

## Project Presentation

# SkySentry : Unmanned Aerial Systems for Fire Detection and Suppression in Open Environments

Joel Joseph Justin(u2003105)   Jonathan Antony(u2003105)  
Justin Joshy(u2003114)   Krishnadas Balachandran(u2003121)

Rajagiri School Of Engineering and Technology  
Dept. of CSE

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Project Guide:  
Ms. Sangeetha Jamal  
Asst. Professor, Dept. of CSE

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**Large open area fires often go undetected, posing significant environmental and human health risks due to impractical manual monitoring.**

# Project Objective

The primary objective of this project is to develop and implement an automated landfill fire monitoring and suppression system that uses drone technology and intelligent automation to detect, respond to, and suppress potential fire incidents in landfills, with a focus on improving environmental safety and preventing fire-related damage.

- Integration of specialized fully autonomous UAVs for fire detection and suppression.
- Utilizes advanced sensors and autonomous capabilities.
- Represents a significant advancement in open environment fire management.
- Offers proactive and efficient approach to combating fires.

# Scope of Implementation

- Design and construction of two distinct UAV platforms.
- Integration of advanced sensors and autonomous navigation systems.
- Rigorous testing and validation under various conditions.
- Considerations for scalability, regulatory compliance, safety, and environmental impact.
- Multidisciplinary effort involving robotics, aerospace engineering, wildfire science, and regulatory compliance.

# Gantt Chart



- The development process followed is the agile model.

The progress in modules :

- **Fire Detection Module**

Live video snippet uploaded.

The video snippet was divided into frames.

A custom YoLov5 model was used to detect the presence of fire in these frames.

- **Communication Module**

Established a Server Client connection between two devices and sent a video stream from server to client when a fire is detected.

- **GUI**

Implemented a GUI to show location of fire on a map once location coordinates was entered into a CSV file.



# 30% Output



Figure: Fire detection model on a video sample

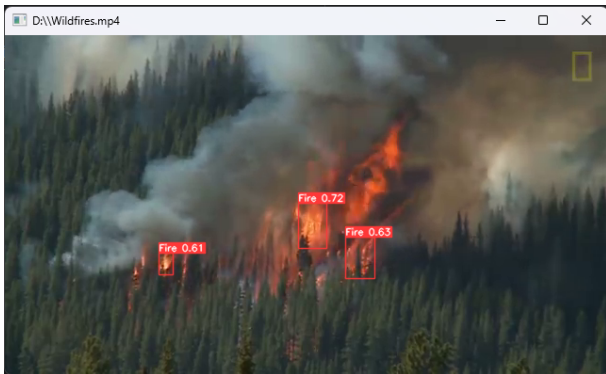


Figure: Fire detection model on a video sample

# 30% Output



Figure: GUI showing location on a map

# 30% Output



Figure: Server Sending Video Frames



Figure: Client Receiving Video Frames

# Work Progress for 60% Evaluation

- Simulation of drone flight:
  - The target altitude and airspeed are taken as input.
  - This information is passed to the dronekit-sitl virtual copter.
  - The flight of the drone and other telemetry information can be viewed using Mission Planner.
- Hardware with drone frame, motors, and battery procured

# Results



Figure: scripting mission by establishing waypoints

# Results

```
telemetry log: mav.tlog
Waiting for heartbeat from tcp:127.0.0.1:5760
MAV: Detected vehicle 1:1 on link 0
online system 1
STABILIZE> Mode STABILIZE
AP: Calibrating barometer
AP: Initialising APM...
AP: barometer calibration complete
AP: GROUND START
Init Gyro++
INS
-----
G.off: 0.00, 0.00, 0.00
A.off: 0.00, 0.00, 0.00
A.scale: 1.00, 1.00, 1.00

Ready to FLY ublox no link
Link 1 down
Link 1 OK
heartbeat OK
EOF on TCP socket
Attempting reconnect
[Errno 111] Connection refused sleeping
[Errno 111] Connection refused sleeping
Attempting reconnect
[Errno 111] Connection refused sleeping
[Errno 111] Connection refused sleeping
Attempting reconnect
[Errno 111] Connection refused sleeping
Exception in thread log-writer:
Traceback (most recent call last):
  File "/usr/lib/python3.10/threading.py", line 1016, in _bootstrap_inner
    self.run()
  File "/usr/lib/python3.10/threading.py", line 953, in run
    self._target(*self._args, **self._kwargs)
  File "/usr/lib/python3.10/socket.py", line 833, in create_connection
    sock.connect(sa)
KeyboardInterrupt

During handling of the above exception, another exception occurred:

Traceback (most recent call last):
  File "/home/jonathan/.local/bin/dronekit-sitl", line 8, in <module>
    sys.exit(main())
  File "/home/jonathan/.local/lib/python3.10/site-packages/dronekit_sitl/_1
    nit.py", line 598, in main
        sitl.download(system, version, target=target, verbose=True)
  File "/home/jonathan/.local/lib/python3.10/site-packages/dronekit_sitl/_1
    nit.py", line 200, in download
        raise Exception('Cannot connect to version list. Please specify a specifi
Exception: Cannot connect to version list. Please specify a specific version
to continue.
jonathan@19110p-062:~/B9:~/./local/bin$ dronekit-sitl copter --hose=35.983597
3.-95.8742389,0,180
on: Linux, apm: copter, release: stable
SITL already Downloaded and Extracted.
Ready to boot.
Execute: /home/jonathan/.dronekit/sitl/copter-3.3/apm --hose=35.9835973,-95.
8742389,0,180 --model=quad '1 0
SITL-> Started model quad at 35.9835973,-95.8742389,0,180 at speed 1.0
SITL-> stderr: bind port 5760 for 0
Starting sketch 'ArduCopter'.
Serial port 0 on TCP port 5760
Starting SITL input
Waiting for connection ....
bind port 5762 for 2
Serial port 2 on TCP port 5762
bind port 5763 for 3
Serial port 3 on TCP port 5763
```

Figure: terminal controlling the drone communication

**The project lays the foundation for several potential avenues of future development and expansion:**

- Enhanced Sensor Integration
- Advanced Autonomous Capabilities
- Scalability and Fleet Deployment
- Community Engagement and Partnerships



# Work Breakdown and Responsibilities

- Krishnadas Balachandran - Fire detection, Collision avoidance, Communication
- Jonathan Antony - Communication, Autonomous navigation
- Justin Joshy - Hardware, Obstacle detection, Fire Detection
- Joel Joseph Justin - Drone Procurement, GUI Software

# Conclusion

The proposed landfill fire detection and suppression system, which integrates infrared camera monitoring and autonomous drones, represents a significant advancement in landfill fire management. This system offers improved response times, reduced environmental impact, and enhanced safety for landfill operations. Implementing this solution can help mitigate the potentially devastating effects of landfill fires.

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