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Low-Power Wide Area Networks-Driven Precision Farming

iLab Africa

About LPWAN

- LPWAN technology is perfectly suited for connecting devices that need to send small amounts of data over a long range while maintaining long battery life. Some IoT applications only need to transmit tiny amounts of information – e.g. a parking garage sensor only needs to transmit when a spot is open or when it is taken. The low power consumption of such a device allows the task to be carried out with minimal cost and battery draw.

LPWAN FEATURES

LONG RANGE
The end-nodes can be up to 10 kilometers from the gateway, depending on the technology deployed.

LOW DATA RATE
Less than 5,000 bits per second. Often only 20-256 bytes per message are sent several times a day.

LOW POWER CONSUMPTION
This makes very long battery life, often between five and 10 years, possible.

About Precision Farming/Agriculture

- Precision farming (PA) is an innovative information controlled management concept of crop production, based upon on various new technologies which include particular satellite-supported positioning systems, sensor technologies for data collection and geoinformation systems.
- Using PA the existing, locally varying soil conditions and properties of crops can be recorded within an arable area. Based upon this information, analysed with special assessment systems, and with suitable agricultural equipment, plant cultivation measures are spatially and quantitatively more accurately applied than previously.
- Precision Agriculture promises a positive impact on farm productivity and economics as it provides higher or equal yields with lower production cost than the conventional practices as it is hinged on data driven decisions.

IoT-Driven Precision Farming

- Through tons of data collected by smart agriculture sensors
- Better control over the internal processes and as a result lowe production risks
- Cost Management and Waste Reduction
- Increased Business Efficiency through Process Automation
- Enhanced product quality and Volumes

Use Cases:

1. Greenhouses – controlling micro-climate conditions to maximize the production of fruits and vegetables and its quality.
2. Crop Management
3. Hydroponics

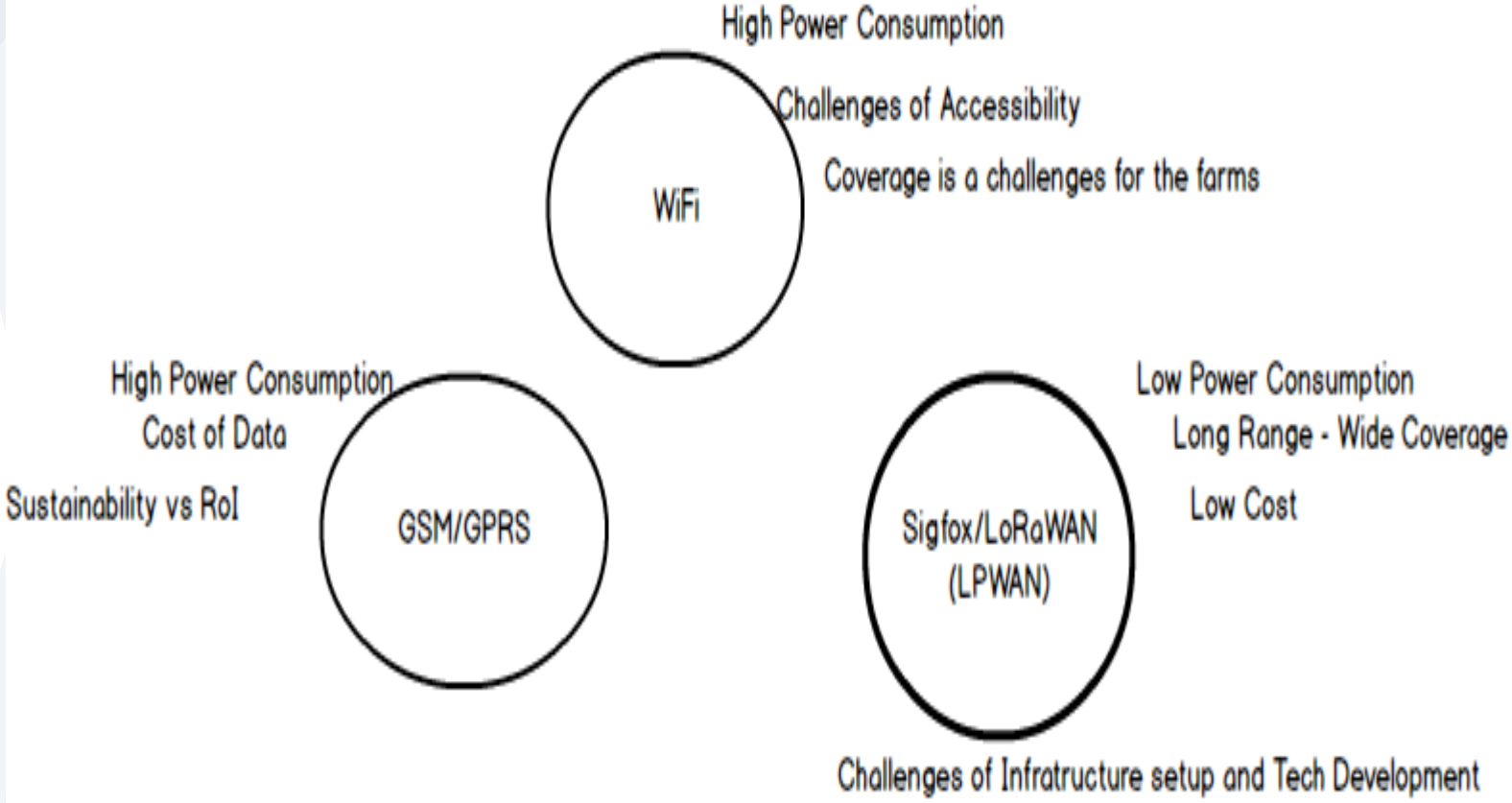
Products - https://easternpeak.com/blog/iot-in-agriculture-5-technology-use-cases-for-smart-farming-and-4-challenges-to-consider/

Kenyan Cases – UjuziKilimo, GrowIntelligence, Illuminum Greenhouses

Precision Farming(P.A/P.F) Requires.

- Hardware – The sensors and their quality
- The Network/Data Transmission Technology
- The Brain – Data analytics to give sense to the collected data
- The Mobility – Access of farm information from anywhere
- The Security

The Network/Data Transmission Technology



Two Main Areas Where LPWANs are Suited

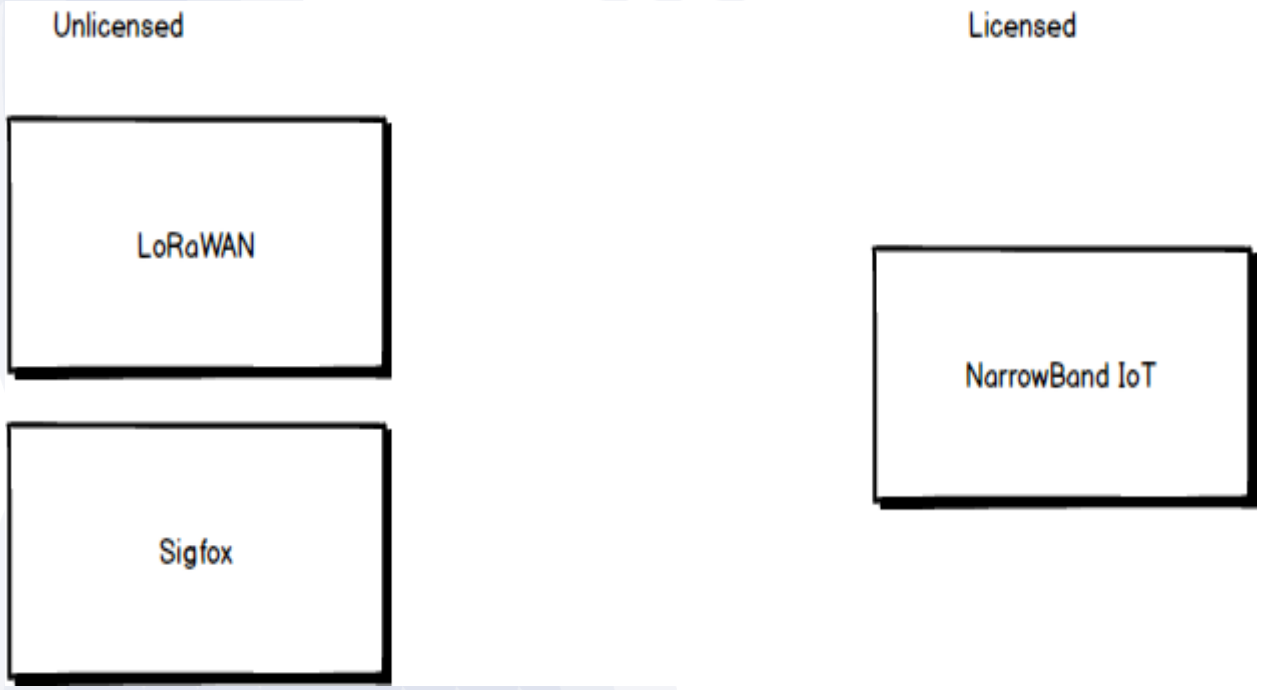
1 FIXED, MEDIUM- TO HIGH-DENSITY CONNECTIONS

In cities or buildings, LPWAN technologies are a great alternative to cellular M2M connections. Some examples include smart lighting controllers, distribution automation (smart grid), and campus- or city-focused GPS asset tracking.

2 LONG LIFE, BATTERY-POWERED APPLICATIONS

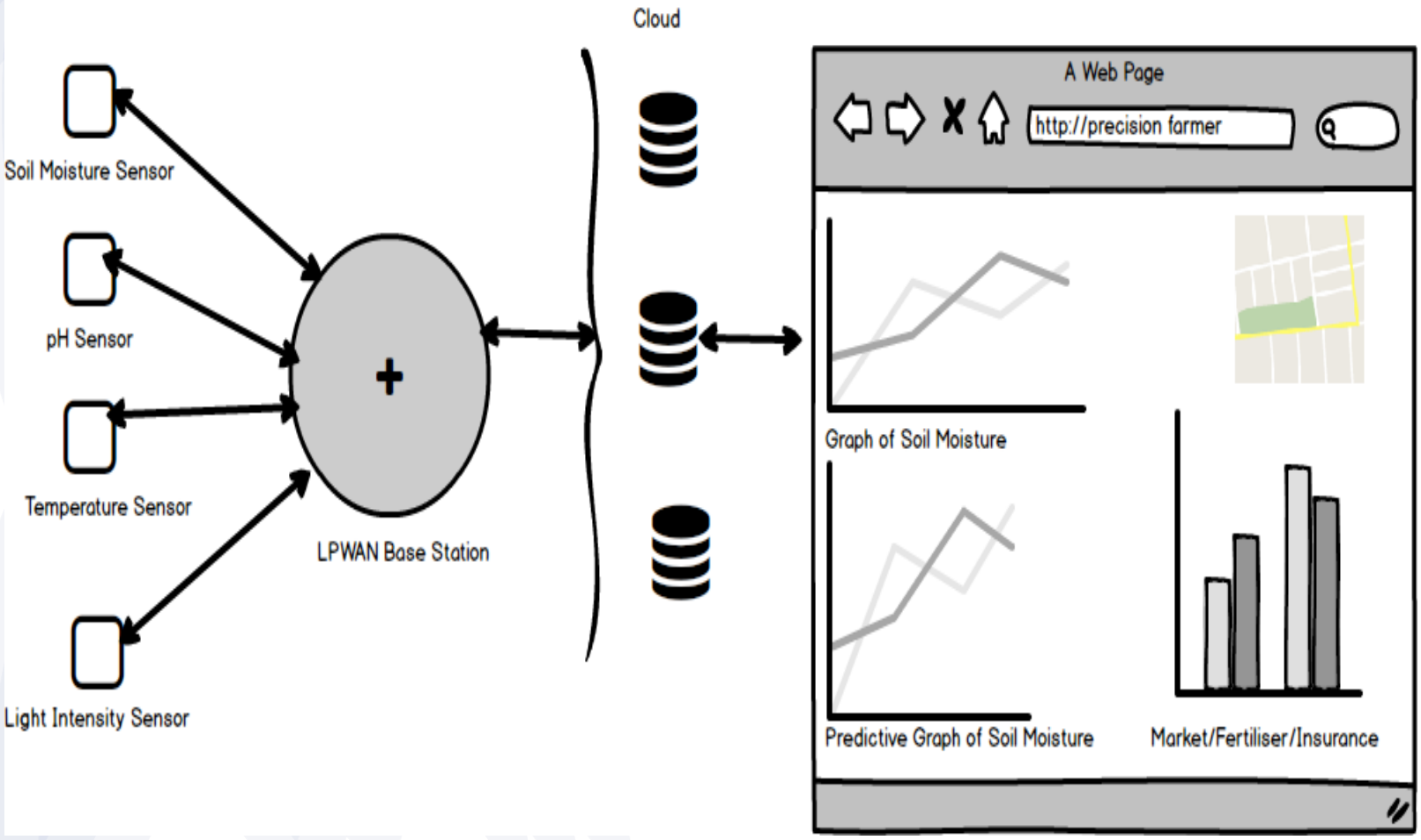
When a longer range is needed than legacy technologies can provide, LPWAN can be a good fit. Examples include wide-area water metering, gas detectors, smart agriculture, and battery-powered door locks and access control points.

Licensed vs Unlicensed LPWAN



Demo … LPWAN-Driven PA

PA Model


Cloud
Soil Moisture Sensor
pH Sensor
Temperature Sensor
Light Intensity Sensor
LPWAN Base Station
A Web Page
http://precision farmer
Graph of Soil Moisture
Predictive Graph of Soil Moisture
Market/Fertiliser/Insurance

Demo Cont'd

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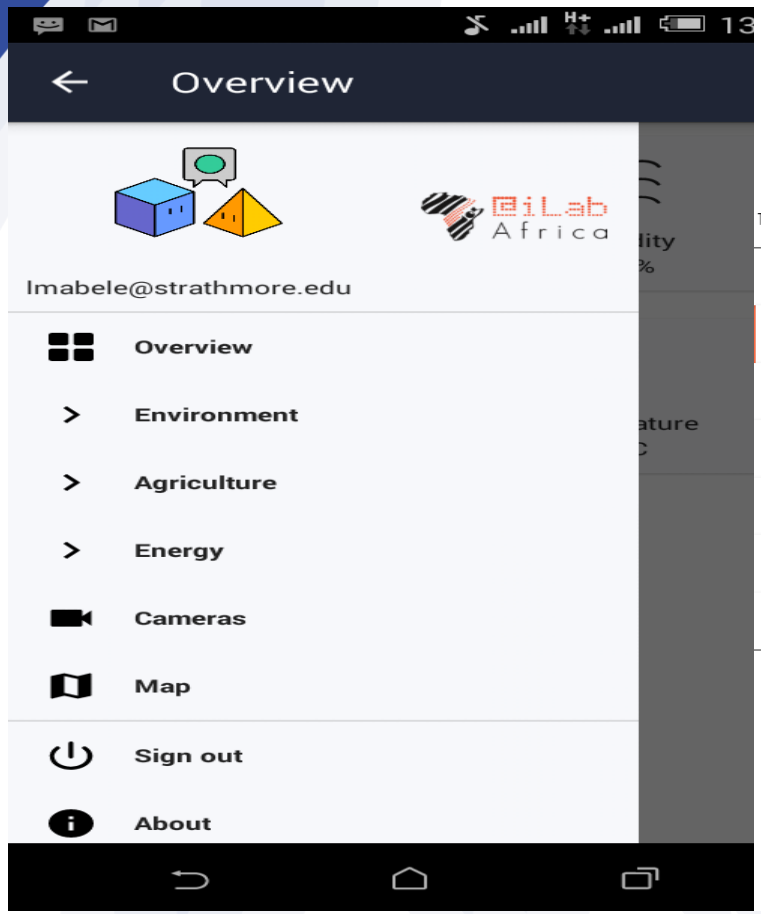

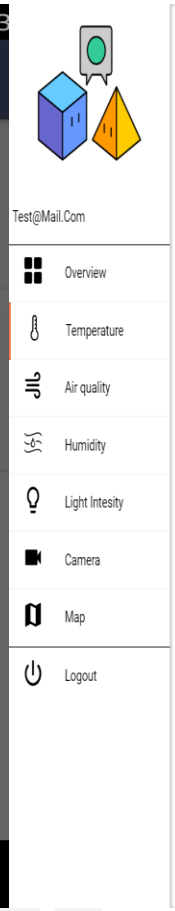

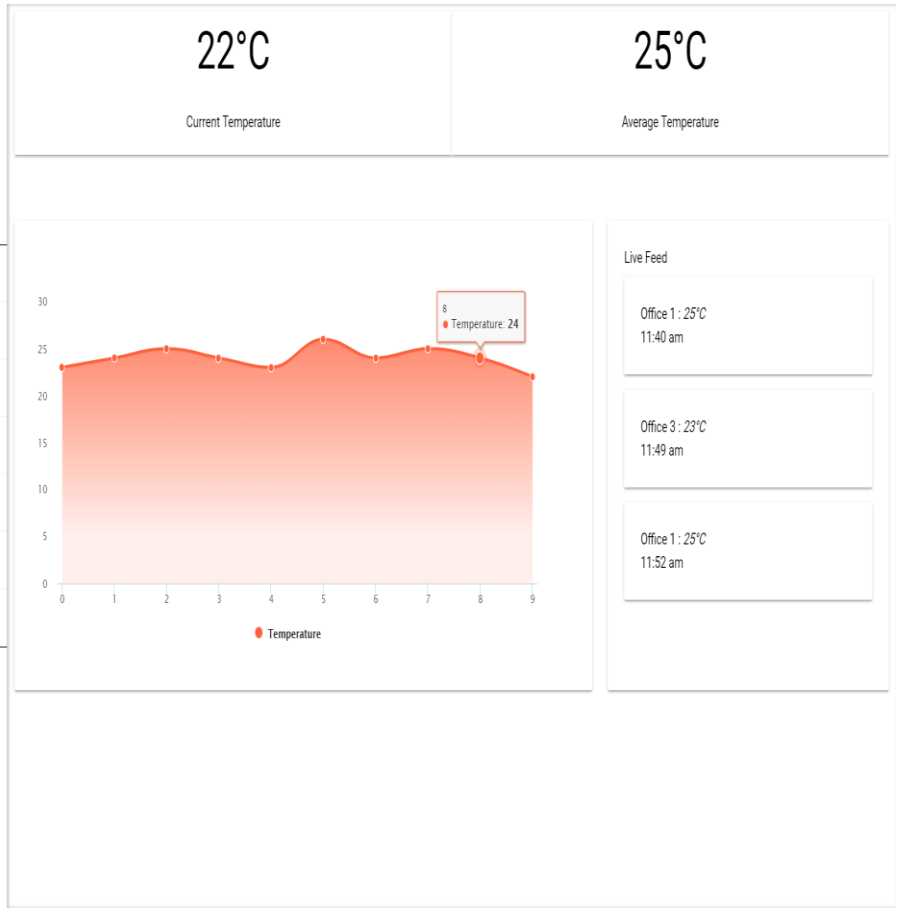

Future Work

- Integration of A.I. and M.L. techniques to correlate data models for precision farming e.g. how sensor data can be tied to fertilizer providers and insurance as well how to predict the suitable crops to grow.

References

- Internet of Things – From Research and Innovation to Market Deployment – Dr. Ovidiu Vermesan and Dr. Peter Friess
- IoT Fundamentals – Networking Technologies, Protocols and Use Cases for the Internet of Things – David Hanes, Gonzalo Salgueiro, Rob Barton, Jerome Henry, Patrick Grossetet (A Cisco Publication)

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Thank you!

Any Questions?