

Local Emergency Area Network (LEAN)

Briefing

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Introduction

- LEAN will create a deployable ad-hoc network.
- Procedurally adaptive to any emergency area
 - Scalable
 - Wireless/Portable
- Intranet connection, no internet access.
 - Waste of bandwidth.
 - Strictly for communication.
- Normal Wi-Fi connection for ICS personnel.



Problem Description

- Communication is imperative to ensure safety.
 - Perform duties.
 - Coordination.
- Communication technologies are insufficient during ICS events.
 - Overloaded, damaged systems.
- Communication security.
 - Data must be secure on LEAN.
- Determining a damaged network node is difficult.
 - Environmental awareness.

State-Of-The-Art And Alternative Approaches

A closes product to the solution that LEAN proposes is the CISCO MANET.

- In MANET environments, nodes can join or leave the network, thus different routing topologies are needed[1].
- This becomes a challenge because the state of a node can change before the event is detected by the normal timing mechanisms of the routing protocol [1].

LEAN is state of the art by providing environmentally aware Wi-Fi repeater pods with the use of an on board sensor array.

Design Overview

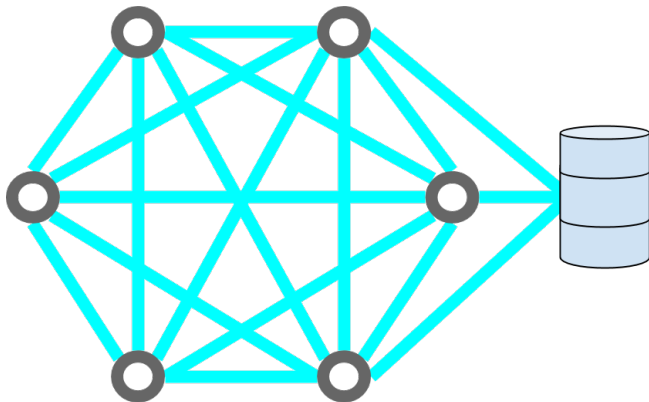


Figure 1: Mesh Network Overview of Lean

Node Description

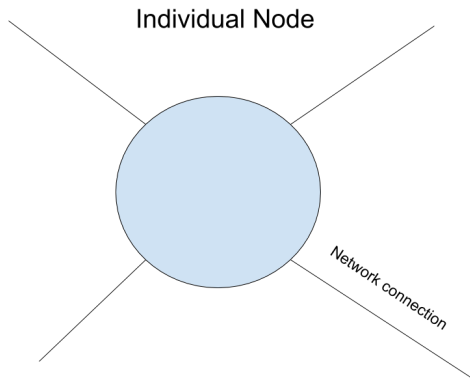


Figure 2: Node Overview

Pod Design

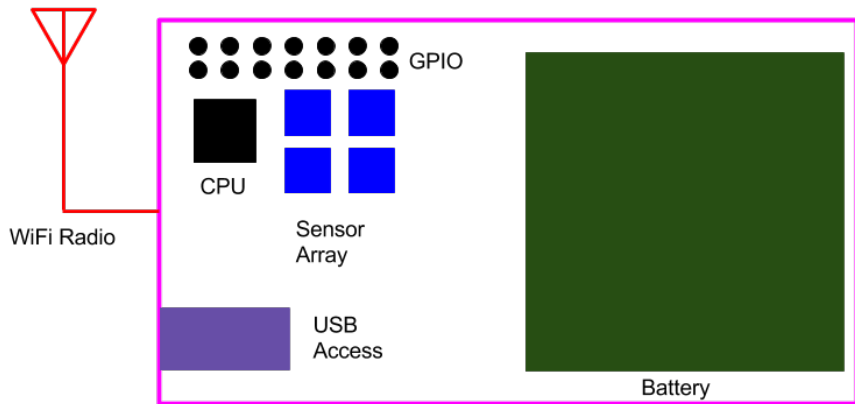


Figure 3: Pod Design Insides

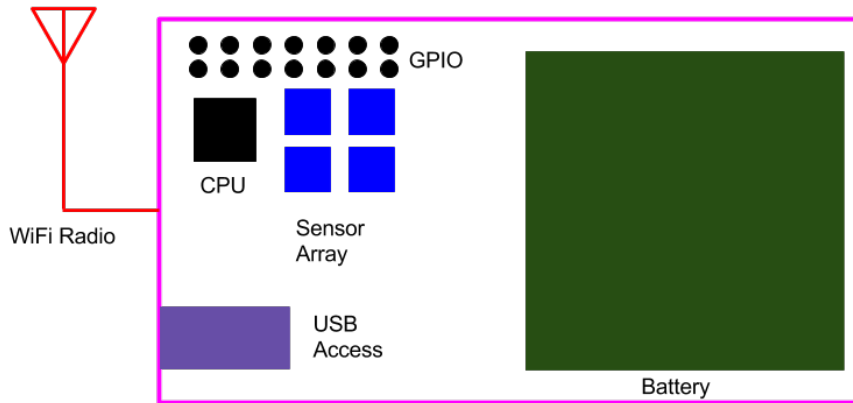
WiFi Radio

- IEEE 802.11n Standard.
- USB connection.
- High gain omnidirectional.
- Inexpensive and diverse options.



WiFi Radio

Pod Design



CPU

- Raspberry Pi 2 Model B.
- Inexpensive and powerful.
- GPIO for sensor array.
- Simple low-overhead software.



GPIO



CPU

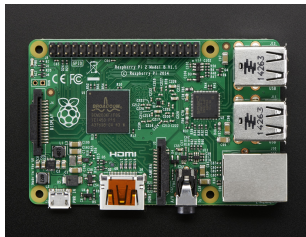
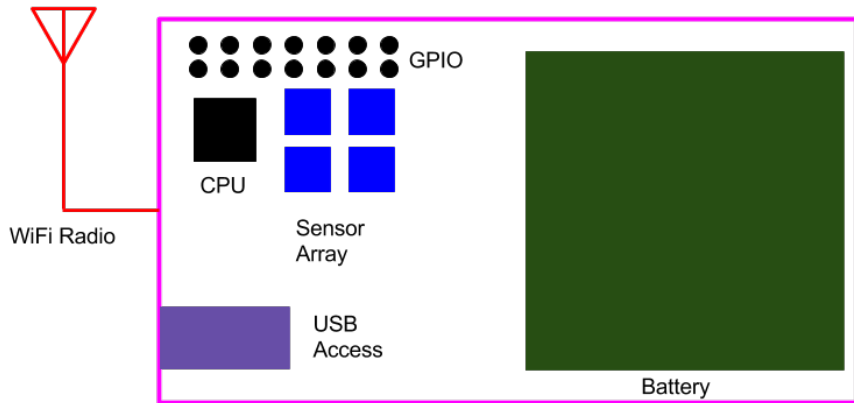


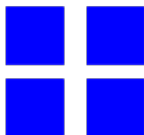
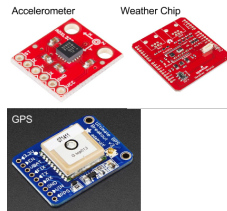
Figure 4: Central Processing Unit [2]

Pod Design



Sensor Array

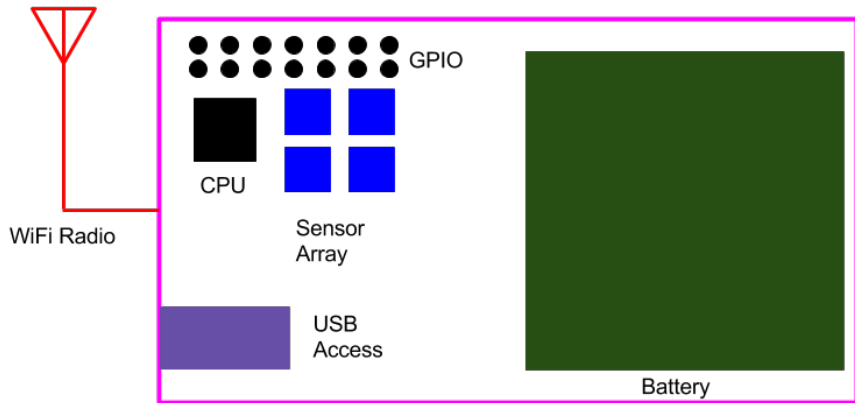
- Accelerometer.
- Weather Chip.
- GPS.
- Breakout boards.
- Rapid prototyping.



Sensor
Array

Figure 5: Sensor Components
[3][4][5]

Pod Design



USB Access

- Squid cable for GPIO.
- Administrator access.
- In field set-up assistance.
- Simple reporting to a bash shell.
 - Geolocation.
 - Other Pods.
- Easy setup documentation.

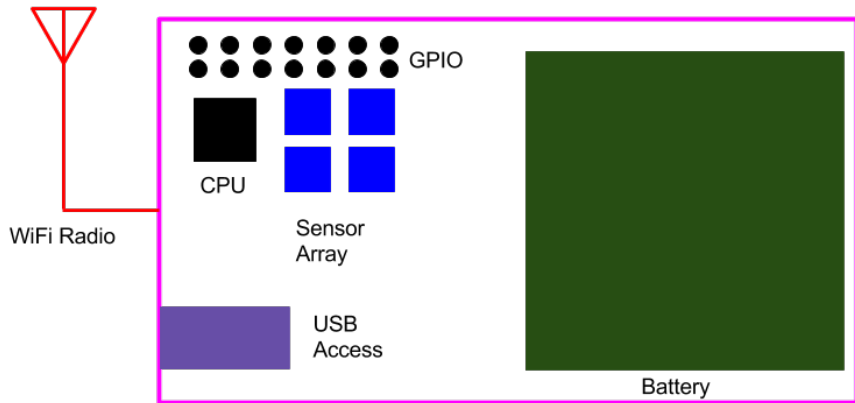


USB
Access



Figure 6: USB Connection [6]

Pod Design



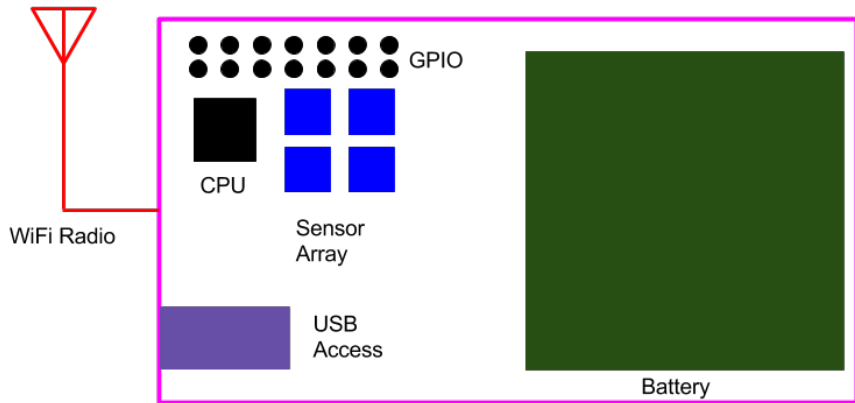
Battery

- Flooded cell acid battery.
- Less than 100 lbs.
- 30Ahr charge capacity.
- Less expensive.
- Weight reduces mobility.



Battery

Pod Design



Pod Shell Enclosure

- Commercial grade battery box.
- Two compartments.
- High-impact polyethylene.
- UV, acid, gasoline, oil, salt resistant.

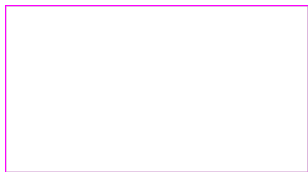
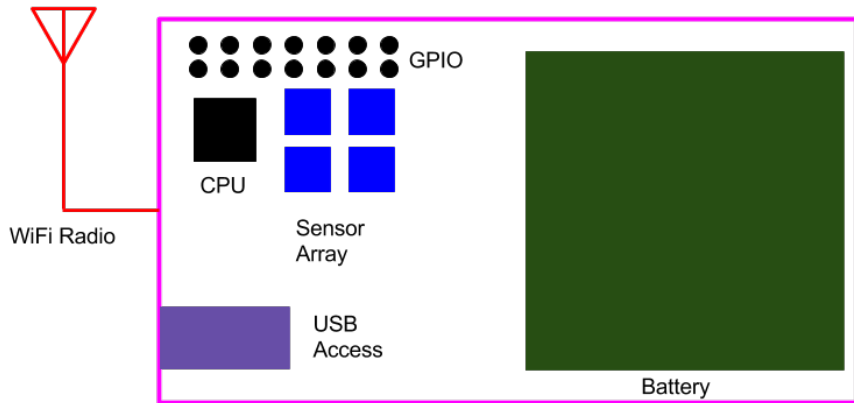
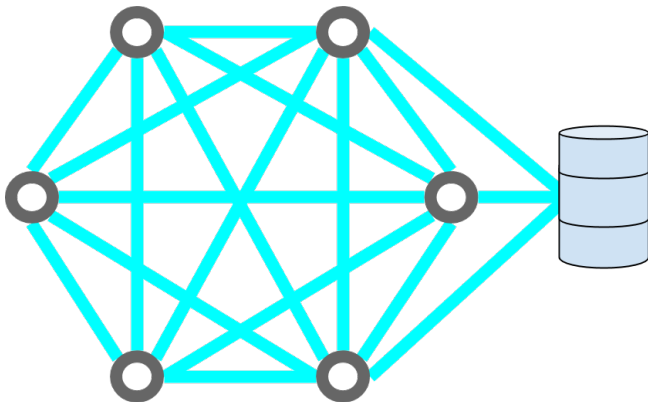


Figure 7: Commercial Grade Battery Case [7]

Pod Design



Design Overview



Central Server Overview I

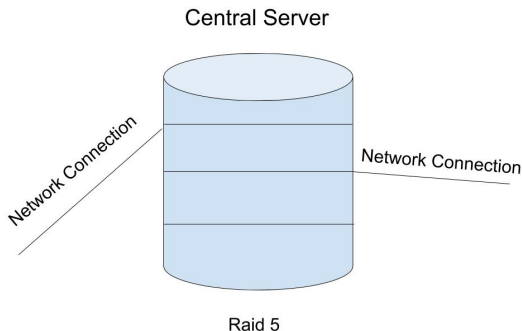


Figure 8: Central Server Database and Network Connection

Central Server Overview II

- Ubuntu LTS.
- Babel routing protocol.
- Best guess placement algorithm.
- MySQL database management.
- Anomaly detection.
- Pod visualization.
- Quicker pod replacement.

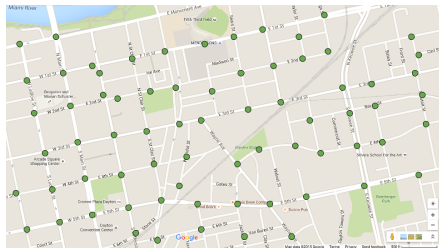


Figure 9: Pod Mapping Visualization

Conclusion

- Deployable ad-hoc mobile network that provides stable communication.
- Using existing hardware to rapidly prototype a system.
- Environmentally aware with sensor array.
- Scales to any emergency situation.
- Provides a platform for future 3rd party applications.





Questions






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