# Remote Sensing for Forest Fires
# Post-Proof of Concept Considerations

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# 1. Hardware

## 1.1. Product Viability

Companies, such as Torch, offer a similar product to the one designed by our team but with infrared camera technology. This product is offered at a similar price ($300) to the one estimated for our design. Another company with a similar design is Dryad which does not use infrared cameras and offers their product at a significantly decreased price ($50). Based on these similar products, it is hard to justify our product on price alone. It should be noted that the disparity between our estimated price and the price of these other companies would be significantly less if the PCBs were manufactured in bulk.

Unlike these other companies, our implementation is open source allowing for consumers to more customise their product.

Our design requires no extra construction to implement. Other designs which use infrared cameras to detect forest fires require a large tower to be built for the camera to be mounted.

Many fire detection methods utilise fire lookout towers. These are tall towers that require a human to spot the fires themself and report it. Unlike this solution our product automates the fire detection process minimising the need for human interaction.

Compared to camera based implementations, the gas sensors of our design can detect fires in its very early smouldering stages. This is because in these early stages the fire may not be visibly noticeable but the abnormal gases produced can be detected by our device. However, this early detection comes at the cost of range as a camera can spot a fire much farther than a gas sensor can detect its smoke.

## 1.2. Future Improvements

### External Power

Pads for an external power source were implemented into the PCB design. This would allow for the sensor device to operate from an external power source rather than its internal battery. To fully implement this feature a waterproof external power port would need to be implemented into the enclosure design. It should be noted that the external power and micro-usb should not be plugged in at the same time or it may damage the PCB.

### Improved AI

Bosch provides the BME AI-Studio software and the BME688 Development Kit. Utilising these tools the sensors used could be better trained and calibrated for environments more specific to this implementation. Unfortunately due to budget constraints the group was unable to purchase these tools.

### Battery Percentage

To further improve the product a battery percentage can be displayed on the web application to provide the user with insight regarding when the device should be recharged.

### GPS

A GPS tracking system can be implemented into the sensor device to help find the device after deployment. Considering the device will be deployed in remote locations it would be beneficial to have a consistent method of tracking down and finding the devices after they have been deployed for their 1.2 year lifespan.

### Solar Power

Implementing a solar power supply unit would further decrease the amount of maintenance with the sensor device as it would not need to be tracked down and recharged every 1.2 years.

### Power Draw

The device currently runs at 3.3V however all components are capable at running at 1.8V. This is not possible for the SHT-31 sensor (which is not implemented in the final solution). The team decided to leave the device at 3.3V in case unforeseen difficulties occurred with the BME688 sensor and the team needed to revert back to the SHT-31 sensor. Running the device at 1.8V would significantly increase the battery life.

# 2. Software

## 2.1. Product Viability

Our fire detection system's software currently operates via a web application. This platform effectively supports the system's unique features like early gas detection, which provides rapid alerts at the first signs of fire.

The application combines sensor data with satellite imagery, presenting this information in easily understandable formats, including graphical displays and maps. It also includes functionalities for alerting users about high fire risks.

A significant advantage of our software is its open-source nature, which allows for extensive customization and community-driven enhancements. This aspect caters to a niche market of tech enthusiasts and developers who value the ability to tailor the system to their specific needs.

## 2.2. Future Improvements

### Mobile Application

The current system is only accessible via a web application. Developing a mobile app would enhance accessibility and user interaction on mobile devices. This improvement requires investment in app design and testing to ensure compatibility across different devices and operating systems.

### User Subscription by City

Currently, users subscribe by providing coordinates, which can be cumbersome and less intuitive. An improvement would be to allow subscriptions by city name. This would involve creating a new table that maps city names to their coordinates. Implementing this feature would enhance user experience by simplifying the subscription process and potentially increasing user engagement.

### Improved UI/UX Design

The current interface is functional, yet there is an opportunity to enhance the user experience through a more intuitive and visually appealing design. Improving the UI/UX would involve redesigning the layout, improving navigation, and ensuring accessibility across devices. This enhancement could increase user satisfaction and engagement by making the system easier and more enjoyable.