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# SiteSentry:

SMART ENVIRONMENTAL  
MONITORING SYSTEM WITH  
REAL-TIME HAZARD MITIGATION  
AND PRECAUTIONARY ALERTS

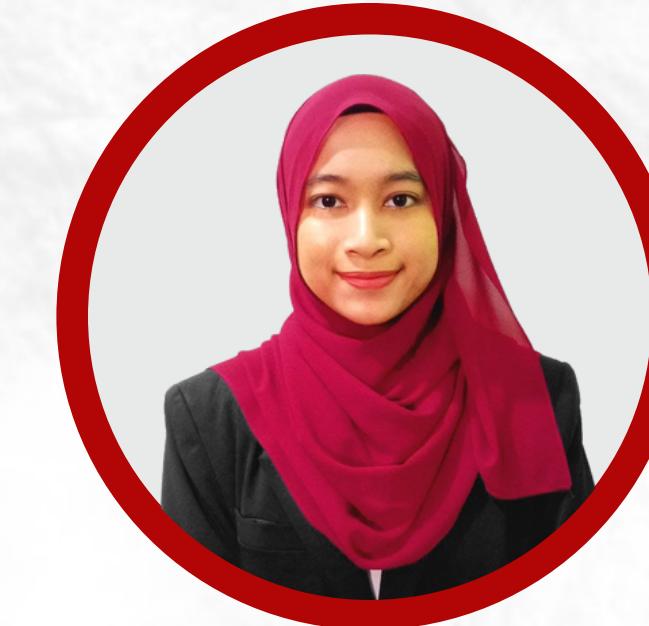
by Julia Nurfadhilah, Noor Syahirah,  
Harith Thaqif, Danish Al-Muhaimin & Izrin Syafiq



# Meet Our Best Team



**Julia Nurfadhilah**



**Noor Syahirah**



**Izrin Syafiq**



**Danish Al-Muhaimin**



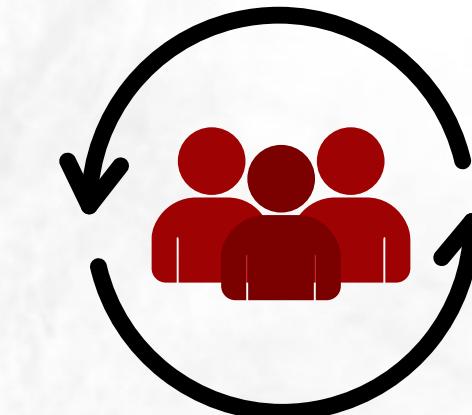
**Harith Thaqif**



# Problem Statement

The **UNPREPAREDNESS** of unpredictable **environmental conditions** during climate change will be one of the major **economic concern** for the construction sector

The screenshot shows a news article from Utusan Online. At the top, there are logos for astro AWANI and PANTAU KERajaan BAHRU. Below them is a navigation bar with links: TERKINI, VIDEO, ENGLISH, MALAYSIA, DUNIA, POLITIK, HIBURAN, BISNES, SUKAN, RA... The main headline reads: "Bekerja dalam keadaan cuaca buruk, majikan boleh diambil tindakan". The article summary at the bottom states: "Faktor cuaca punca projek lewat". The Utusan Online logo is visible at the bottom left, along with social media icons for LIVE, YouTube, Facebook, and Twitter.



who will be affected?

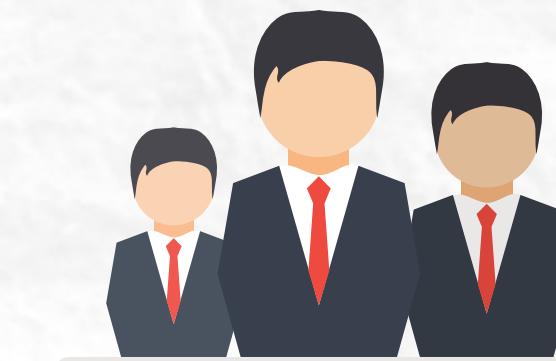
**23, 577**  
registered construction  
companies in Malaysia



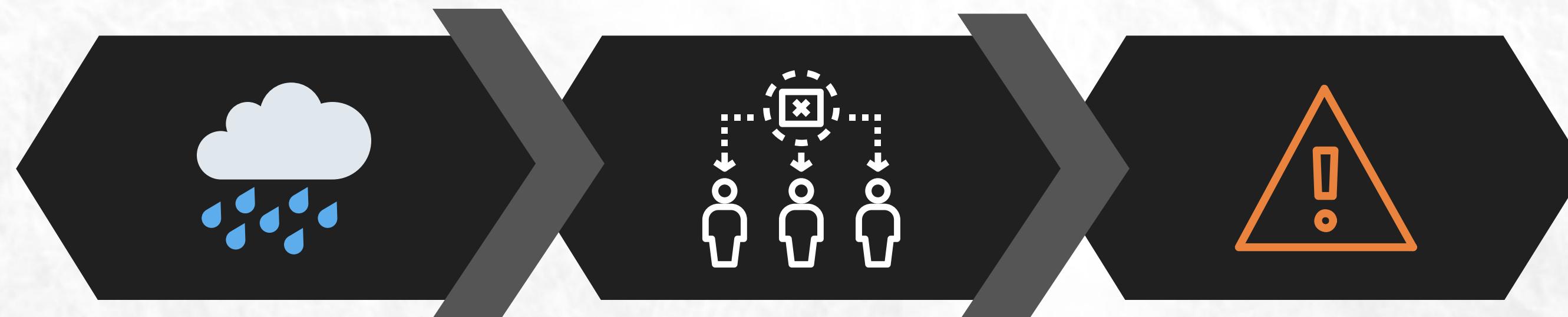
one of the affected company,

# COMPANY H

are facing issues:



- Construction company
- 200+ sites around the globe
- Handle hazardous equipment and materials
- Develop in countries with extreme weather



## Minor Issue

Heavy Rain

Intense Heat

Low air quality

## Problem

Lack of preparation for  
construction's  
environmental condition

## Consequences

Operation Efficiency

Labour Safety

Cost and Resources



# Three Types of Major Consequences

Operation Efficiency	Labour Safety	Cost and Resources
<ul style="list-style-type: none"><li>• Weather disruption that halts construction operations</li><li>• Lack of contingency plans</li></ul>	<ul style="list-style-type: none"><li>• High employees on-site incidents and injuries</li><li>• Lack of safety equipment and procedures</li></ul>	<ul style="list-style-type: none"><li>• High materials degradation</li><li>• High equipment maintenance and replacement cost</li></ul>



# An attempt to solve the problem



Weather forecasting application:

- Low location accuracy
- Lack of real-time weather alarm features
- Lack of precaution or countermeasure reminder
- Too less required information provided
- Hard to integrate with the company's system



Hard for company H to come up with effective contingency plans, appropriate equipment and procedures for different type of locations.



**How to solve?**



## Our solution

# SiteSentry

*"Environmental awareness  
at your fingertips."*





# Main Features



Accurate **real-time** environmental conditions monitoring for **multiple construction sites**

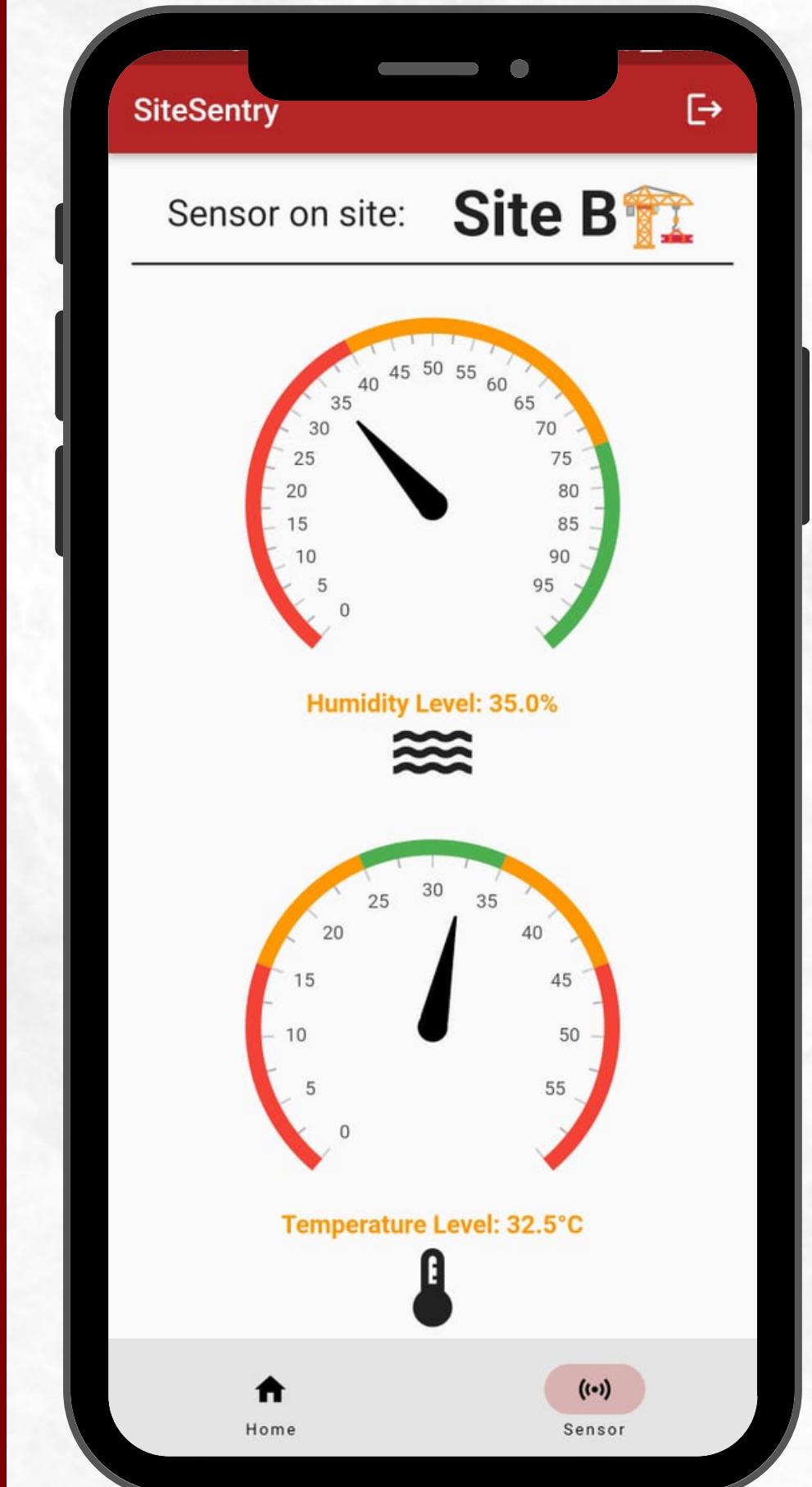


Rapid sensor data and weather pattern analysis for **site condition prediction**



Alert employees with **automated real time precaution measures**

Sufficient and credible resources to **PREPARE** with location-specific real-time **COUNTERMEASURE** and **CONTINGENCY PLANS**





# Technology Implementation



**Flutter** for front-end mobile development



**Firebase** for hosting, real-time database and analysis, and prediction



**Node.js** for server-side programming and non-blocking, event-driven servers



**Open source** which available for used, modification and distribution ,



**API** to incorporate more reliable from the open source into the software application



# Hardware Requirements



## Microcontroller

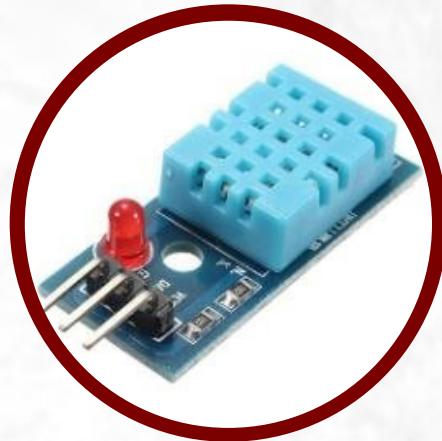
Arduino Wemos D1 R1



## Air Quality Sensor

MQ135

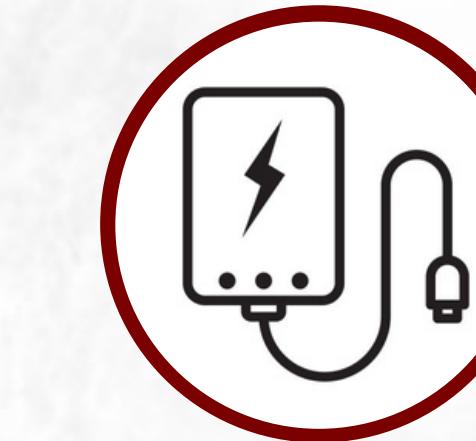
(Ammonia (NH<sub>3</sub>), sulfur (S), Benzene (C<sub>6</sub>H<sub>6</sub>), CO<sub>2</sub>, and other harmful gases and smoke)



## Temperature & Humidity Sensor

DHT11

(0-50°C for temperature and  
20-90%RH for humidity)



## Power Source

USB Cable / 5V DC power supply



# How accurate the SiteSentry readings?



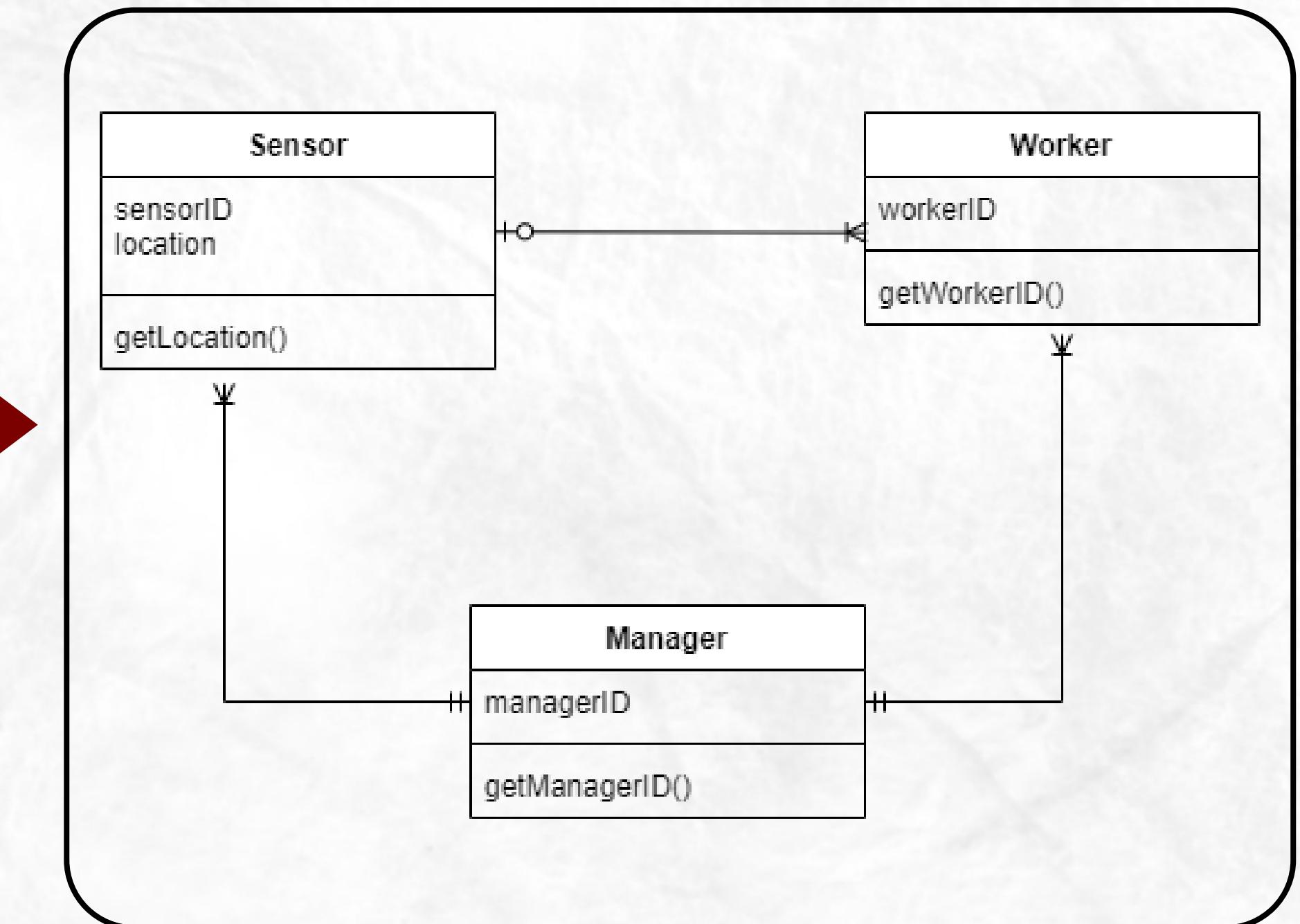
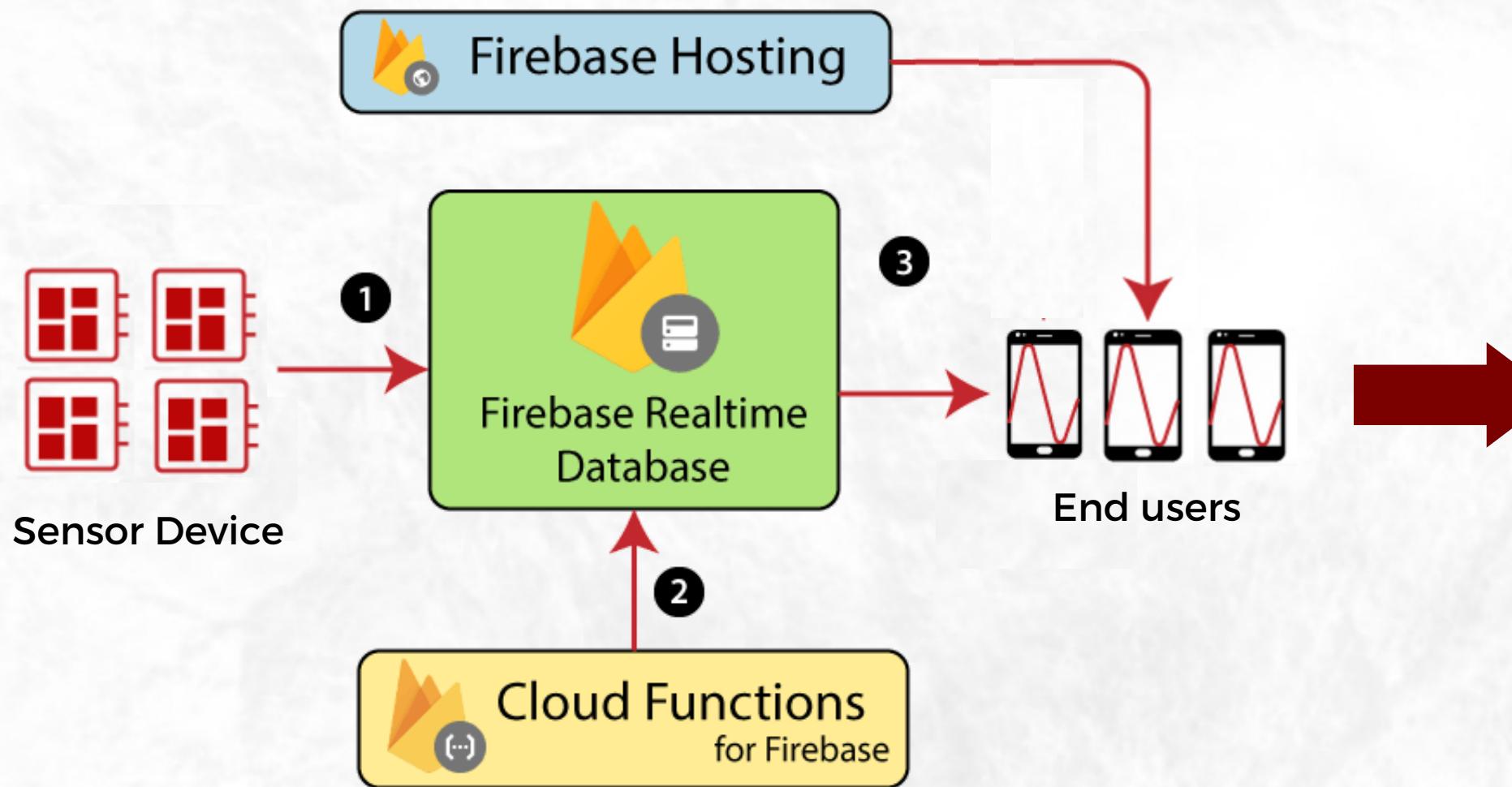
## STUDIES THAT TESTED THE PERFORMANCE OF DHT11 AND MQ135 SENSORS:

- DHT11 Sensor has an accuracy of +/- 2°C for temperature measurements and +/- 3-5% for humidity measurements - [Rui Santos](#)
- MQ135 Sensor has an accuracy of ±20 ppm for Carbon Monoxide, Ammonia and Nitrogen Dioxide measurements, with a response time of less than 10 seconds. - [A. Shaik, S. Sheikh, and M. Syed.](#)

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# Communication between Components in Back-end System

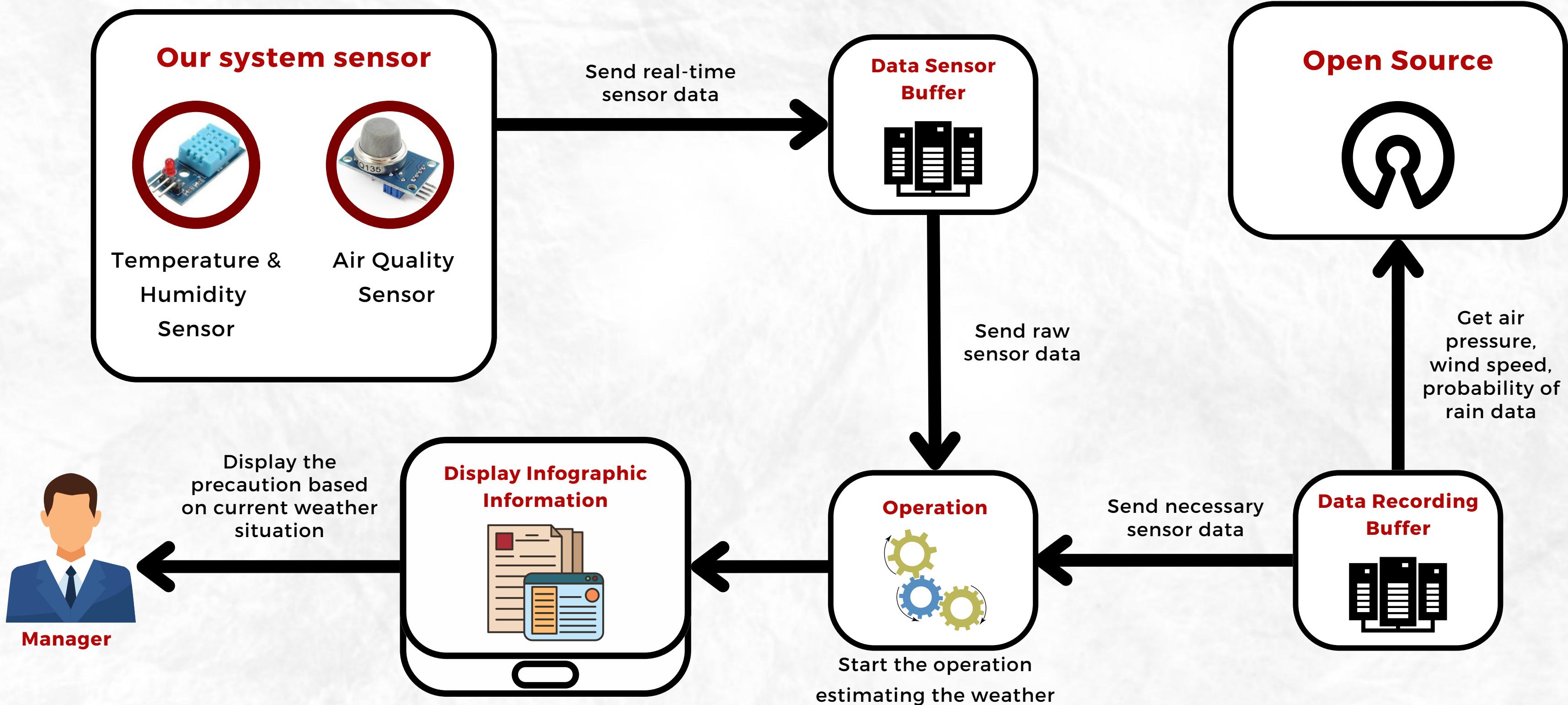


**3-tier architecture :**

Presentation, Business and Database

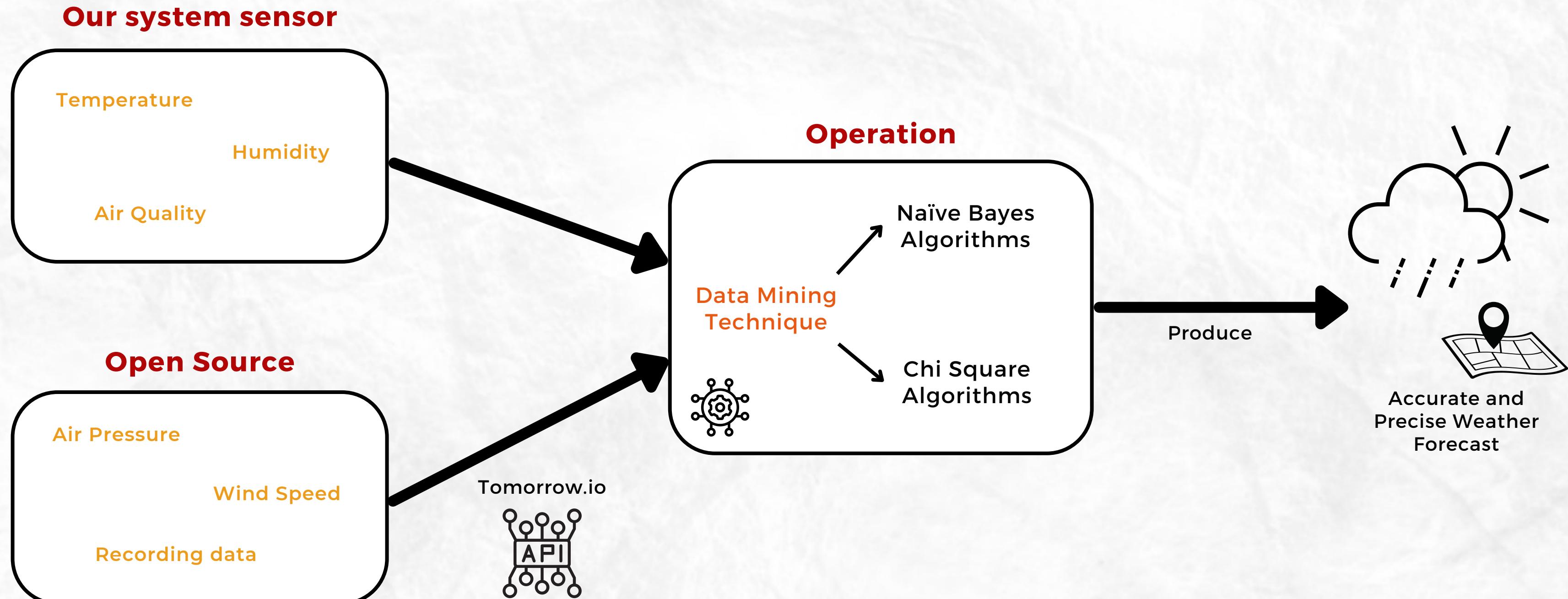


# Integrate sensor with open source





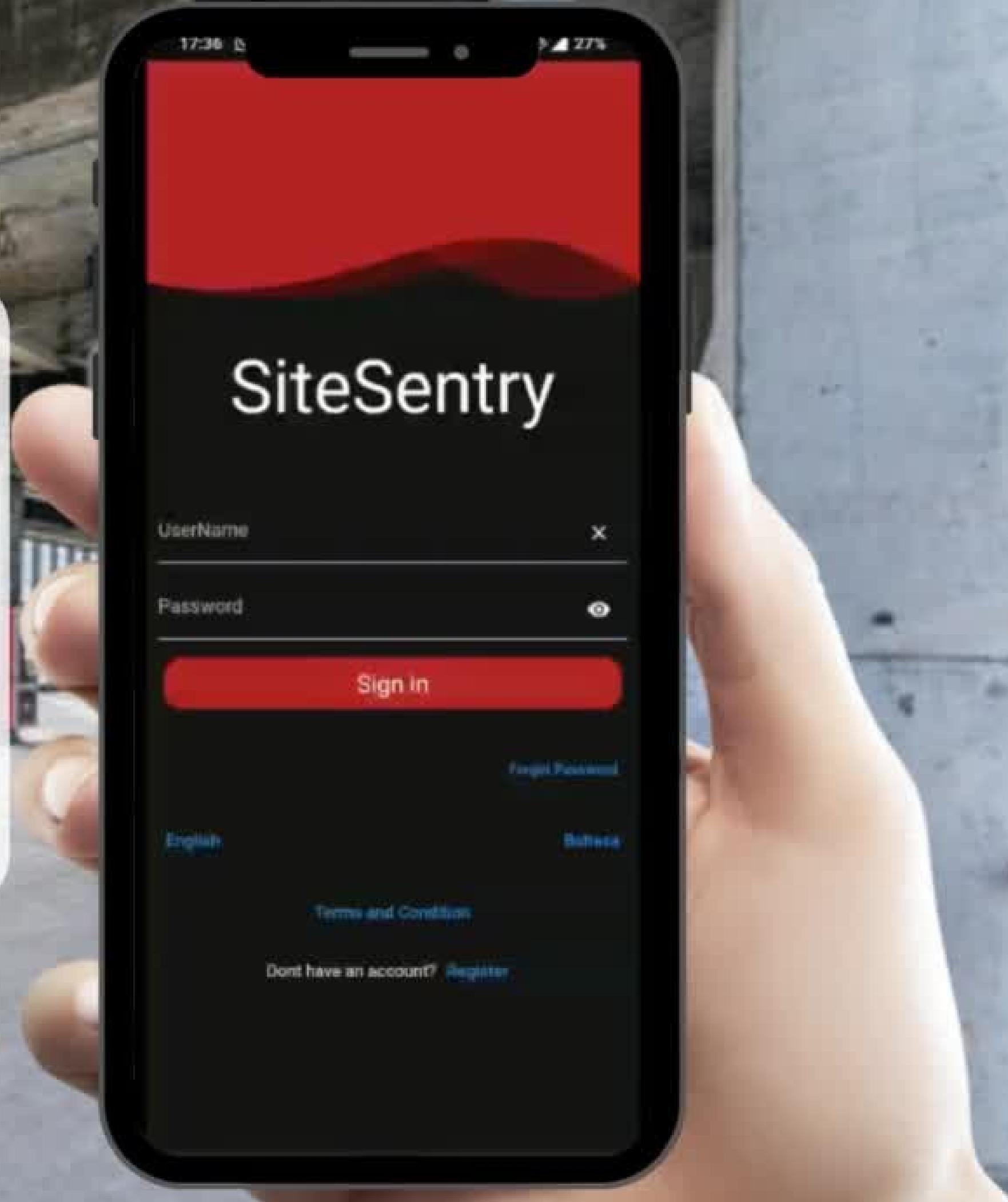
# What is the operation involve for weather forecasting in real-time situation?



## Functionality

### User Type : Manager

- Assign employees to construction site
- Track employees on each site
- Track real-time environment conditions
- Broadcast additional alarm to employees





# Why choose SiteSentry?



## Elongate Resources Lifespan

Preserve equipment and materials from weather damage



## Protect Employees

Reduce risk of on-site incidents and injuries



## Control Hazardous Conditions

Early detection of unsafe state and potential dangers



## Improve Facility Management

Plan, prepare and coordinate for predicted case scenarios



# How does SiteSentry excel from others?

## EXISTING SENSOR MONITORING SOLUTIONS ARE :

	siteSentry	Other
Location-accurate analysis outcome	✓	✗
Appropriate precaution recommendation	✓	✗
Real-time environment monitoring	✓	✗
Data analysis and site condition prediction	✓	✗
Easy to integrate various sensor in multiple location	✓	✗



**REJECTED**

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Integration challenges emerge from growing use of sensors

Source: Lisa Hsu Date: 2017/02/03 Related tags: AMAG Technology, iOmniscient, Allegion, Optex, sensor, PureTech Systems

SCIENCE | GLOBAL ISSUES

Why are weather forecasts sometimes wrong?

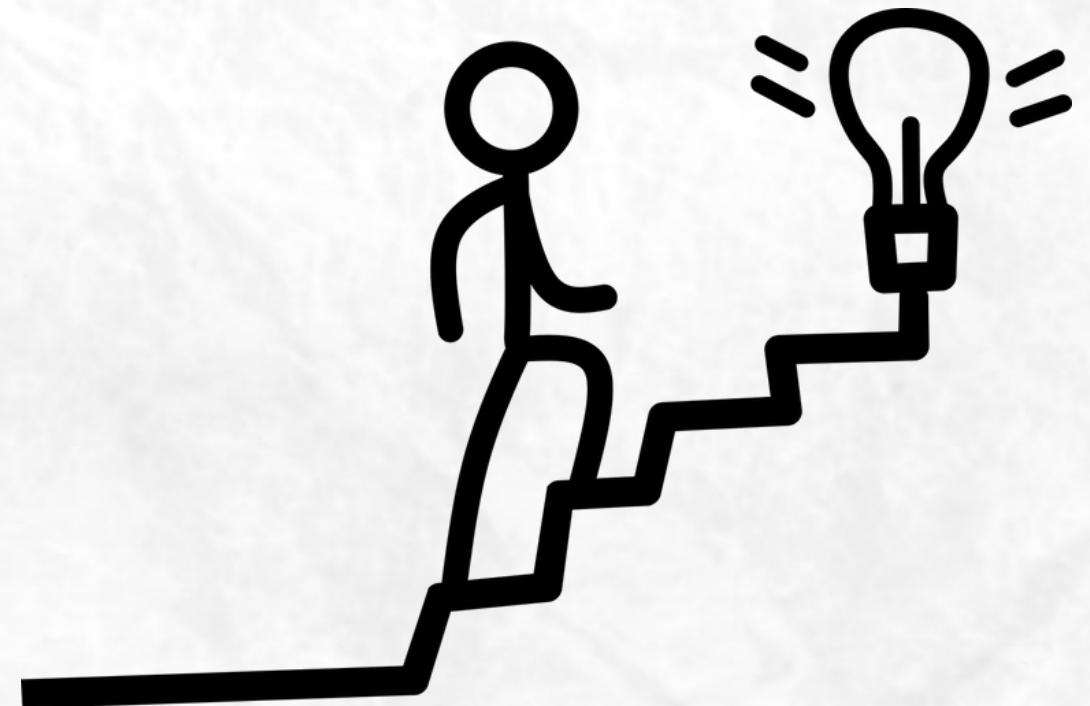
Claire Roth  
07/18/2022



# Looking ahead: Our Future Plan

## WHAT'S MORE?

- Improving the **accuracy** and **precision** of the sensors
- Integrating site**Sentry** with other types of sensors
- Merging site**Sentry** with **project management tool**





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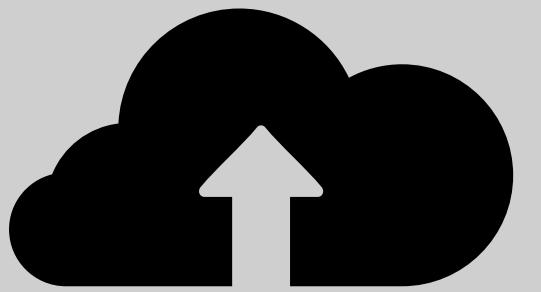


# Thank You

*for choosing*

## *SiteSentry*

*" Environmental awareness  
at your fingertips. "*



SiteSentry  
Automation Server

- ✓ TEMPERATURE
- ✓ HUMIDITY
- ✓ AIR QUALITY

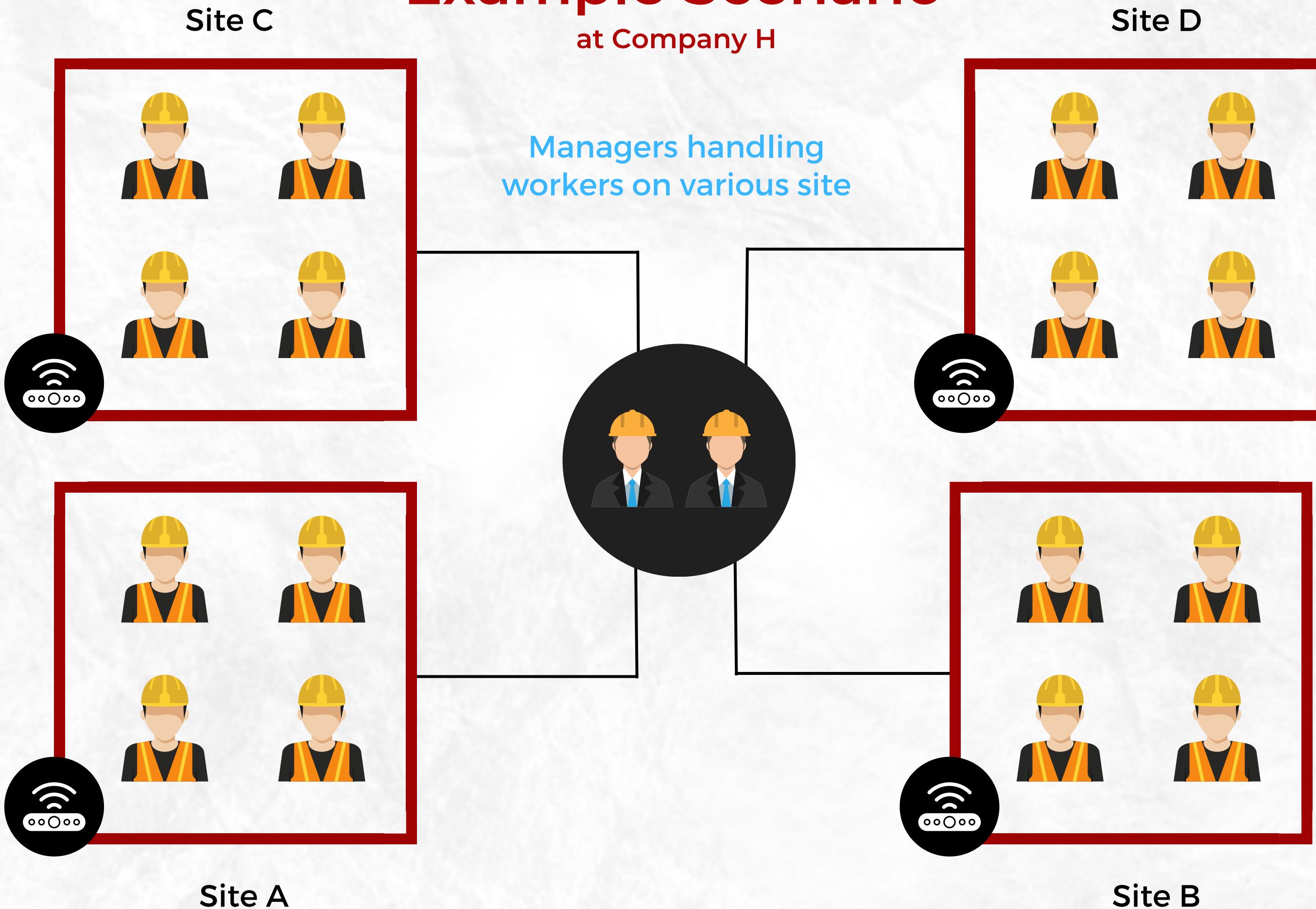


SiteSentry  
Unified Sensor Device



# Example Scenario

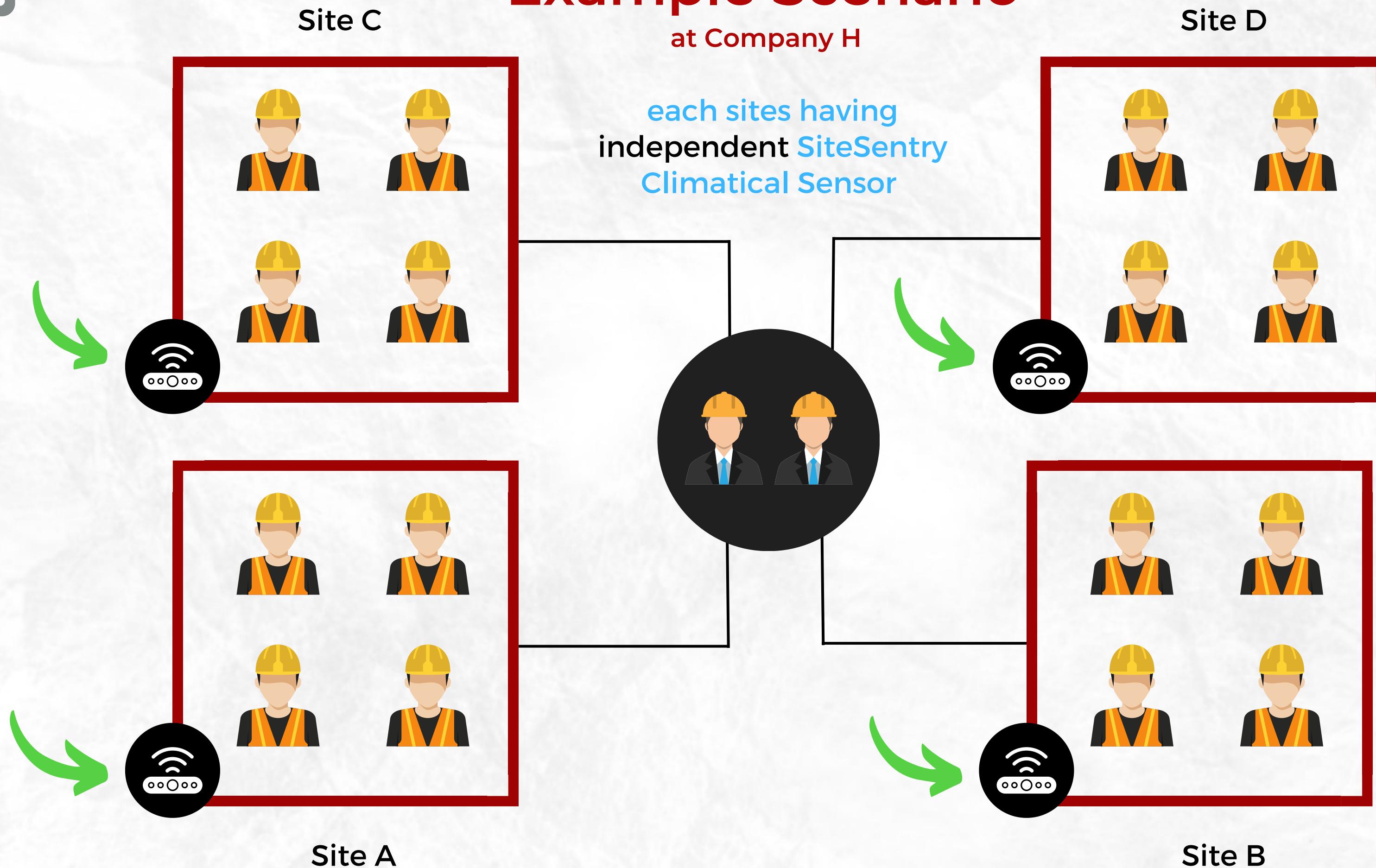
at Company H





# Example Scenario

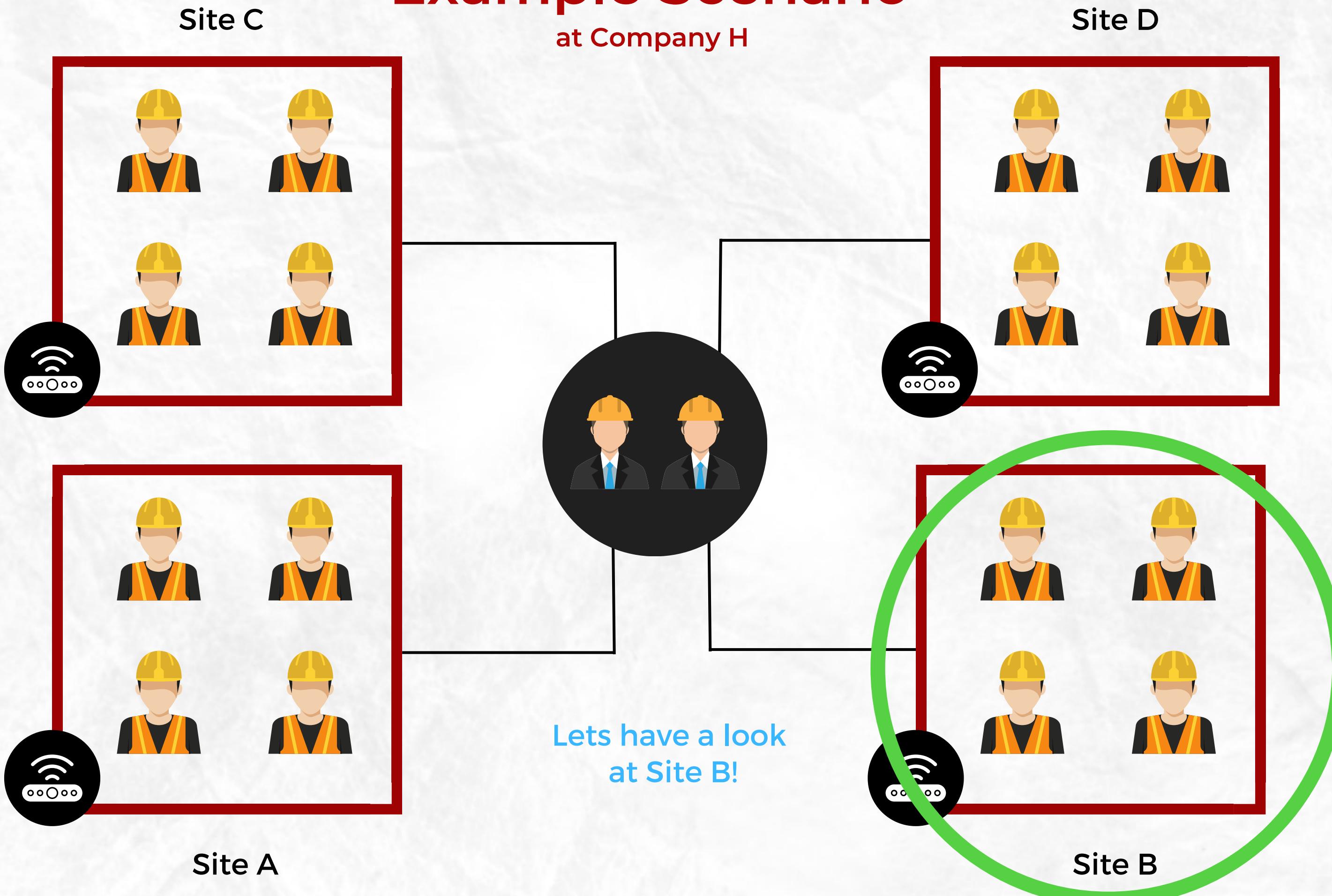
at Company H





# Example Scenario

at Company H



# Project Cost Summary

**40-50 MYR**



Device Components

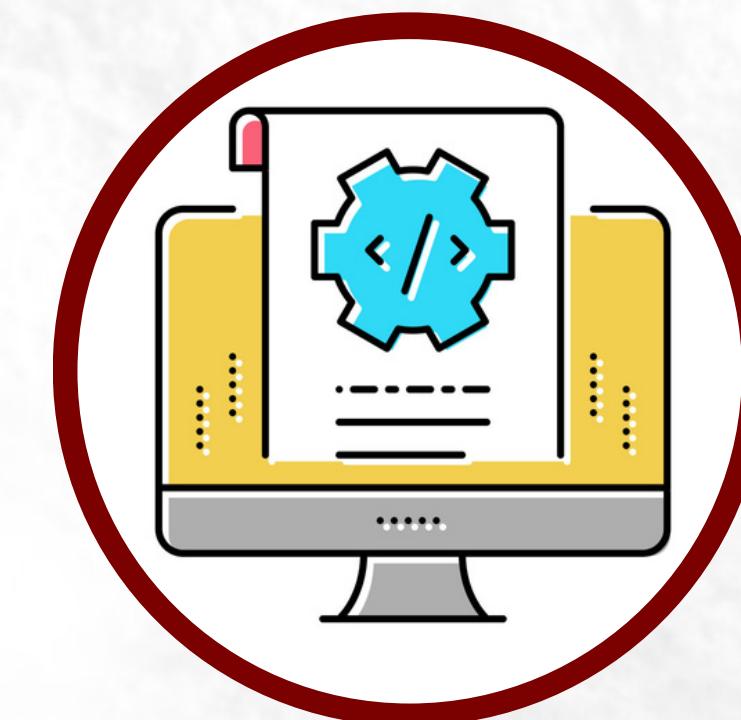
Microprocessor - 20 MYR

DHT 11 - 5 MYR

MQ 135 - 8.50 MYR

USB Cable - 6.00 MYR

**No Charge**



Software Application





# Absense of Internet connection

Does **Firebase Firestore** work offline?

Cloud Firestore supports offline data persistence. This feature caches a copy of the Cloud Firestore data that your app is actively using, so your app can access the data when the device is offline.

Does **SiteSentry Climatical Sensor** work offline?

As it uses WiFi module to connect with the database, it requires internet connection. However, it is an option to change the device into "Bluetooth" version to work efficiently.



## How feasible is SiteSentry?

- SDLC : Agile method - It is more practical to implement changes rapidly
- Portability : Easy to carry to different sites, compact size
- User experience : The system displays information in simple, direct and relevant infographic. It also automates a general precaution reminder that reduces the work of project manager.
- Cost : Low cost to produce and run the system as it also uses open source data.

# References

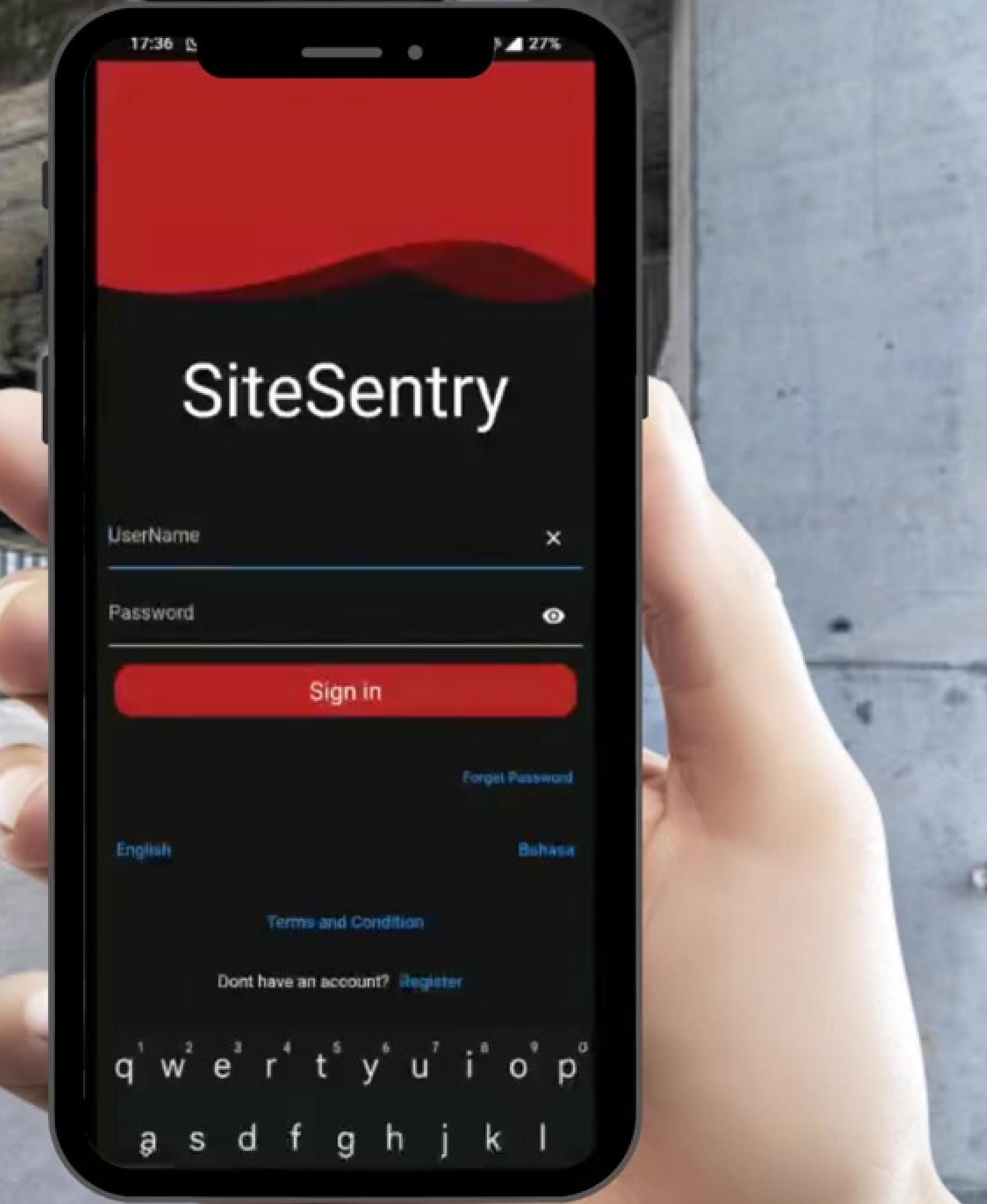
[https://citeseerx.ist.psu.edu/document?  
repid=rep1&type=pdf&doi=cc74651c54855ece016e3bf71fe5826dcd8504f4](https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=cc74651c54855ece016e3bf71fe5826dcd8504f4)

Weather forecasting-  
<https://iopscience.iop.org/article/10.1088/1755-1315/961/1/012038/pdf>

## Functionality

### User Type : Manager

- Assign employees to construction site
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# Open source

## From Weather Forecast System

Weather Forecast System mostly **cover a maximum of a 10-day timeframe**

Getting extra sensor information such as **wind speed, air pressure and possibility of rain** can help to create much **accurate** result

Weather Forecast System also has their own **recording data**.

Some activities in construction site need a **short-term decision**.



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