

# SciTinyML

Africa Regional Workshop –29 April 2022

## Wildfire Detection made easier

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# How can technology to help prevent and detect wildfires?

- *Loss of Life*
- *Loss and Damage to homes and livelihoods*
- *Infrastructure damage*
- *Long term recovery*



Forest/Mountain/Bush

Informal Settlements

# Problem Statement

- Wildfires - Are we doing enough to help society and how can technology be an enabler?

Informal settlements are prone to hazards in the form fire, crime and unsafe living conditions. The result is that there is often loss of homes, possessions, livelihoods and even lives. The long-term negative socio-economic impact on these communities leaves a lasting legacy that leads to perpetuating the status quo. There are no open technology community safety platforms widely available or in use in Southern Africa to address and help mitigate these problems.

**The solution needs to be non commercial and open source for the benefit of society to foster innovation and learning while also solving real social problems**



# STAKEHOLDERS

**COMMUNITY**



**GOVERNMENT**



# Initial IoT Approach



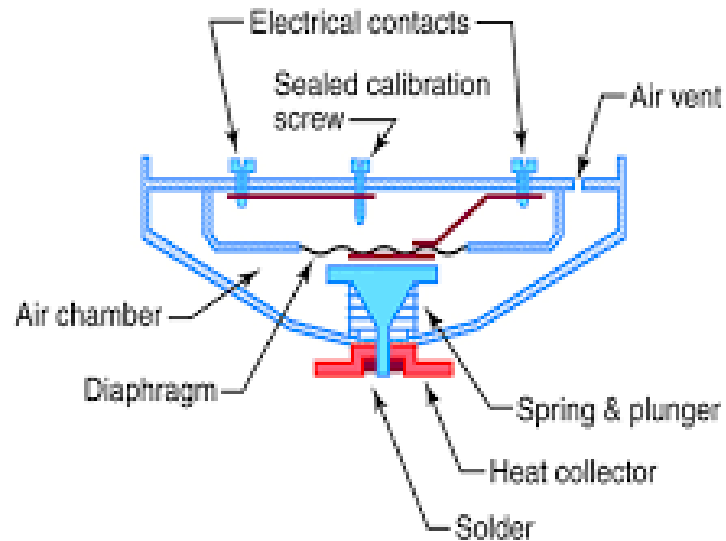
IoT Approach  
Sensor fusion and signal process on Temperature, IR and Gas  
LORA

# Commercial Approaches to Fire detection



Smoke Detection

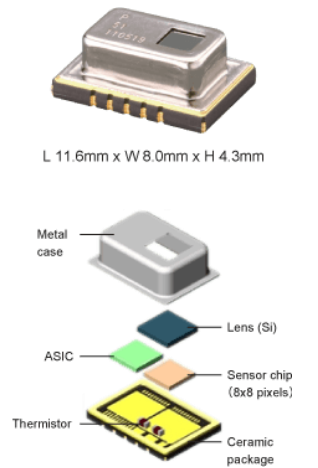
## Rate-of-Rise Heat Detector



ROR Fire Detection

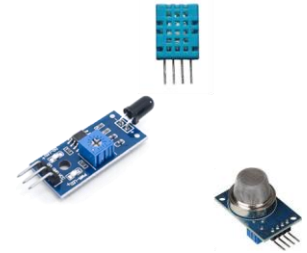


Thermal Imaging



# Limitations of Non ML approaches

- Empirical data required and modelling of all scenarios
- Algorithm development
- Reactive rather than predictive
- Component quality



- Only works once fire has reached a detectable level
- Thermography Costly
- Proprietary



# tinyML approach

- Combining Sensor Fusion with Deep Learning
- Training vs Experimentation and Algorithm development
- Variability across environments
- Prediction vs reaction
- Flexibility to work with different hardware
- Low Power/Low Cost
- Edge Impulse MLOps
- Potential application of TinyML For Good



# EDGE IMPULSE





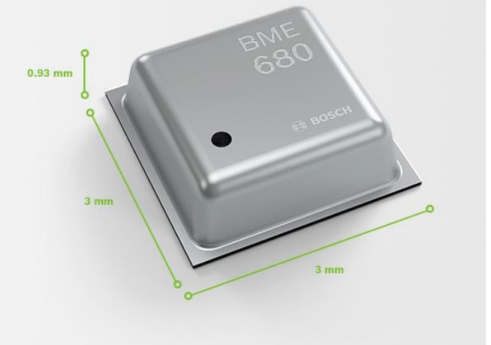
# Nordic Thingy91 Prototyping Platform



- Accelerometer
- Environment
- Light
- Accelerometer + Environment
- Accelerometer + Light
- Environment + Light
- Accelerometer + Environment + Light



Gas sensor BME680



Relative humidity barometric pressure



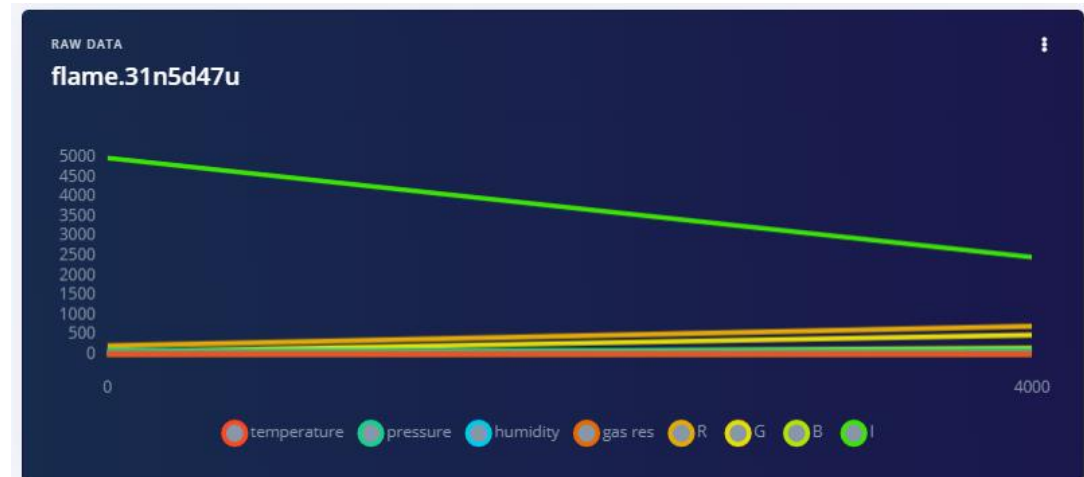
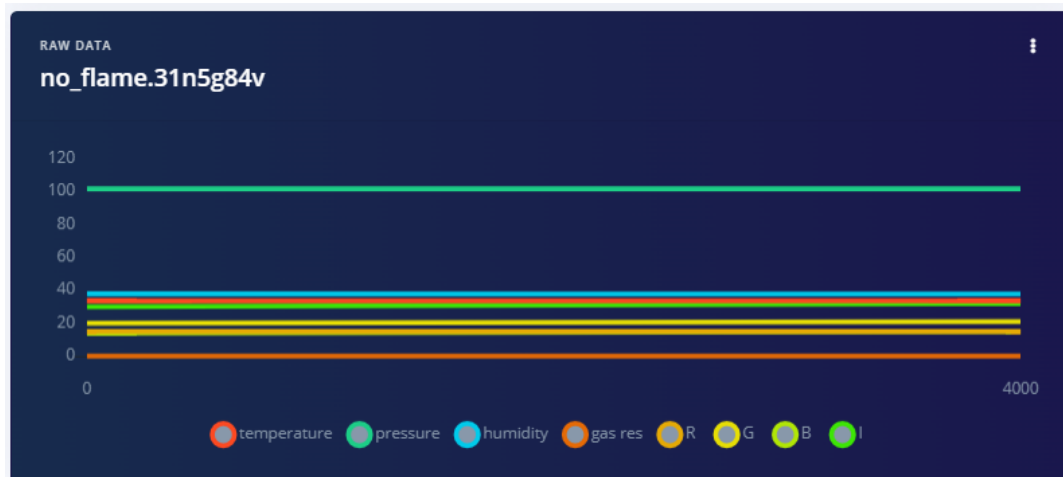
Excellent temperature stability



Humidity



Air quality monitoring



# Initial Concept – AIoT approach



## Monitoring

- Light
- Temperature
- Volatile Organic Compounds
- Humidity

Cellular IoT

## Messages

2022-04-29 13:52:56	Topic: edgeimpulse/firesensor1	Qos: 0
flame		
2022-04-29 13:52:54	Topic: edgeimpulse/firesensor1	Qos: 0
flame		
2022-04-29 13:52:53	Topic: edgeimpulse/firesensor1	Qos: 0
flame		
2022-04-29 13:52:53	Topic: edgeimpulse/firesensor1	Qos: 0
flame		



# What needs to be done

- Dataset collection across a wide variety of use cases
  - Informal settlement indoor and outdoor
  - Forests
  - Bushvelds
  - Day/Night
- Feature identification
  - Identification of the optimum set of features
  - Feature processing
- Hardware selection and cost reduction
  - Look at different options for lower cost sensors



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