

# *A LoRa and MQTT-Based Monitoring System*

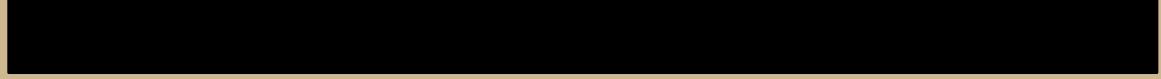
## **For Internal and External Beehives**

**Minju Jeon, Jiyun Kim, Sewon Kim, Seongmin Park, Bo Zhang**

# *Contents*

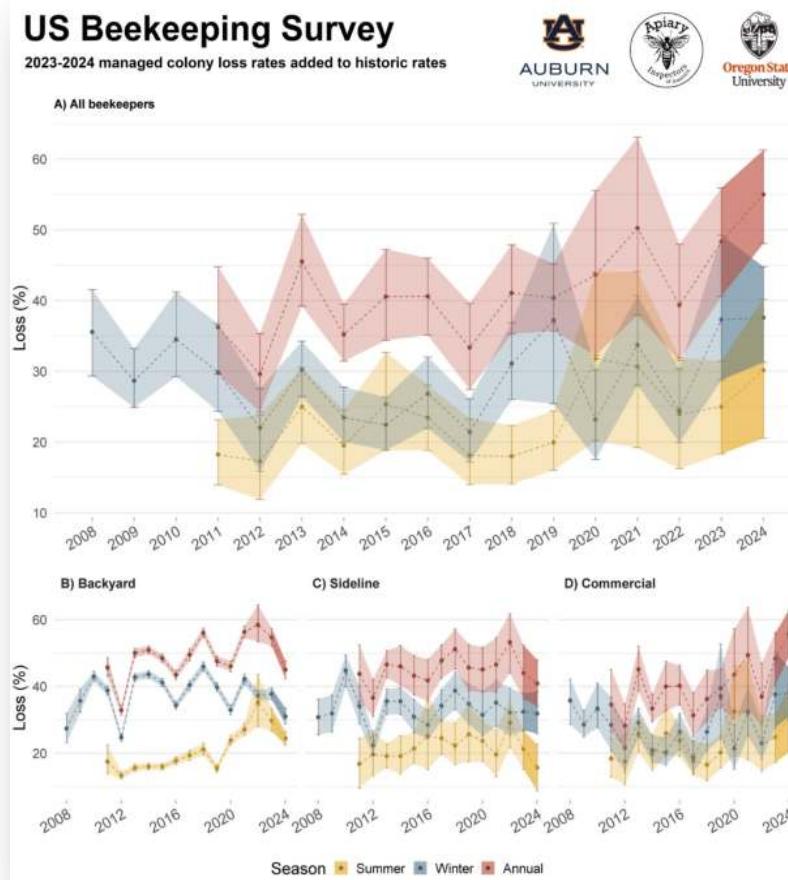
- 1. Introduction**
- 2. Background and Requirement**
- 3. System Architecture**
- 4. Video Demo**
- 5. Result and Future Plan**

# Introduction



Speaker : Minju Jeon

# Introduction



## *Introduction*

**Cost-Effective**

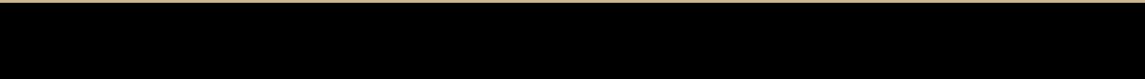
**Compact Design**

# **WaggleNet**

**Scalable  
Architecture**

**Dual-Scope Environmental  
Monitoring**

# Background and Requirement



Speaker : Sewon Kim

## Background: Why External Conditions Matter

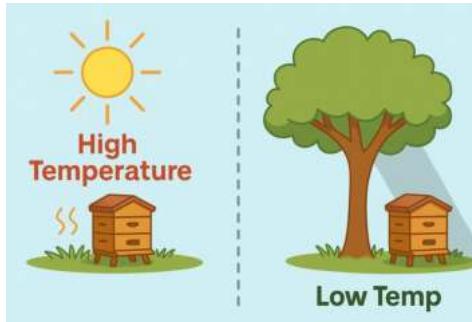
**Article**  
**Exploring the External Environmental Drivers of Honey Bee Colony Development**

Nuno Capela <sup>1,\*</sup>, Artur Sarmento <sup>1</sup>, Sandra Simões <sup>1</sup>, Sara Lopes <sup>1</sup>, Sílvia Castro <sup>1</sup>, António Alves da Silva <sup>1</sup>, Joana Alves <sup>1</sup>, Yoko L. Dupont <sup>2</sup>, Dirk C. de Graaf <sup>3</sup> and José Paulo Sousa <sup>1</sup>

**Understanding the Impact of Heat Stress on Honeybee Populations: Insights into Thermoregulation, Colony Dynamics, and Environmental Interactions**

Parul Kamboj <sup>a</sup>, Guramrit Kaur <sup>a</sup> and Garima Gupta <sup>a\*</sup>

<sup>a</sup> University Institute of Agricultural Sciences, Chandigarh University, India.



Inside + Outside → Context output

## *Requirement: What We Designed For*

### **Scalability**

*Easy node expansion/removal*

### **Accessibility**

*Real-time mobile app*

### **Comprehensive Hive-Environment Analysis**

*Internal + External data*

### **Low-Cost Implementation**

*Uses LoRa, not GSM/ LTE + Cost Low*

# System Architecture



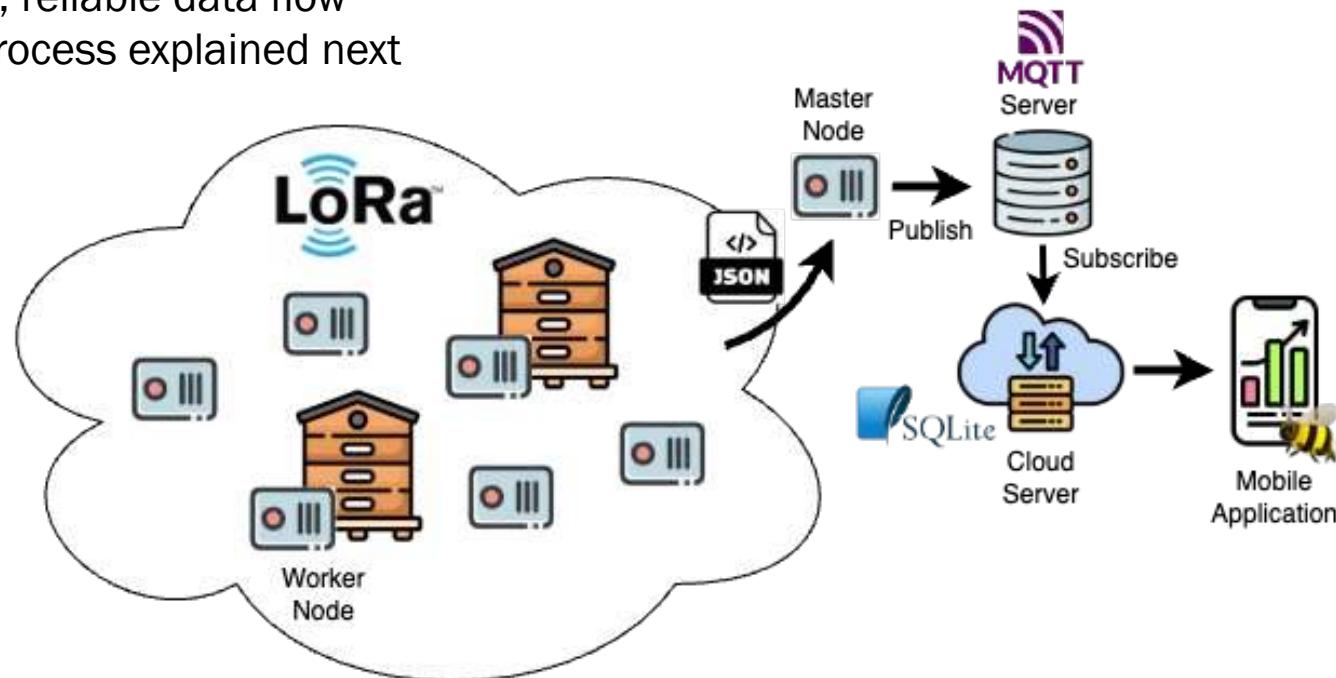
Speaker : Sewon Kim

## *System Architecture: End-to-End Data Flow*

LoRa → MQTT → Cloud → Mobile

Low-power, reliable data flow

Detailed process explained next

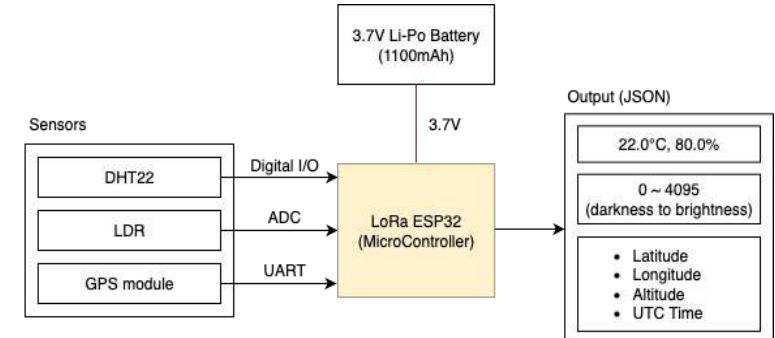
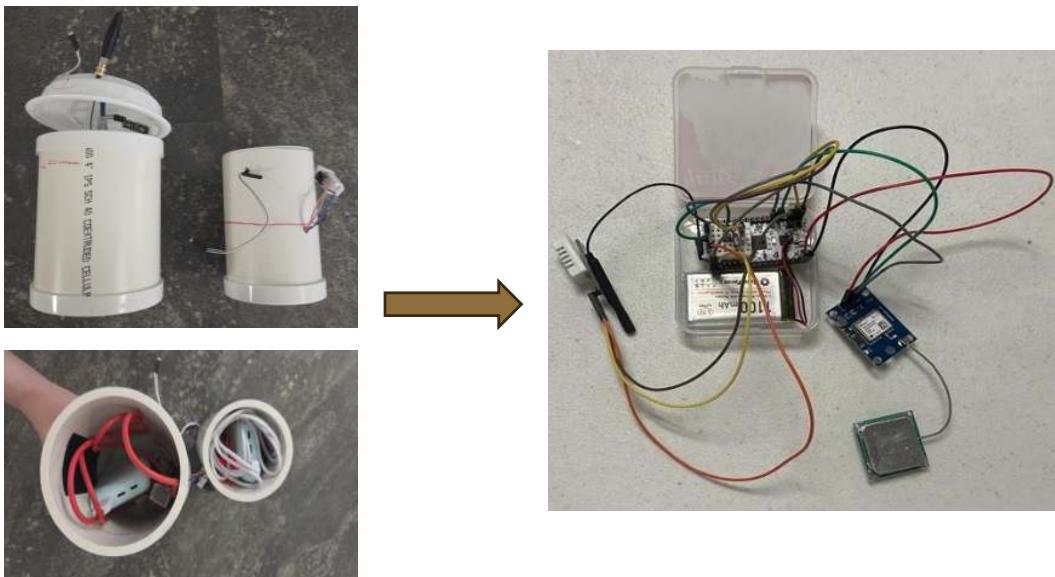


# Hardware



Speaker : Jiyun Kim

# Hardware

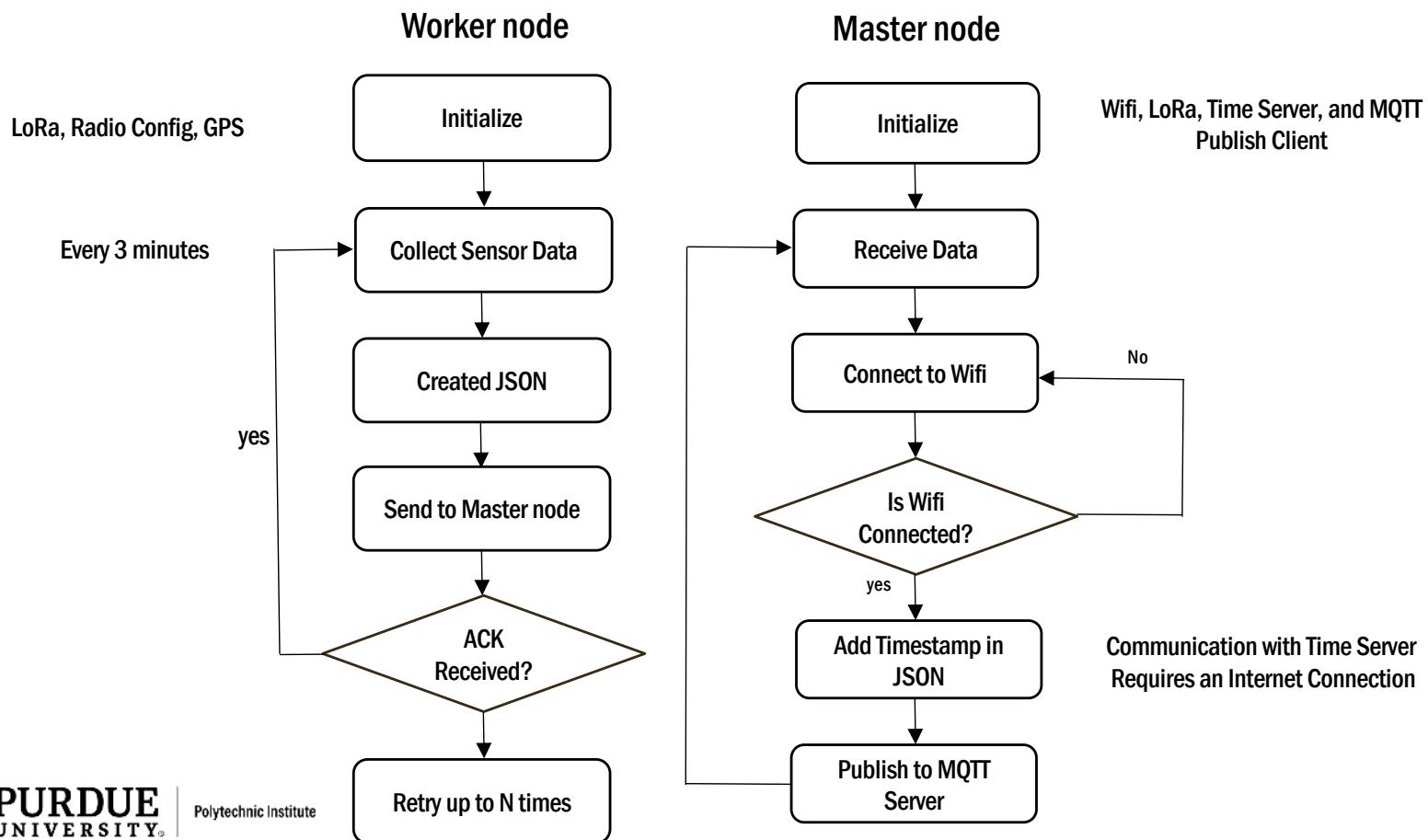


# Software



Speaker : Minju Jeon

# Software



# Server



Speaker : Seongmin Park

# Server

MQTT server

Request Response

Subscribed to 1 topic | Connected | 0.00

Messages Visualization

Search All Messages

farm/sensor {"type": "periodically", "source": "sensor/NOD..."} 13:42:36.853  
farm/sensor {"type": "periodically", "source": "sensor/NOD..."} 13:41:17.665  
farm/sensor {"type": "emergency", "source": "sensor/NOD..."} 13:41:08.829  
farm/sensor {"type": "periodically", "source": "sensor/NOD..."} 13:39:36.396  
farm/sensor {"type": "emergency", "source": "sensor/NOD..."} 13:38:08.814  
farm/sensor {"type": "periodically", "source": "sensor/NOD..."} 13:36:38.772

Cloud server

Func API

Old Version Features: Sync API | Async API | ?

Func

insert\_token Sync  
def BEEPROJ\_db\_related\_funcs.insert\_token( fcm\_token )  
ID application.add\_token

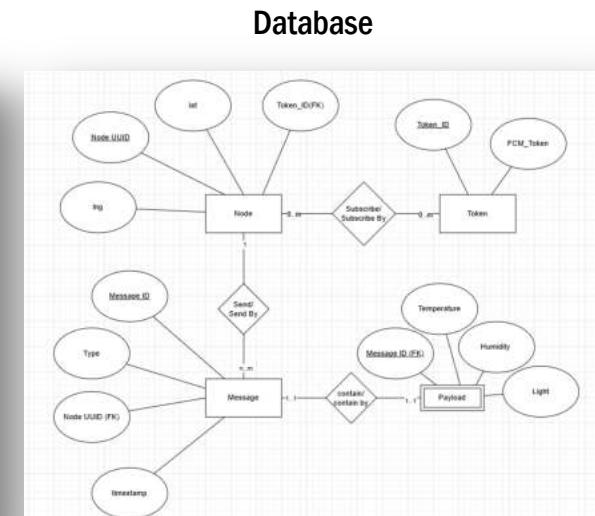
month\_detail Sync  
def BEEPROJ\_db\_related\_funcs.get\_month\_environment\_detail( node\_name , time\_range )  
ID month\_summary

month Sync  
def BEEPROJ\_db\_related\_funcs.get\_month\_environment( node\_name )  
ID environment.month

week Sync  
def BEEPROJ\_db\_related\_funcs.get\_week\_environment( node\_name )  
ID environment.week

today Sync  
def BEEPROJ\_db\_related\_funcs.get\_today\_environment( node\_name )  
ID environment.today

current Sync  
def BEEPROJ\_db\_related\_funcs.get\_current\_environment( node\_name )  
ID environment.current



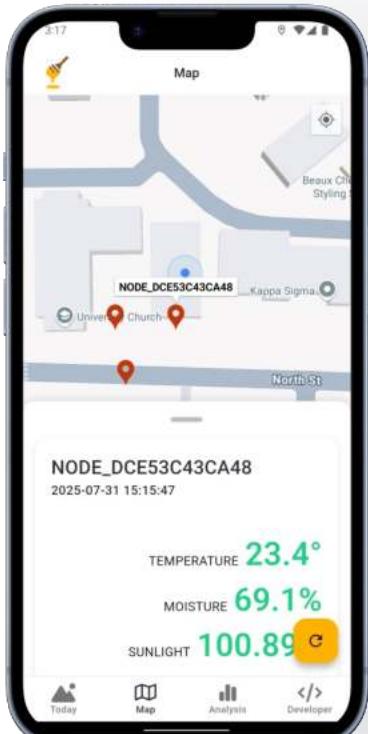
# Mobile Application



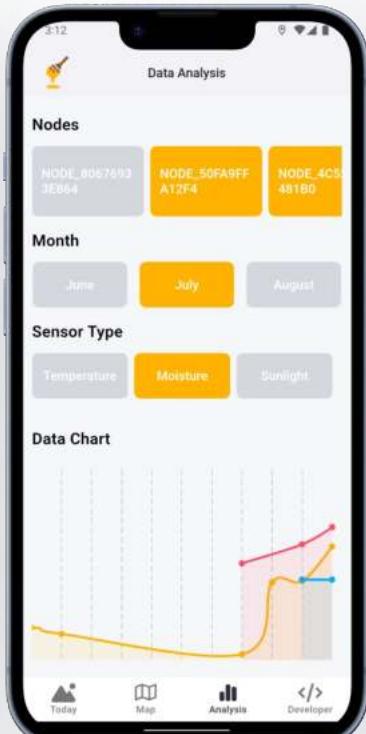
Speaker : Seongmin Park

# Mobile Application

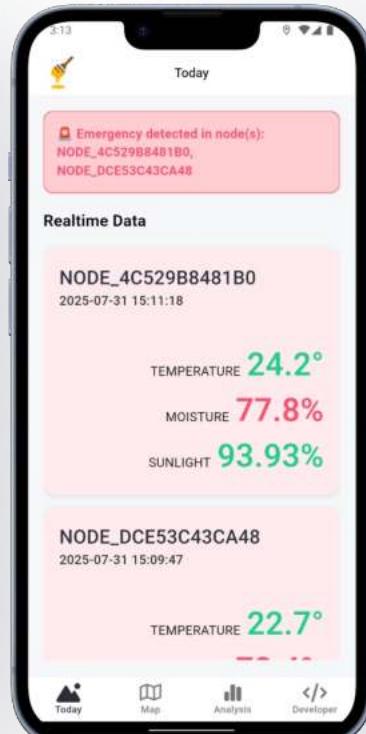
Map Screen



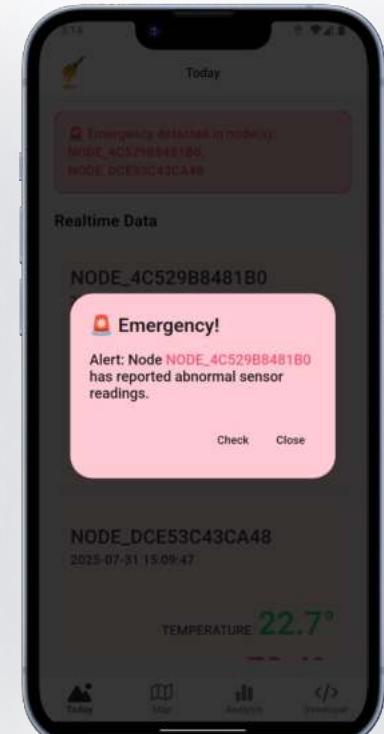
Graph Screen



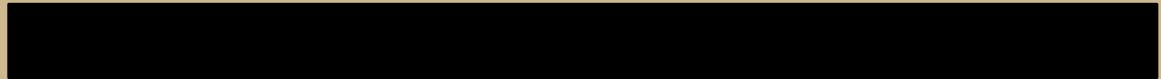
Home Screen



Emergency Alarm



# Video Demo

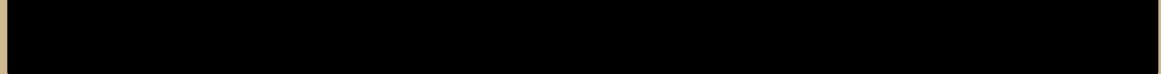


Speaker : Minju Jeon

## *Video Demo*



# Result and Future Plan



Speaker : Minju Jeon

## *Result and Future Plan*

The image shows two side-by-side mobile phone screenshots. Both phones have a black header bar with signal strength, battery level, and time indicators. Below the header, each screen displays a weather monitoring application interface.

**Left Screen (inside):**

- Header: 3:21, NODE\_DCE53C43CA48
- Text: Last updated: 15:21:18
- Table:

TIME	TEMP	MOIST	SUN	STATUS
2025-08-04 15:20:29	34°	50%	0%	Normal
2025-08-04 15:17:29	34°	50%	0%	Normal
2025-08-04 15:14:28	33°	50%	0%	Normal

**Right Screen (outside):**

- Header: 3:18, NODE\_4C529B8481B0
- Text: Last updated: 15:18:48
- Table:

TIME	TEMP	MOIST	SUN	STATUS
2025-08-04 15:16:36	28°	88%	100%	Warning
2025-08-04 15:13:36	29°	90%	100%	Warning
2025-08-04 15:10:36	30°	88%	100%	Warning

Below the screens, the word "inside" is centered under the left one, and "outside" is centered under the right one.

- 1. Access point**
- 2. Hardware miniaturization**
- 3. AI-based optimal beehive placement recommendation**

# *Thank You*