

MeasureMesh

LoRa based wireless measurement system and analytics interface

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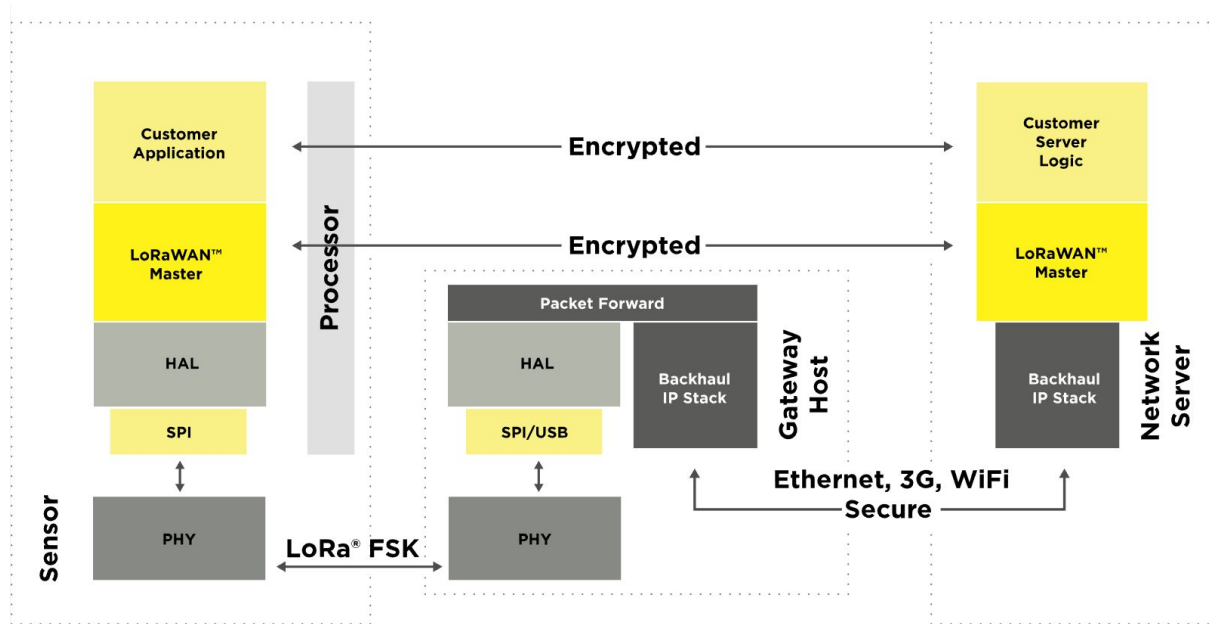
Wireless Monitoring

- Wide range of applications
 - Agriculture
 - Biomedical
 - Households
- Longer wireless range enables more applications
- Ease of data visualization improves system utilization



LoRa Radio

- Low power
- Encrypted
- Long Range
- Low bit rate.



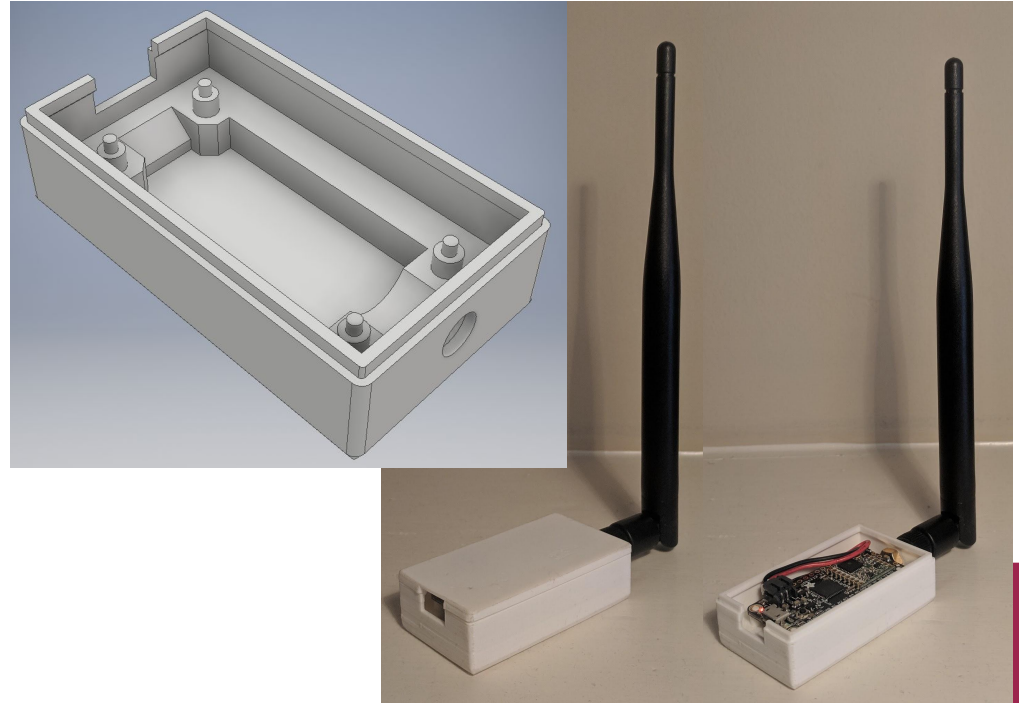
Hardware Overview

- Server hardware is a Linux box at my house.



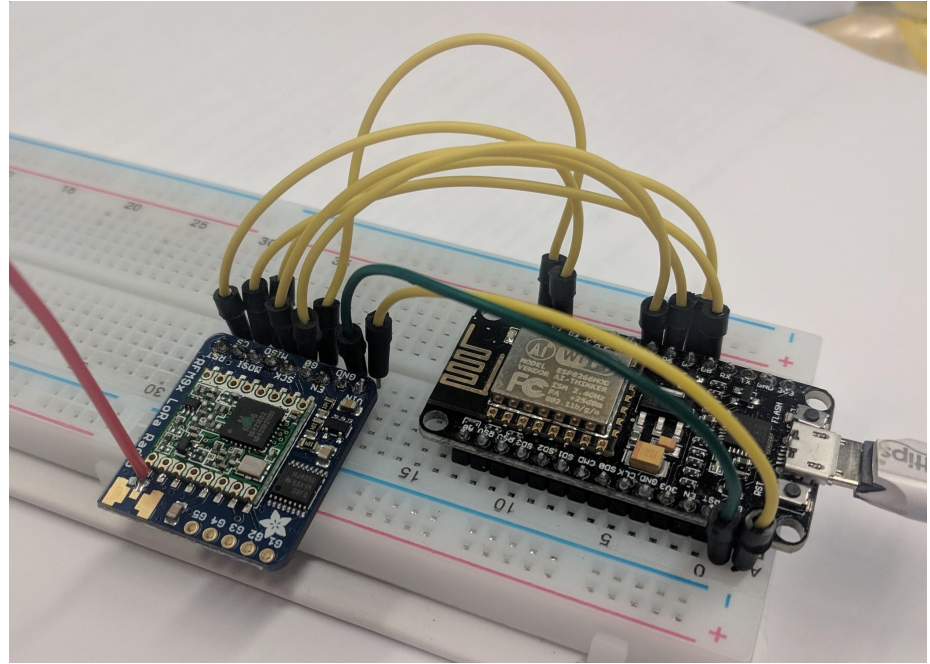
Node Design

- Atmel SAMD21 processor
 - Arduino compatible
- LiPo battery charging
 - Discharge data of node plotted for user interface demo
- 900Mhz 1/2 wave whip
- Cost: \$53



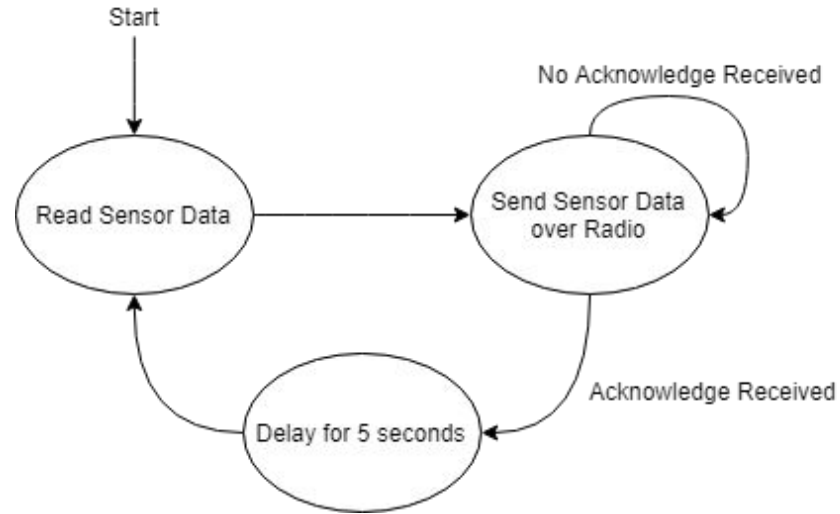
Gateway Design

- ESP8266 processor
 - Arduino compatible
 - WiFi enabled for future features
- Serial connection to server
- Cost: \$25.



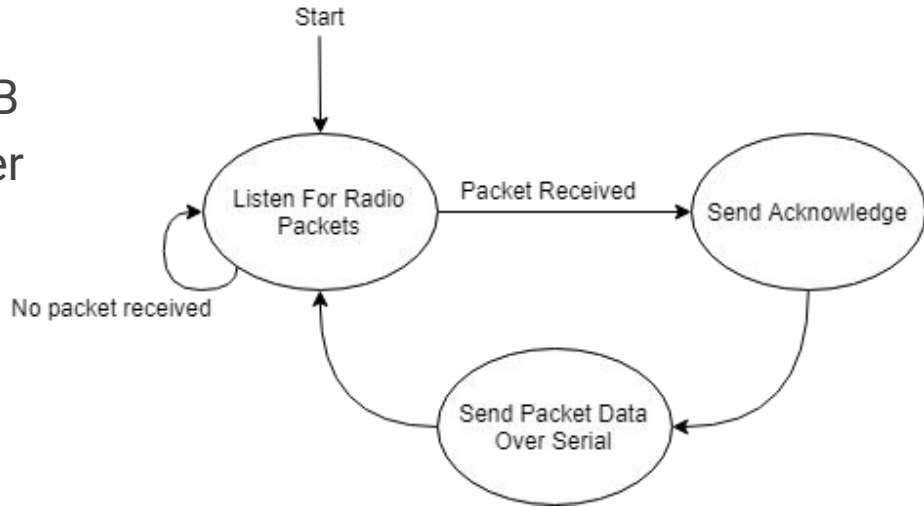
Node Firmware

- 48Mhz processor with rich peripheral set enables wide variety of sensors
- Battery voltage is currently the only data that is logged
- Low power sleep in delay should be implemented in the future.



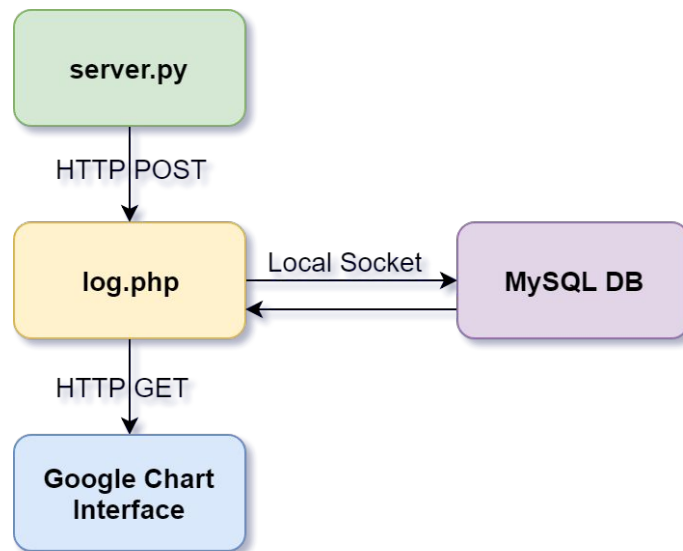
Gateway Firmware

- Processor allows for either wired USB serial or wireless connection to server
- Could be implemented as a repeater for longer ranges between nodes
- Sends ACK if valid packet is received



Server Software

- Data is inserted via HTTP GET request
 - Allows for flexible insertion by gateways connected over the internet.
- Python logging daemon serves as wired gateway helper to read serial preform GET requests locally.
- Front end based on Google Polymer and Google Charts pulls and plots logged data to the user.



Database Schema

- Timestamp added at time of insertion so clock differences in hardware is not an issue

```
1 CREATE DATABASE logger;
2
3 USE logger;
4
5 CREATE USER 'logger'@'localhost' IDENTIFIED BY 'password';
6 GRANT ALL PRIVILEGES ON logger.* TO 'logger'@'localhost';
7
8 CREATE TABLE data_log (
9     pkey INTEGER NOT NULL AUTO_INCREMENT,
10     time TIMESTAMP NOT NULL DEFAULT CURRENT_TIMESTAMP,
11     temps VARCHAR(64) NOT NULL,
12     mtype VARCHAR(10) NOT NULL,
13     stype VARCHAR(10),
14     PRIMARY KEY(pkey))
15     ENGINE=INNODB;
16
17 CREATE TABLE params (
18     pkey INTEGER NOT NULL AUTO_INCREMENT,
19     id VARCHAR(20) NOT NULL,
20     val VARCHAR(64) NOT NULL,
21     stype VARCHAR(10) NOT NULL,
22     PRIMARY KEY(pkey))
23     ENGINE=INNODB;
```

Demonstration

<http://ruffner.ddns.net/measure-mesh/Server>

