



Midterm Presentation

Team Coyote1



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01

Introduction

1.1 Team members



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Computer Science and Engineering



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Computer Engineering



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Purdue University
Network Engineering Technology



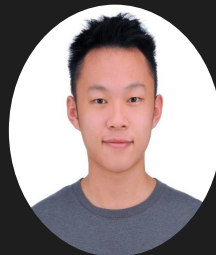
Hyeongjun Kim

Daegu Catholic University
Computer Engineering



Nayoun Kim

Woosong University
Information Technology Convergence



Wei-Chieh Chin(Victor)

Purdue University
Computer & Information Technology



1.2 Background



United States
Department of
Agriculture

Animal and
Plant Health
Inspection
Service

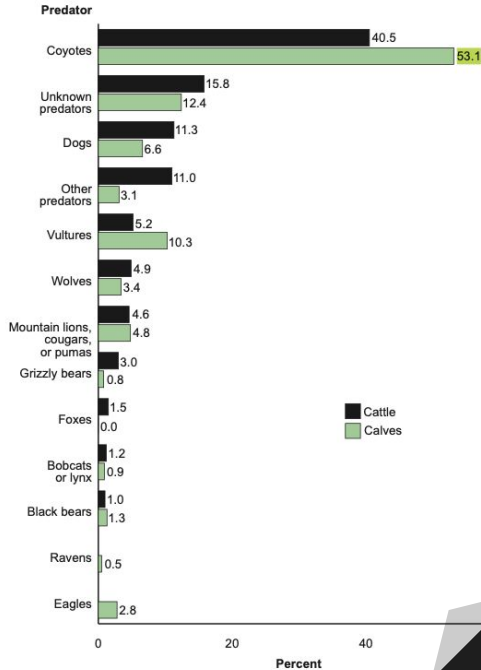
Veterinary
Services

National
Animal Health
Monitoring
System

December 2017

Death Loss in U.S. Cattle and Calves Due to Predator and Nonpredator Causes, 2015

Percentage of cattle and calves death loss, by predator



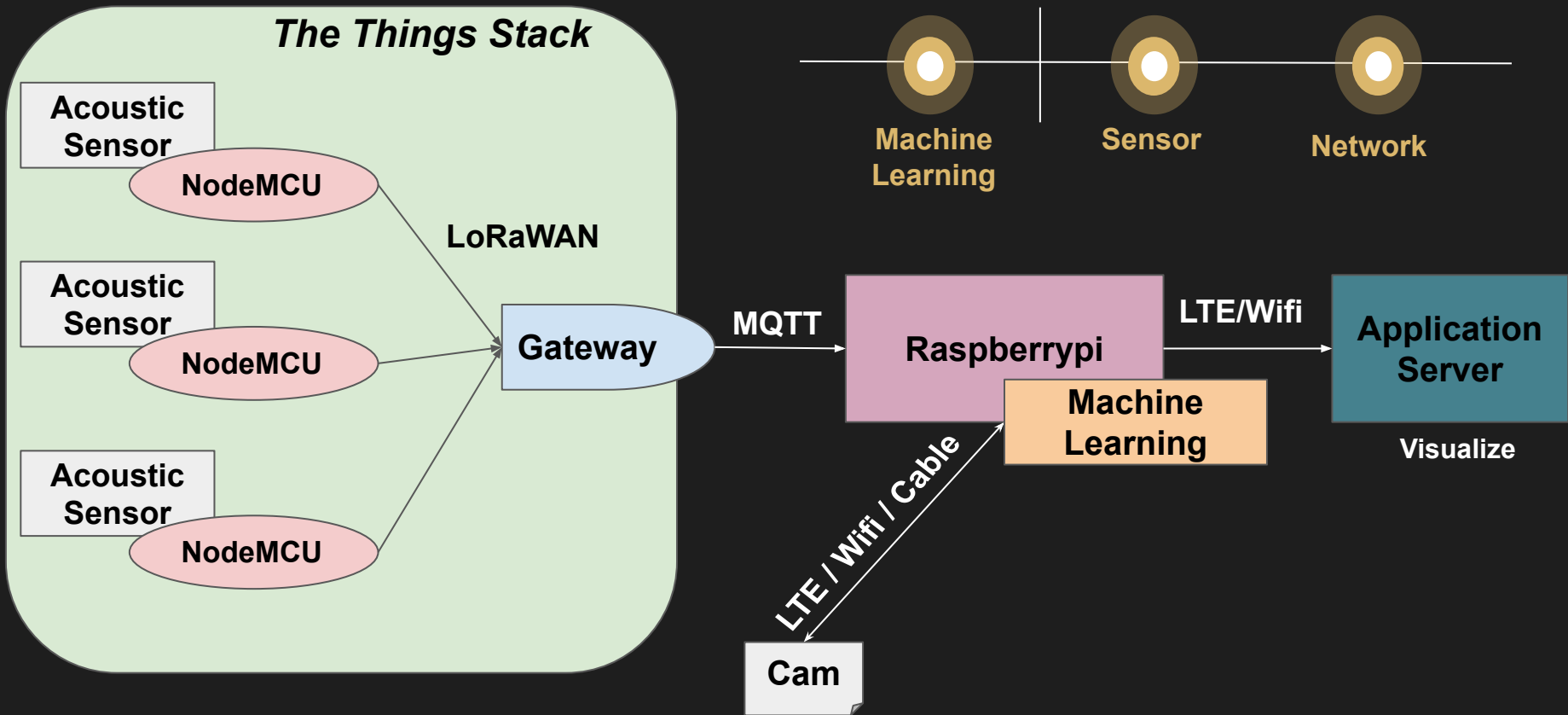
- ✓ Cost-Effective
- ✓ Easy-to-use



Introduction

1.3 Project Architecture

The Things Stack





Progress

02

Progress

2.1 LoRaWAN



- ✓ Network server stack
- ✓ Open-source components for networks
- ✓ Physical layer process of radio modulation



2.1 LoRaWAN



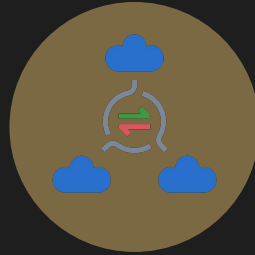
**Low Power
Consumption**



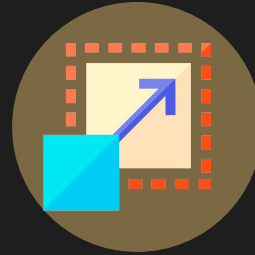
**Years of
Battery Life**



Long-distance



Multi-usable



Scalable



Cost-effective



Progress

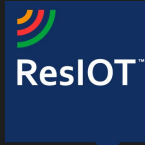
2.2 Gateway



To connect the gateway to the ResIoT,
The program provided by the ResIoT had to be installed on the gateway.

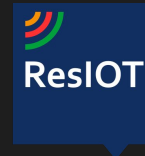
✗ Memory error that the multi-tech gateway lacked storage

✗ When we looked at how much storage was left
on the mLinux terminal, there was enough storage



Rak7249 Gateway

✗ ResIoT did not support the Rak gateway



Multi-tech gateway



2.2 Gateway



Local Server VS Cloud Server



ChirpStack



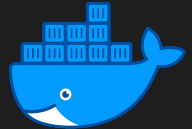
Failed to install it due to unknown errors



configuration files



uploaded



docker



The application server could be created



Connection failed due to an authentication problem

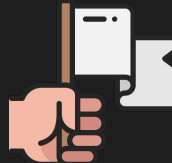


Progress

2.2 Gateway



- ✓ The process of building the server went smoothly
- ✓ If clients are connected to the same network access to the application server through the static IP address was successful
- ✗ It was necessary to access the console window to register the gateway, but it was not possible to access the console window
- ✓ Re-created the certificate and tried registering
- ✗ The same authentication problem occurred such as 401 and 404 errors



**multi-tech gateway
had been previously registered.**



Progress

2.2 Gateway



Decided to turn our attention back to the cloud server.



An attempt was made to register a different multi-tech gateway with the SENET cloud server.



The multi-tech gateway could not connect to the Internet, so the gateway software provided by SENET could not be installed.



Progress

2.2 Gateway

Tried to connect the RAK7249 gateway to The Things stack



But it always show disconnected



Debugged the Rak's Internet connection



Connected to The Things Network again,
the gateway's status said connected-!!



Progress

2.3 Esp32 – Gateway

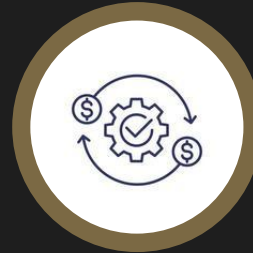
[Esp32]



Wifi & Bluetooth

Wide Range of applications can be targeted

No need to connect bluetooth - wifi module



Low-cost & Low-power

Low-cost & Low-power system on a chip microcontrollers



Temperature range

Wide operating temperature (-104°F ~ 221°F)



2.3 Esp32 – Gateway

[Esp32]



Overview Applications Gateways Organizations

Applications > Acoustic Sensors > Live data

Time	Entity ID	Type	Data preview
↑ 05:50:35	eui-70b3d57ed00565be	Forward uplink data message	DevAddr: 26 0C 58 75 <>
↑ 05:50:28	eui-70b3d57ed00565be	Forward uplink data message	DevAddr: 26 0C 58 75 <>
↑ 05:50:20	eui-70b3d57ed00565be	Forward uplink data message	DevAddr: 26 0C 58 75 <>
↑ 05:50:13	eui-70b3d57ed00565be	Forward uplink data message	DevAddr: 26 0C 58 75 <>
↑ 05:50:06	eui-70b3d57ed00565be	Forward uplink data message	DevAddr: 26 0C 58 75 <>

Payload: 07 9F 00 <>

Payload: 07 9F 00 <>

Payload: 08 47 00 <>

Payload: 07 A3 00 <>

Payload: 07 B0 00 <>

Export as JSON

SF9BW125 SNR: 5.25 RSSI: -105

SF9BW125 SNR: 5.5 RSSI: -107

SF9BW125 SNR: -0.5 RSSI: -106

SF9BW125 SNR: 6.5 RSSI: -106

SF9BW125 SNR: 3.25 RSSI: -110

NAM1 Community

Fair use policy applies



Progress

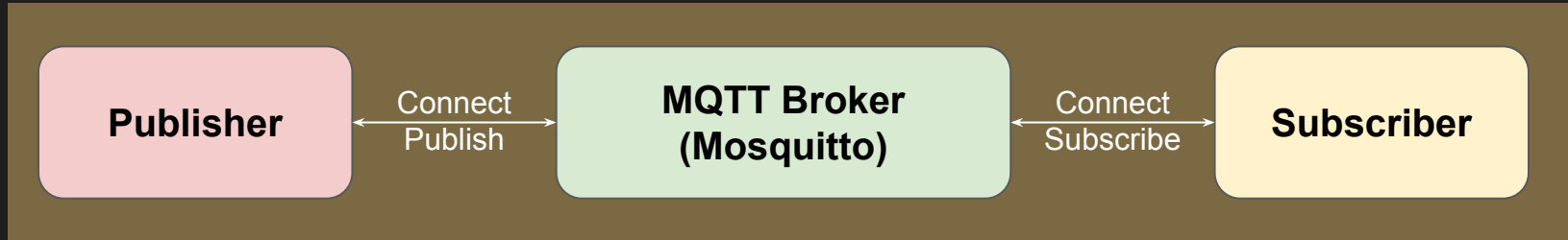
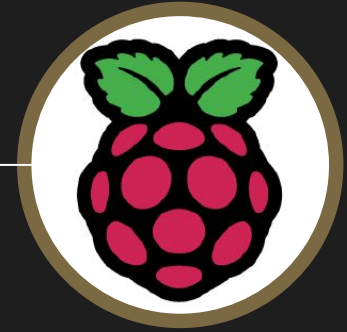
2.4 Gateway – Raspberry pi

[MQTT]

- ✓ MQ Telemetry Transport
- ✓ Light weight
- ✓ Machine - Machine Network protocol
- ✓ Minimum power & packet



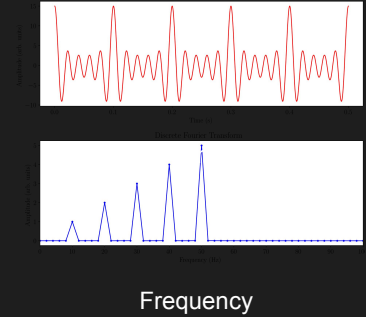
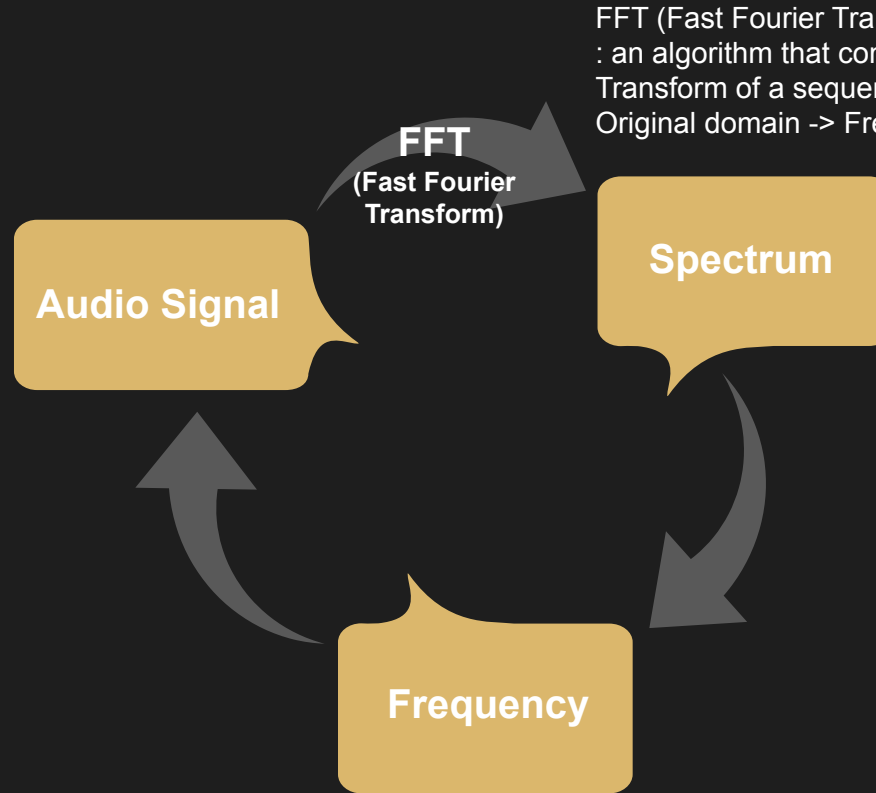
MQTT



2.5 Acoustic Sensor

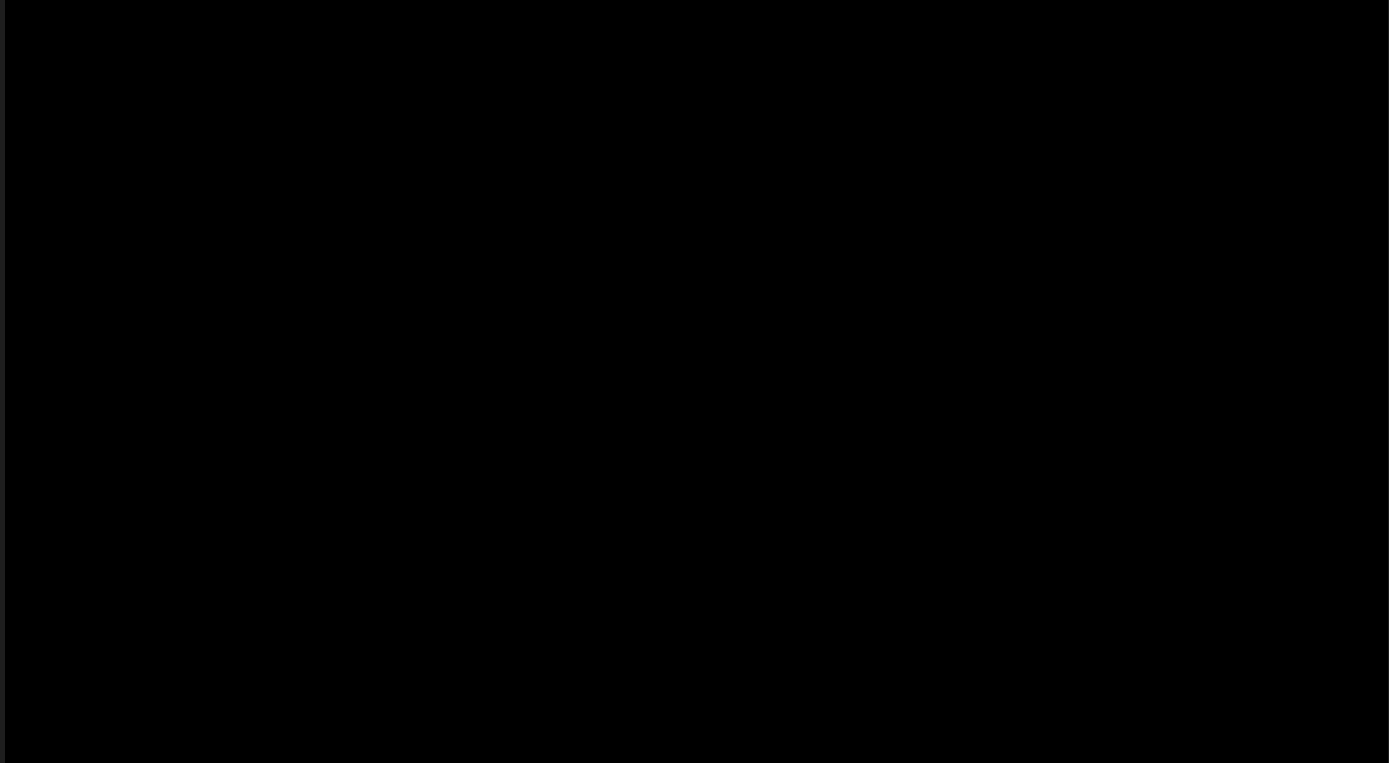


[max4466]



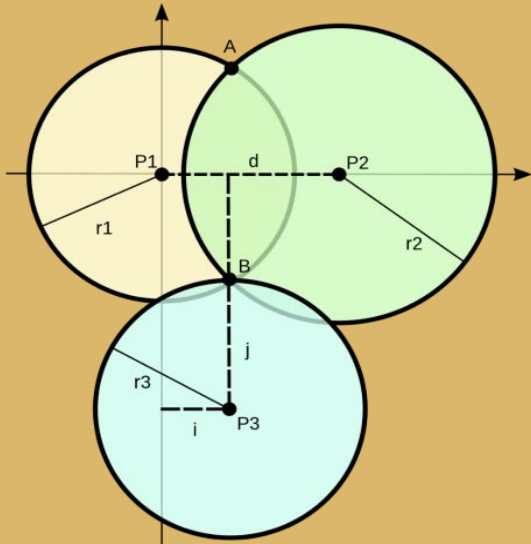
2.1 ~ 2.5 Demo Video

Esp32 — the things stack cloud server — MQTT Broker



2.6 Acoustic Localization

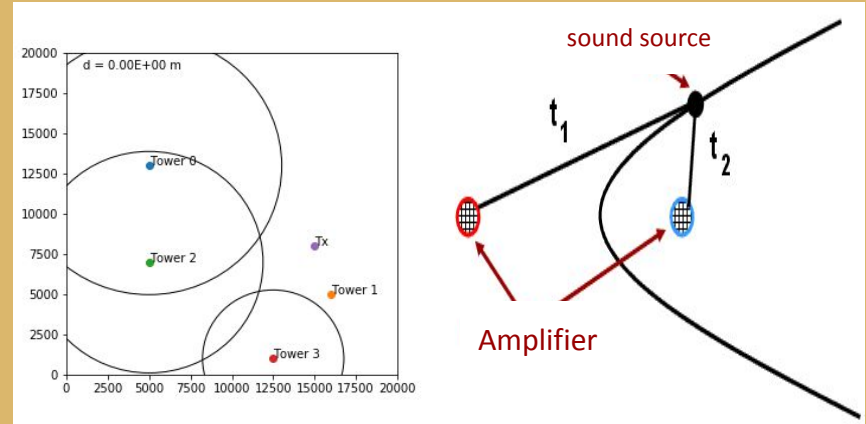
[Trilateration]



~~r_1, r_2, r_3~~

- r_1, r_2, r_3 : distance between the source of the sound and three acoustic sensors
- N : the first time when the sound came in

[Triangulation] - hyperbola



- The process of acoustic localization using forming triangles to the point from know points
- Three hyperbola \Rightarrow the source of the sound





Problem

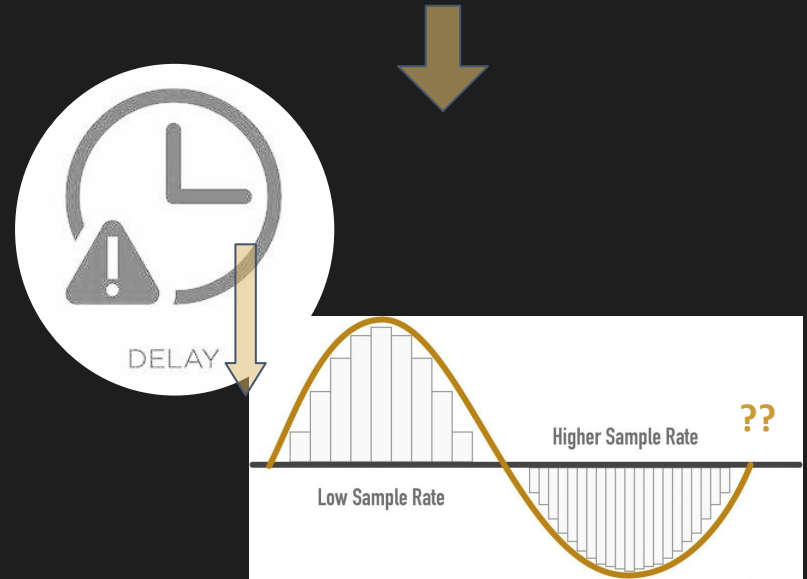
03

Problem

3. Problem



- Low Power
- Low Bit Rate Networking Protocols





Weekly Plan

04

Weekly Plan

4. Weekly Plan

		Sep 4th	Oct 1st	Oct 2nd	Oct 3rd	Oct 4th	Nov 1st	Nov 2nd	Nov 3rd	Nov 4th	Dec 1st	Dec 2nd	Dec 3rd
LoRaWAN Setting	✓												
NodeMCU - Acoustic Sensor Code	✓												
AcousticSensor - GW Connect	✓												
Sound Filtering & Data Compress													
MQTT Connection	✓												
Raspberrypi-MachineLearning													
Camera Sensor Code													
GW - CameraSensor Connect													
Test													
Paper													
PR													





Q&A



Thank you