The SMART POTATO

Group 1:
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Customer and Farmer request

- LoRa NB-IoT LTE-M (pre-5G)
- Sensors needs to measure within an accuracy of ±0.1
- Display data and alert emails if values are outside a certain threshold, temperature (0-25 degrees) and moisture (90-100%)
- Main concerns: signal penetration and power consumption

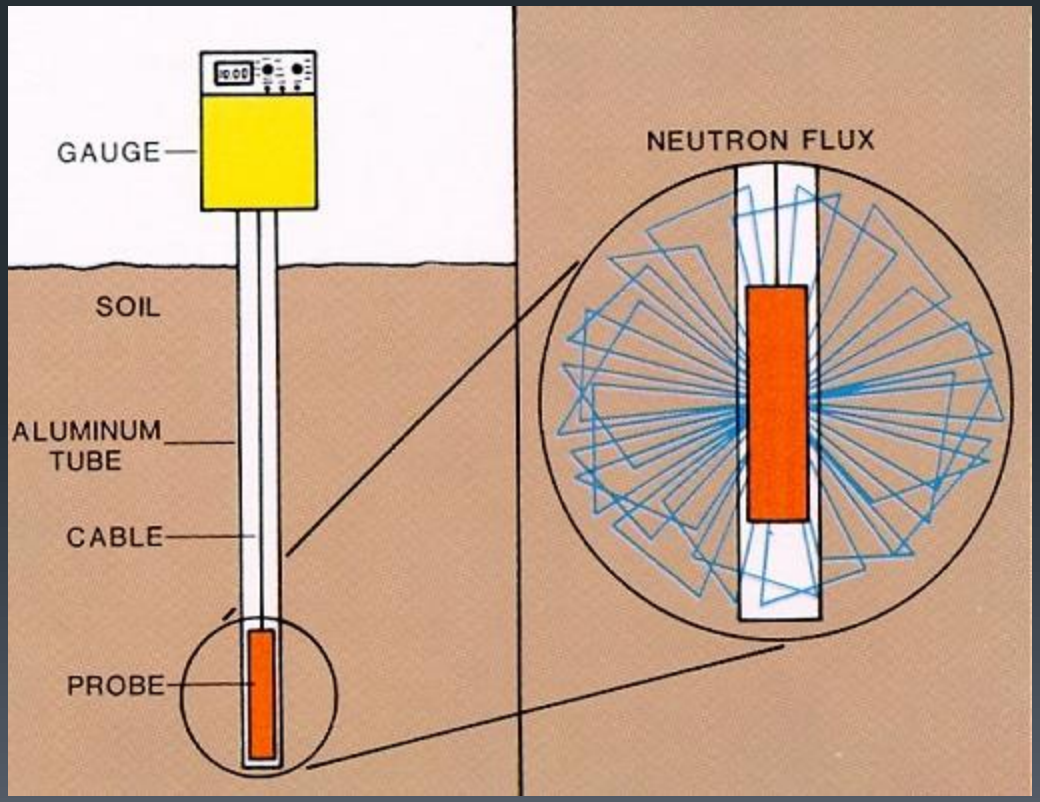
Requirements for the project

- Sending data to the IoT application
- Display data and alert email system
- Selection of microcontroller and sensors
- Signal penetration and power consumption

Moisture Sensor

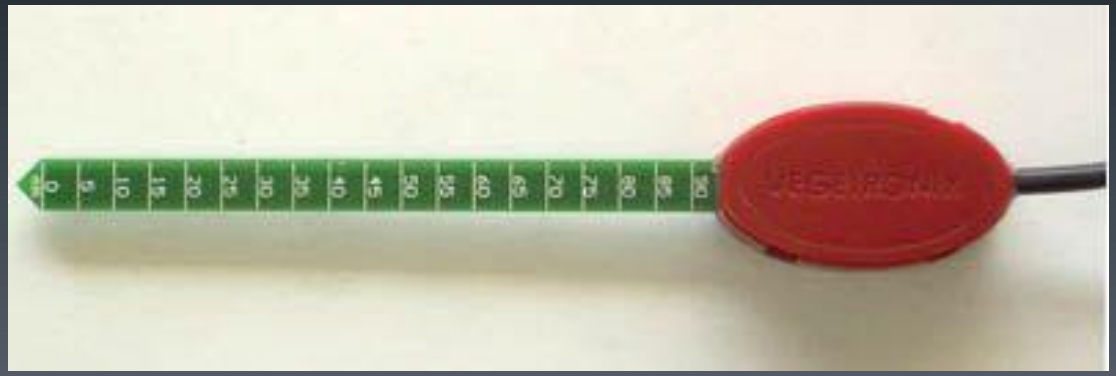
- Neutron probe
- Reflectometry/ Transmissometry
- gypsum Block
- Capacitance

- Neutron probe



- Reflectometry/ Transmissometry

- gypsum Block
- Capacitance



Temperature sensor

DSB18B20

Waterproof

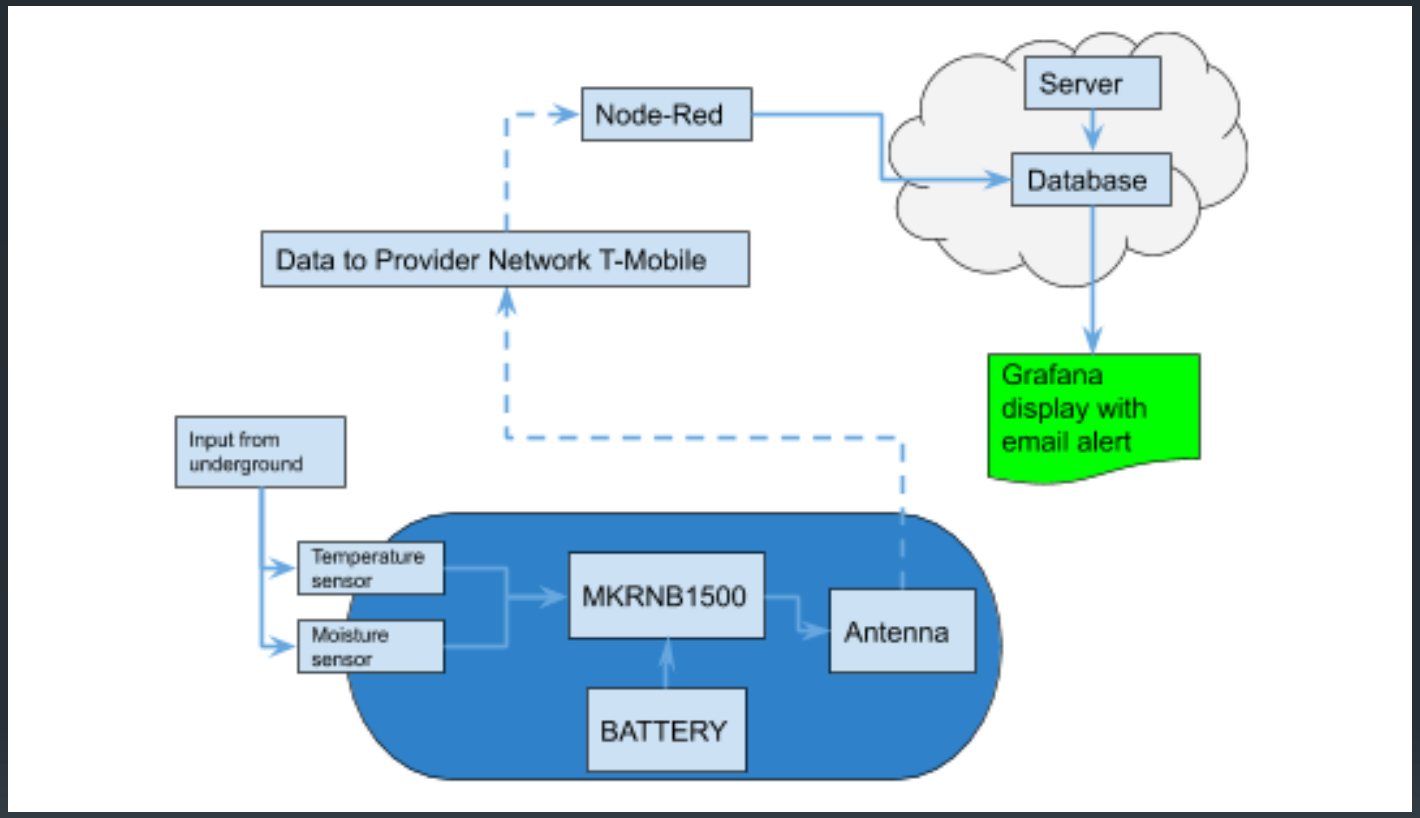
Easy to connect

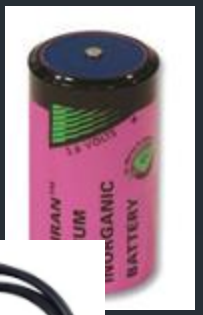
OneWire protocol

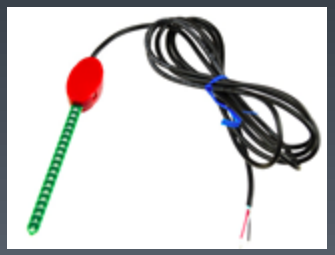
0.125 °C accuracy

Calibrated with help of two thermometers

Complete system







Internet of Things

T · ·Mobile·

Protocols	NB-IoT	LTE-M	LoRa
Max Download/upload peak rate	230 ~ 250 kbps	1 Mbps	~ 50kbps
Bandwidth	180kHz	1.4MHz	500kHz
Latency	< 10s	10 - 15ms	2s
Signal Range (rural area)	< 35Km	~ 11Kms	~ 15 - 22Kms
Current consumption (TX)	80mA with 12dB	125mA with 12dB	47mA with 14dB
Signal Penetration	Excellent	Weak	Good
For standing IoT applications:	✓	~	x
Battery Life duration	~ 10 years	~ 10 years	~ 10 years

Arduino and T-Mobile

AT+USOCR=17

AT+USOST=0,”172.27.131.100”,15683,8,”DataTemp”

AT+USOCL=0

Need more connections or projects?

SEE OUR DIFFERENT PLANS

Starter kit

Plan : Starter kit
Start date :Apr. 22 2019

DEVICES | YOUR API CREDENTIALS | YOUR APPLICATION SERVER

Devices

REFRESHING TABLE | REGISTER DEVICE

IMEI	IMSI	First message	Last message	Payload
352753090887892	901405700009449	Jun 21 2019 15:33	Jun 21 2019 16:16	32323830

END PROJECT

T · ·Mobile·

T-Mobile to Node-Red to Azure

Your application server

After registering a device you can enter the callback URL or your application server (where you like to receive the data) below. The header information is only necessary when your application requires it.

CALLBACK URL

http://52.233.153.207:1880/data

Name

Function

```
1  //value from JASON file
2  msg.payload2 = msg.payload.reports[0].value
3  msg.timestamp = msg.payload.reports[0].timestamp
4  //convert hex to string
5  msg.payload1= hexToString(msg.payload2)
6  //convert hex to ascii
7  msg.payload = msg.payload1.toString('utf8');
8  var timestampVAR = new Date(msg.timestamp);
9
10
11
12 msg.temperature = msg.payload[0] + msg.payload[1];
13 msg.moisture = msg.payload[2] + msg.payload[3];
14 msg.mytime = timestampVAR.toISOString();
15 msg.device = '18E752'
16
17
18 msg.payload3 = { "action": "Q", "query": "insert into mytable (device, mytime, temperature, moisture) VALU
19 msg.payload = msg.payload3
20 return msg;
21
22
23
24 function hexToString(str)
25 {
26     const buf = new Buffer(str, 'hex');
```

T-Mobile

Node-RED

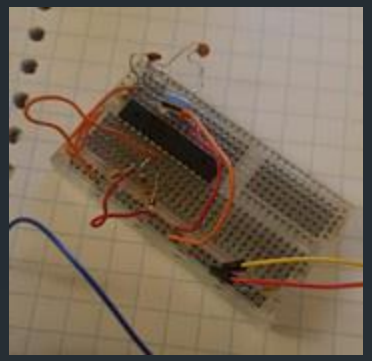
Microsoft Azure

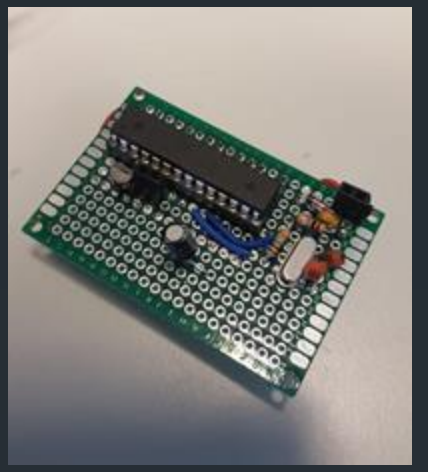
Microsoft Azure to Grafana and Email system Alert

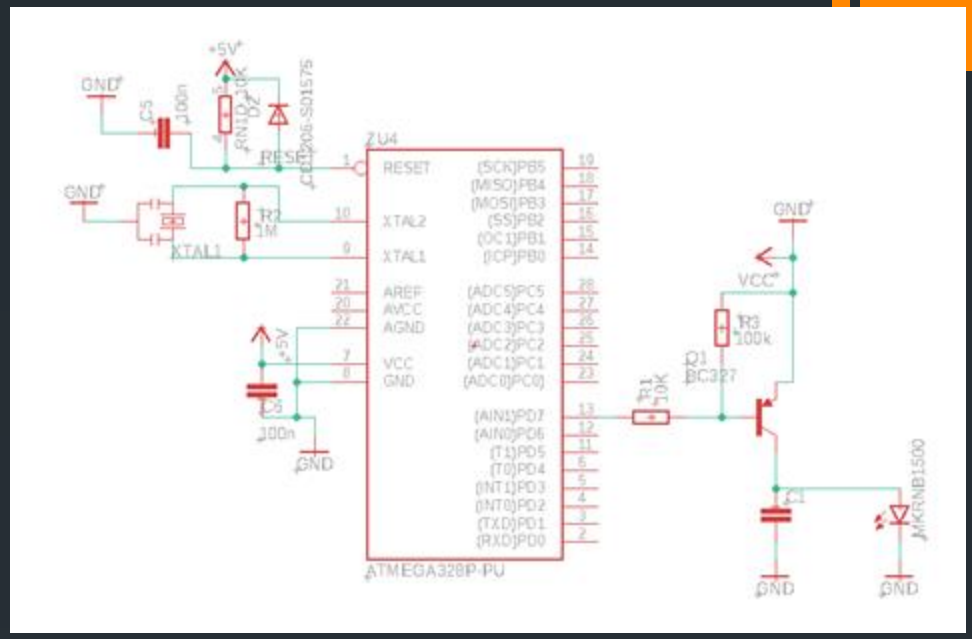
Microsoft Azure

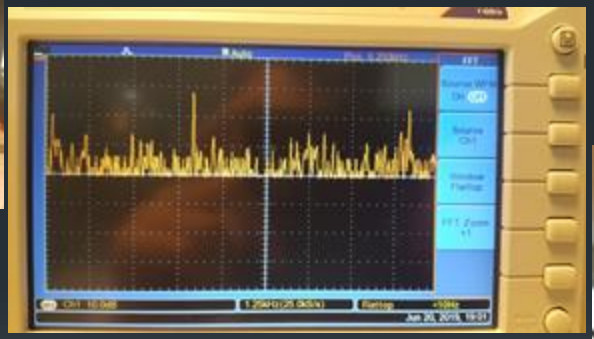
Grafana

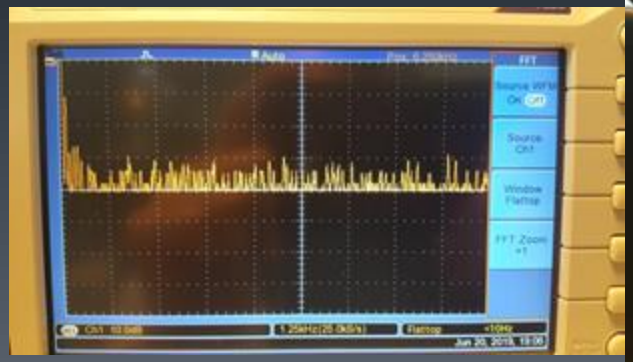
Power consumption - WDT

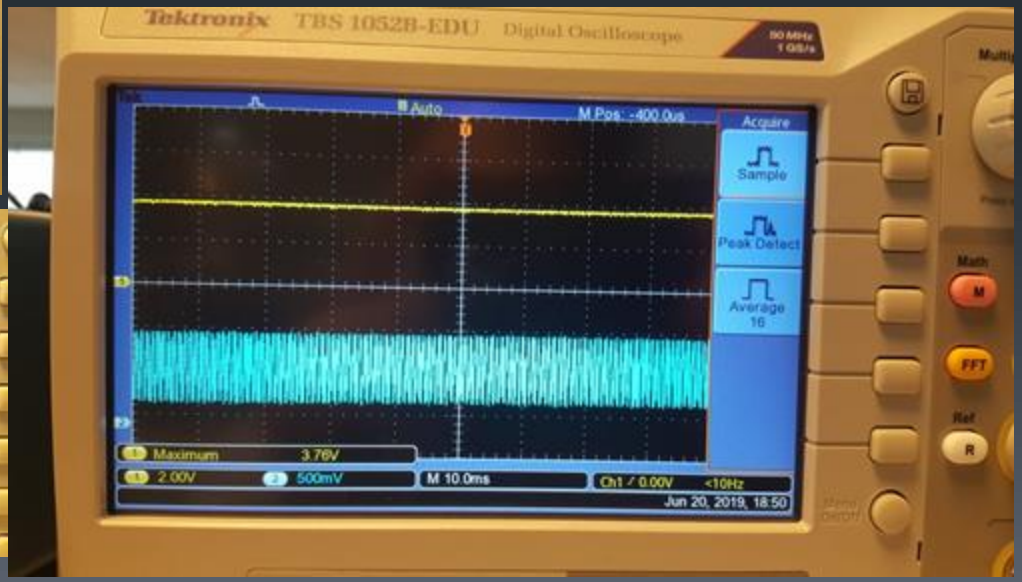




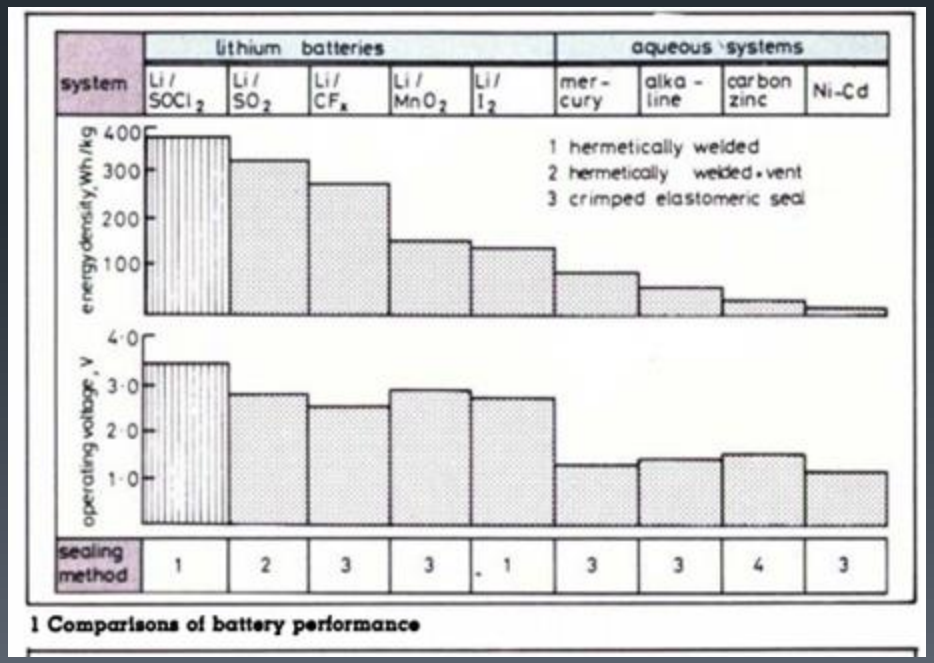




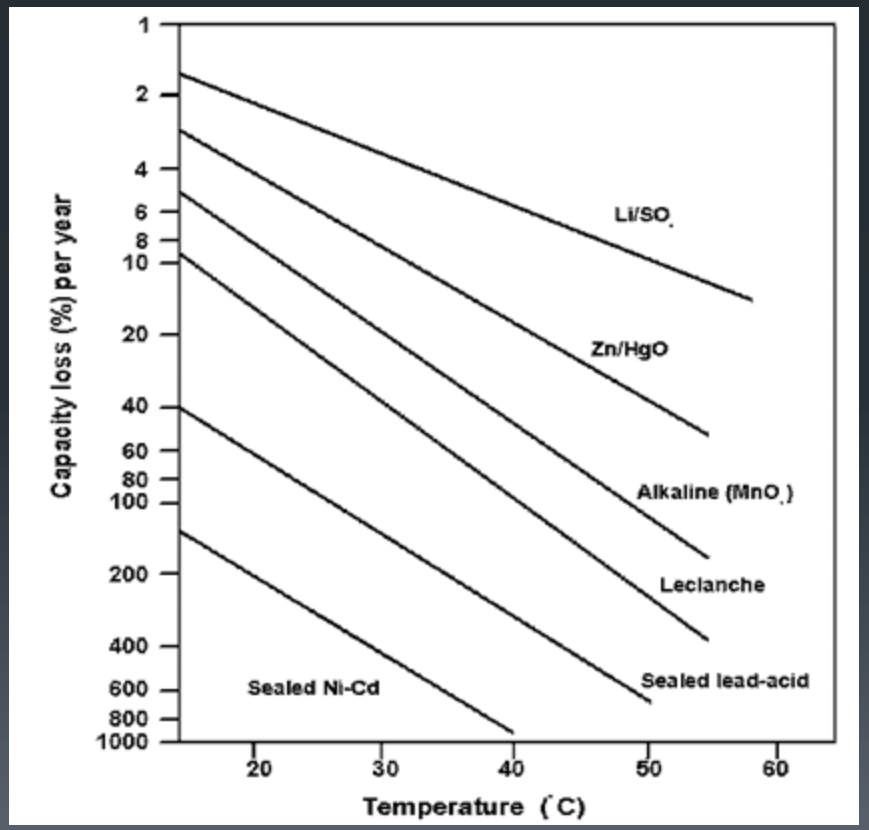




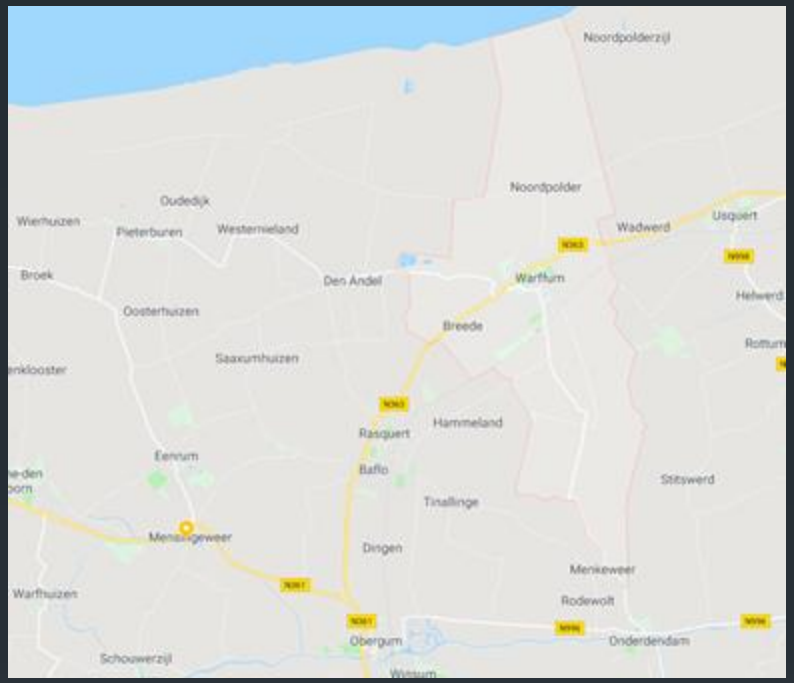
Power consumption - Battery



1 Comparisons of battery performance



Validation of signal penetration



Warffum

Date/Conditions	Dry Soil	Wet Soil	Soil length (± cm)	Temperature (C)	Cloudy Day	Rainfall (mm/h)
6th May 19	✓	✓	27	16	Yes	4
7th May 19	✓	✓	26	16	Yes	5
8th May 19	✓	✓	30	16	No	1
9th May 19	✓	✓	35	17	No	2
10th May 19	✓	✓	30	17	Yes	10
11th May 19	✓	✓	26	17	Yes	0
12th May 19	✓	✓	32	17	No	0
13th May 19	✓	✓	30	17	Yes	0
14th May 19	✓	✓	27	17	Yes	0
15th May 19	✓	✓	30	18	Yes	0
16th May 19	✓	✓	32	18	Yes	0
17th May 19	✓	✓	28	18	Yes	0

Table test

System is able to:

- Different systems can communicate together
- System can send, store and display data on the pc and phone
- System can read sensor values
- System can work with the email alert

Questions?