. Normalize the drone for drift by changing the roll and angle of pitch of the current state.

Step 4. Set the next set point to control the flight and iterate the process.

Fire Detection in the Forest Region

A classic UAV can autonomously fly over the forest area and detect the forest fire and yaw around the burning forest fire area. The UAV is well equipped with IR sensors, a 12K camera for image accretion, and the onboard CPU, which can broadcast the real-time video of the forest fire to the ground station using the signals that are used for remote navigation. The ground station would diagnose and take necessary measures to stop the forest fire. In parallel, the ground station can also control the UAV by sending the operational commands.

The onboard CPU has good computation power to perform the forest fire detection using YOLOv4 tiny, which has good detection speed with well-grounded accuracy. The YOLOv4 tiny model is divided into two layers, that is, the feature extraction layer and the processing layer. The feature extraction layer is the combination of the DarkNet and ResNet, similar to the feature-like pyramid network that has the convolutional layer, batch-normalization layer, and leaky ReLU layer. The problem of overfitting is shut out using batch normalization. The combination of the convolutional layer, batch-normalization layer, and leaky ReLU layer is called CBL. The combination of the convolutional layer, batch-normalization layer, and mish activation function is called CBM.

Prediction of the Possibility of Forest Fire

When UAV is patrolling over the forest region, it observes for the forest fire; if the fire is found, it drifts to that affected area and broadcasts all the data to the ground station and then helps the people extinguish the fire. If there is no fire in the forest, then UAV tries to find the possibilities of forest fire in that region. In general, forest fire is caused either by man-made errors or natural errors. The man-made errors that lead to forest fire are campfires that are not completely turned off, used and thrown mosquito coils, the smoked cigarettes remain, and tribal traditions related to fire. The natural causes that lead to forest fire are lightning [6, 7, 34], combustion of dry vegetation, and volcanic activities. UAV predicts the occurrence of forest fire based on any of the above-stated situations [35]. UAV finds the possibilities of fire such as oxygen, fuel, and heat (shown in Figure 7), while it is patrolling and transmits the results to the ground station.