Home Automation System

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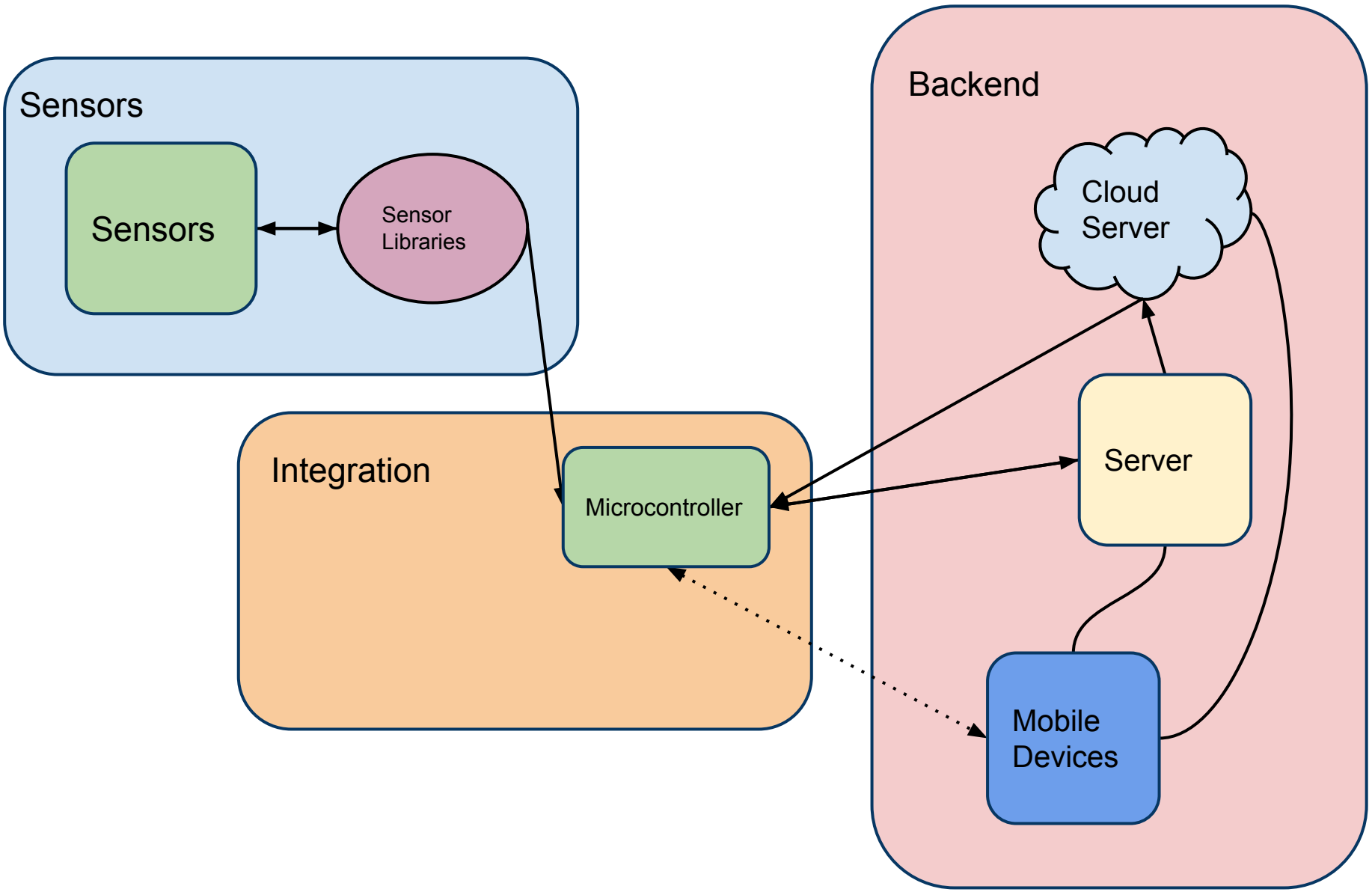
What is it?

A home automation framework that aims to remedy the problems of current home automation systems.

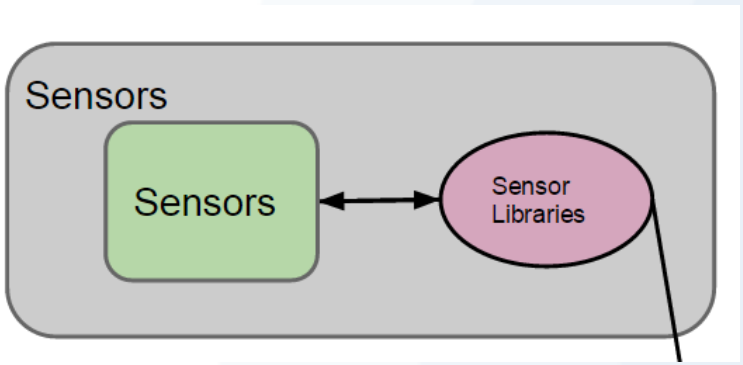
- Functional despite lack of internet connectivity
- Simple to use with existing sensors in market
- Easily extendable to any custom sensors
- Easy to build applications over

General System Model



Sensors – Overview

- Low level hardware components used to read data
- Fed toward the main system in which the data is used for higher level applications
- Created libraries for sensors so that it can be easily used for applications.

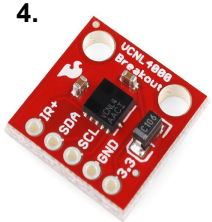


Sensors – Types

1. 

2. 

3. 

4. 

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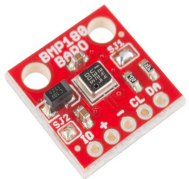
7. 

8. 

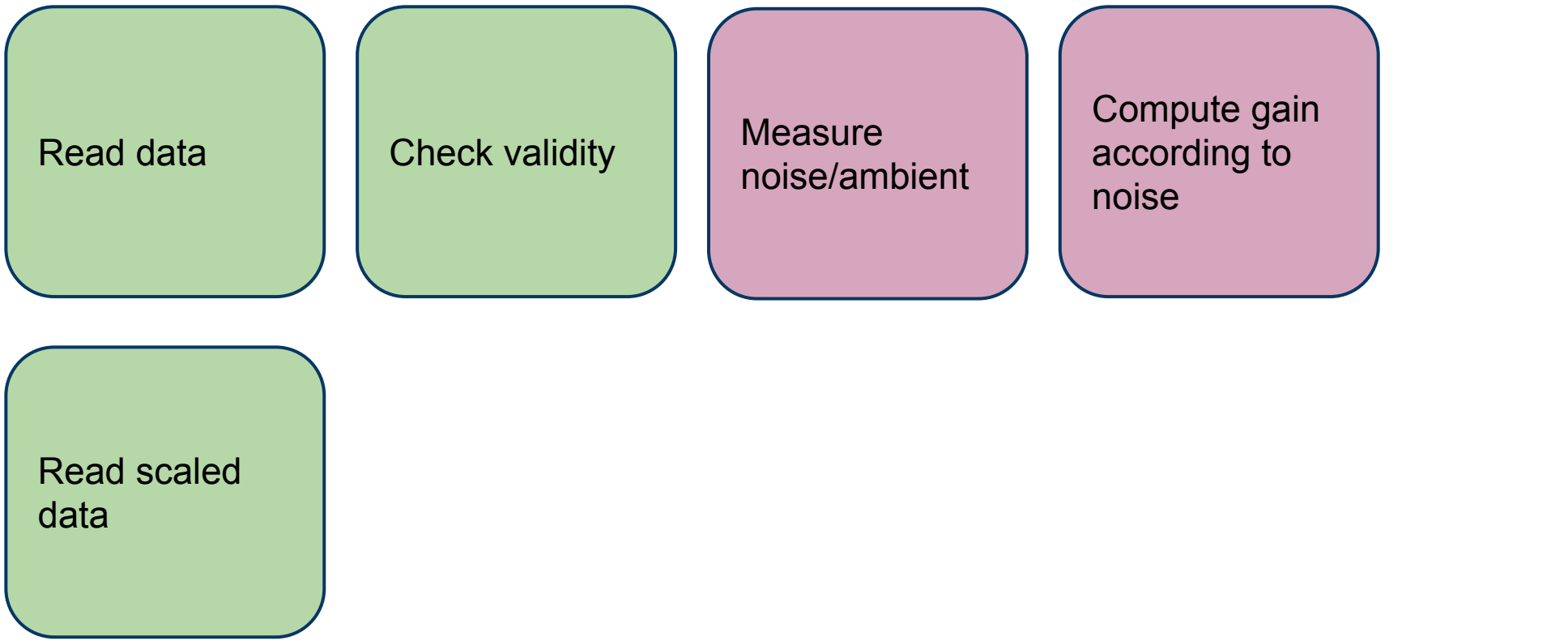
9. 

1. Carbon Monoxide sensor -MQ-7
2. Combustible gas sensor -MQ-2
3. Humidity and Temperature Sensor Breakout - HIH6130
4. Infrared Proximity Breakout - VCNL4000
5. Luminosity Sensor Breakout - TSL2561
6. Triple-Axis Digital-Output Gyro Breakout - ITG-3000
7. SparkFun Barometric Pressure Sensor Breakout- BMP180
8. Ultrasonic Range Detector - LV-MaxSonar-EZ3
9. SparkFun Sound Detector - LMV324

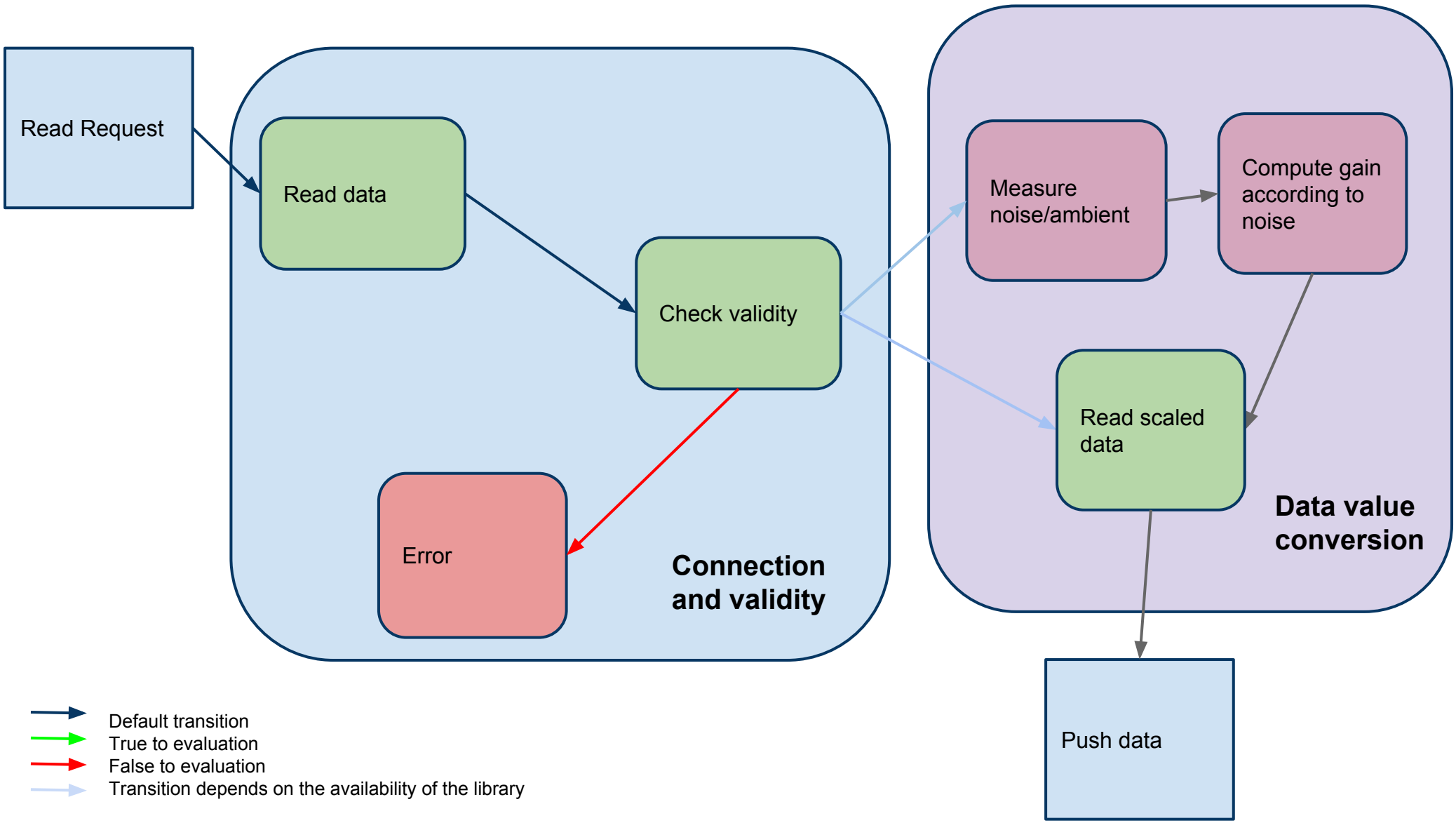
Sensors - Communication

- Divided into 2 communication methods
- One set uses I2C protocol, where communication between sensor and processor is made through acknowledgement
- Other set communicate purely through reading analog values of the output pin of the sensor
- According to the type of communication, libraries were created/edited

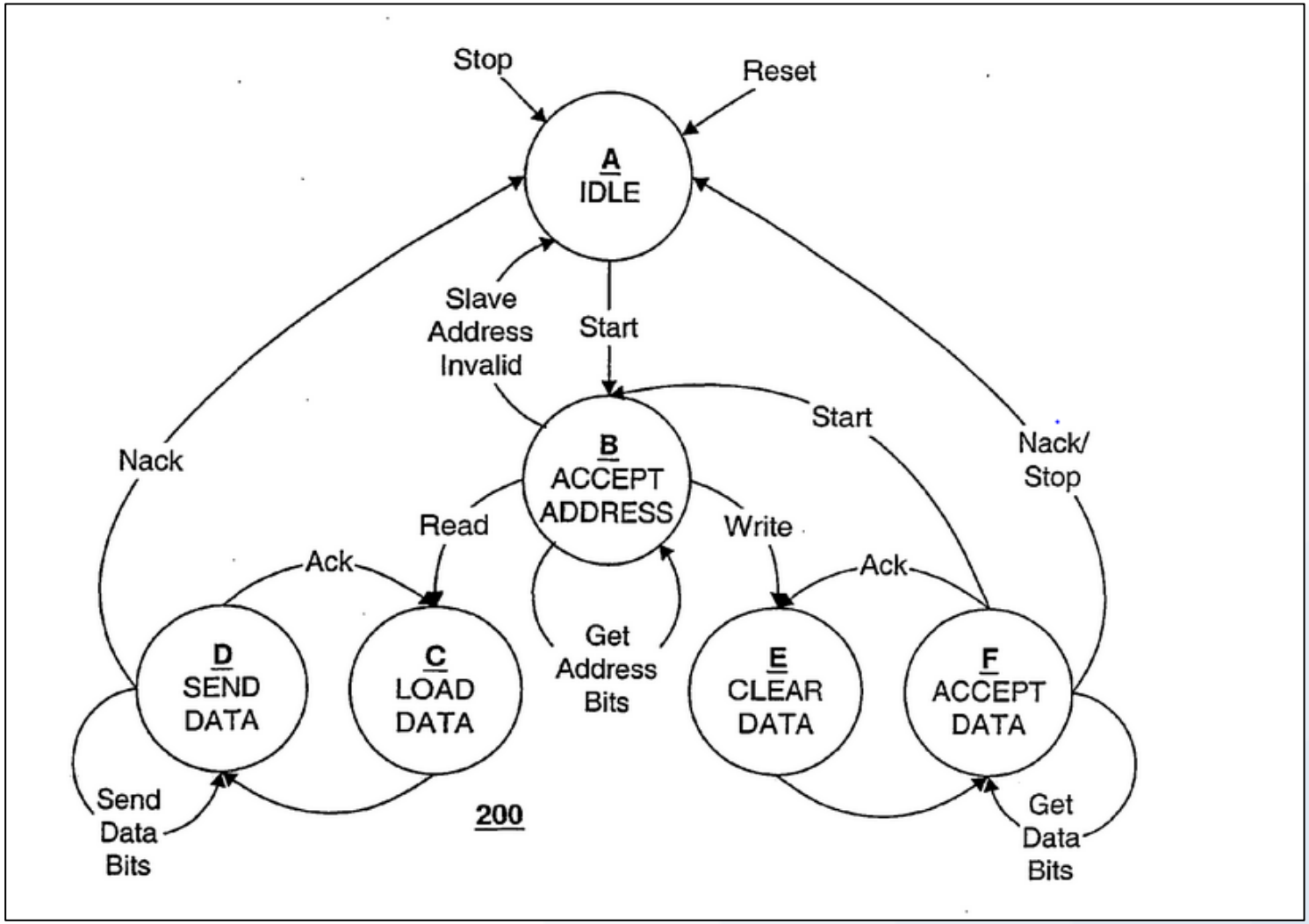
Basic Model of Libraries for Pure Analog



Basic Model of Libraries for Pure Analog



I2C Represented as State Machine



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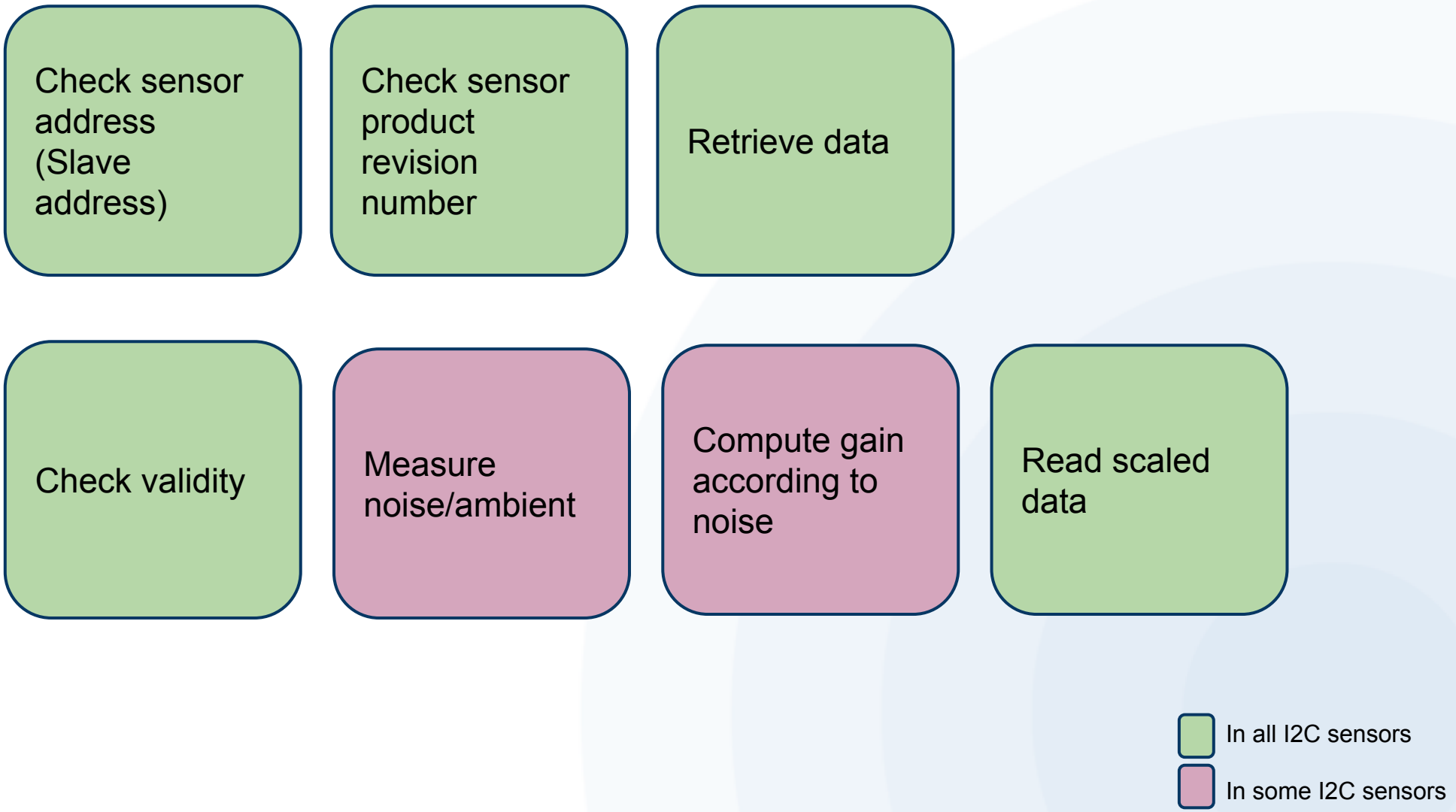
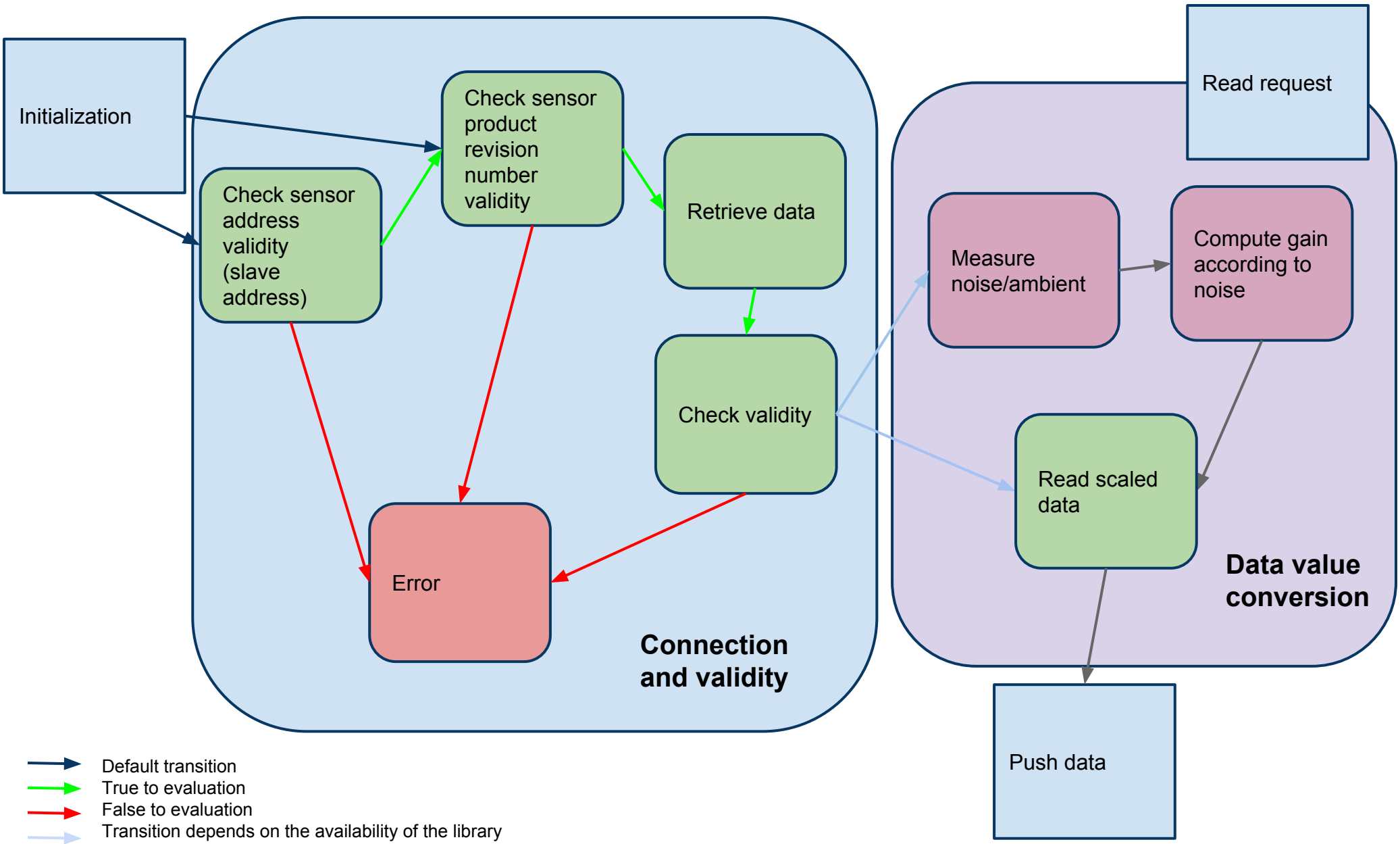
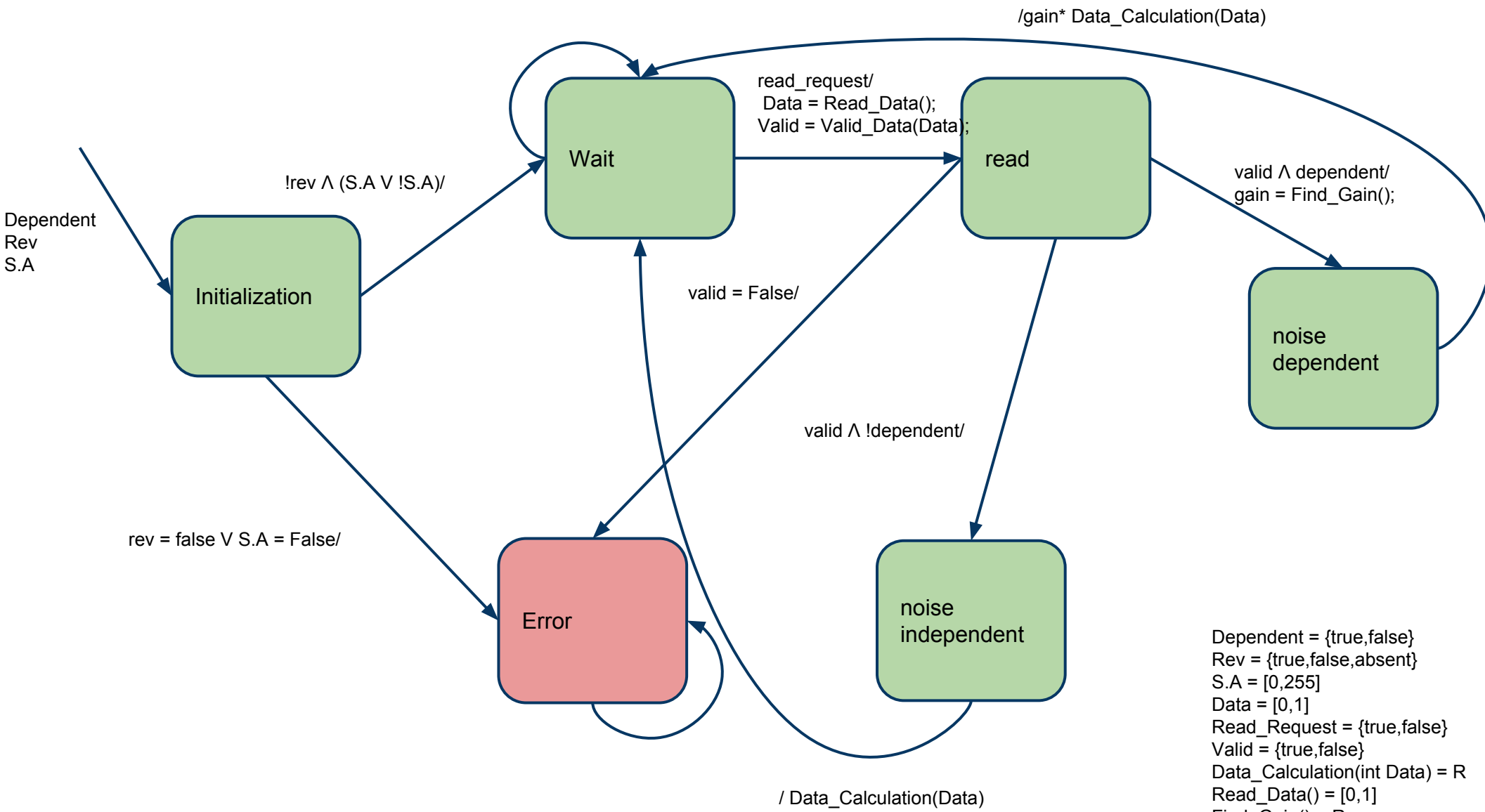
Basic Model of Libraries for I2C



Basic Model of Libraries for I2C



Libraries represented in State Space Model



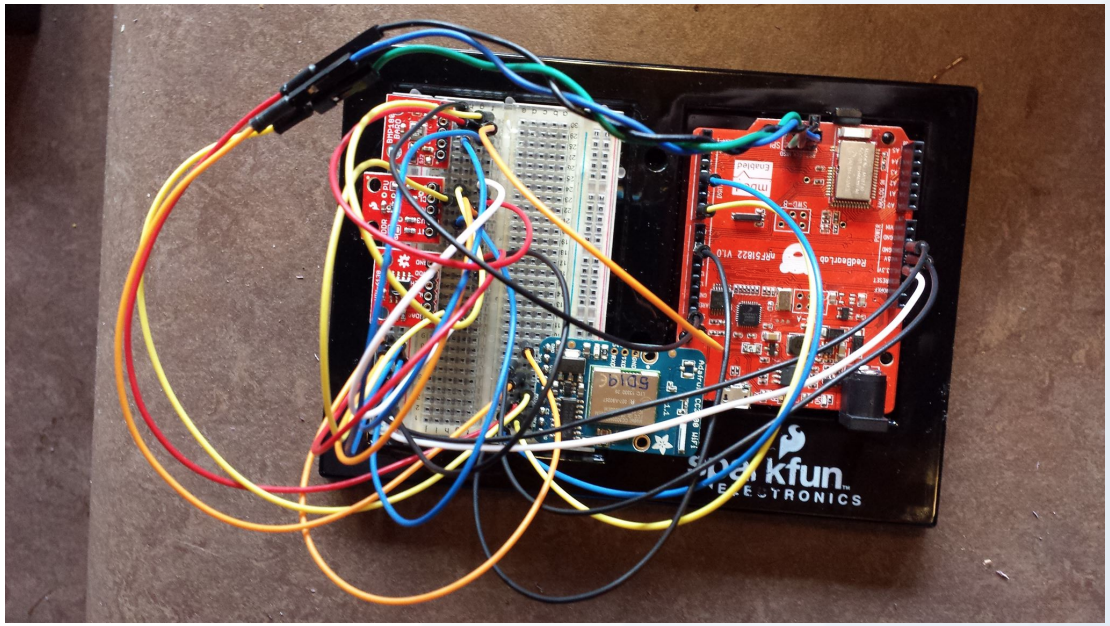
Dependent = {true,false}
Rev = {true,false,absent}
S.A = [0,255]
Data = [0,1]
Read_Request = {true,false}
Valid = {true,false}
Data_Calculation(int Data) = R
Read_Data() = [0,1]
Find_Gain() = R

Connection of Multiple Devices

- These libraries support multiple sensor connections to a single processor.
- I2C Sensors we are using for the project all have unique slave addresses that allows multiple connections to the main processor
- Applications that require multiple sensors can utilize these libraries without requiring more pins
- Abstract away frontend knowledge required to utilize multiple sensor data

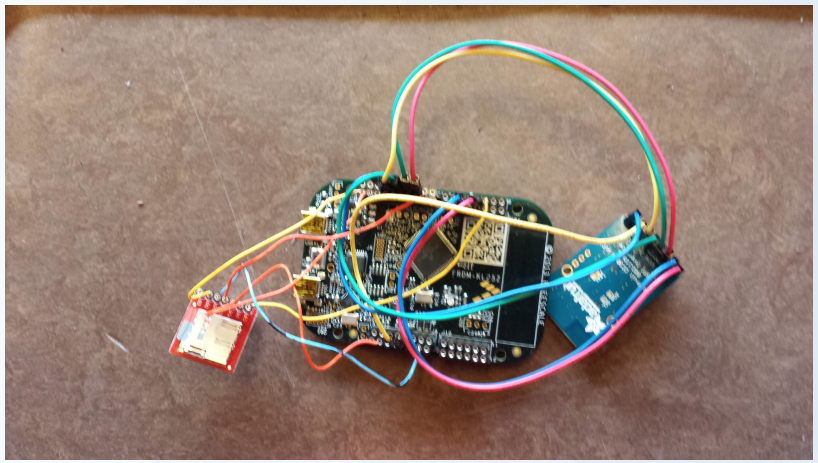
Components – Network

- Sensor readings are passed to the server using a lightweight TCP connection.
- Users can access stored data through a mobile device or desktop.

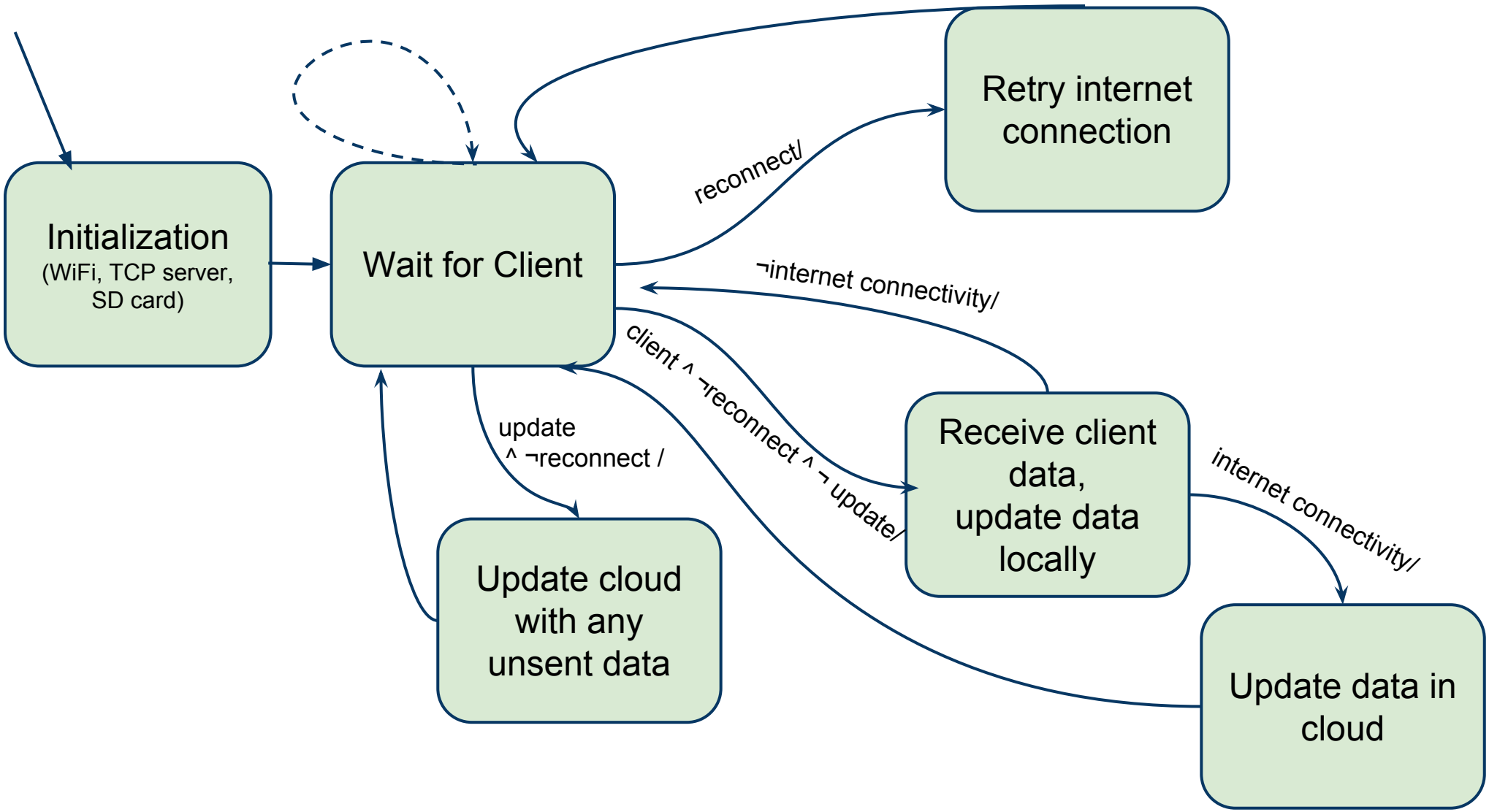


Components – Local Server

- Acts as TCP server and receives data from sensors
- Relays sensor data to the cloud when possible
- Periodically updates cloud if sensor data is received during time of no internet access
- Stores data locally on SD card to fortify against power outages and allow data access despite internet connectivity

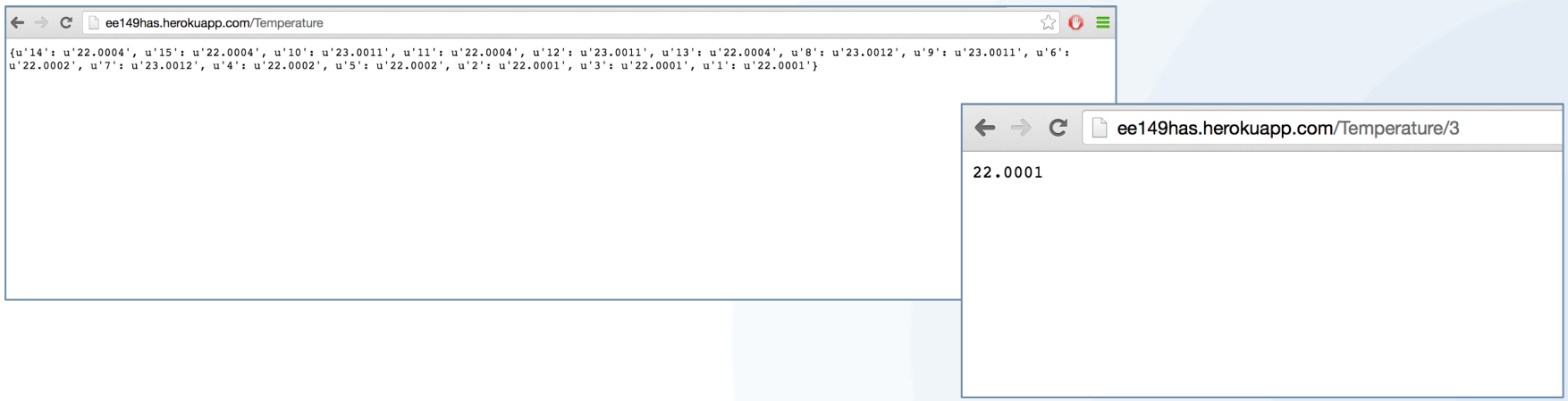


Components – Local Server

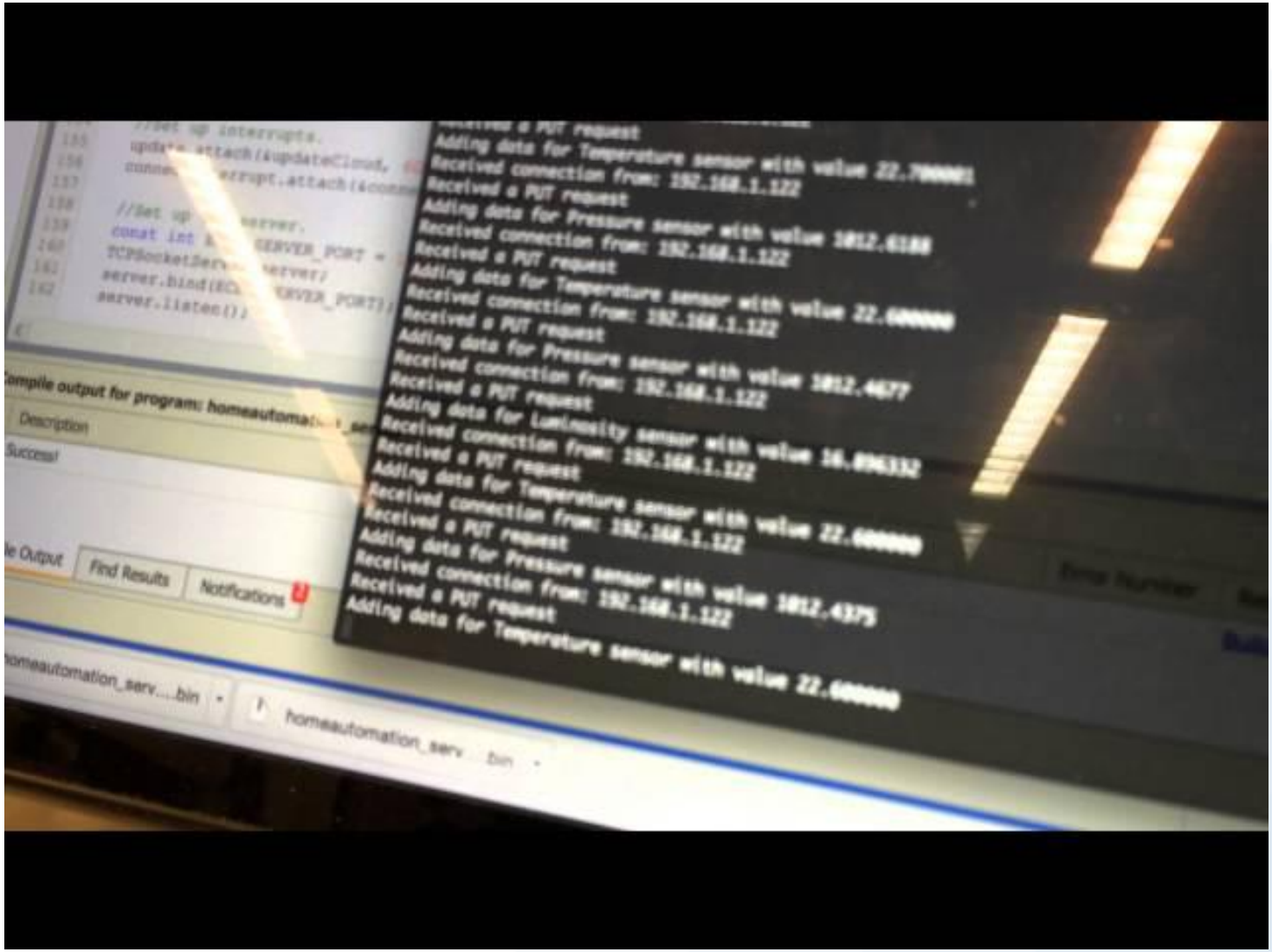


Components – Cloud Server

- Deployed to cloud via Heroku
- Allows users to access data regardless of location
- RESTful API provides simple interface for users to easily query for data they need, making it easy to build applications upon our architecture



Video/Demo


Adding data for Temperature sensor with value 22.700001
Received connection from: 192.168.1.122
Received a PUT request
Adding data for Pressure sensor with value 1012.6188
Received connection from: 192.168.1.122
Received a PUT request
Adding data for Temperature sensor with value 22.600000
Received connection from: 192.168.1.122
Received a PUT request
Adding data for Pressure sensor with value 1012.4677
Received connection from: 192.168.1.122
Received a PUT request
Adding data for Luminosity sensor with value 16.896332
Received connection from: 192.168.1.122
Received a PUT request
Adding data for Temperature sensor with value 22.600000
Received connection from: 192.168.1.122
Received a PUT request
Adding data for Pressure sensor with value 1012.4375
Received connection from: 192.168.1.122
Received a PUT request
Adding data for Temperature sensor with value 22.600000
Description
Success!
Find Results
Notifications
homeautomation_serv...bin
homeautomation_serv bin

Future Plans

- Enclose the boards in rugged cases to improve robustness.
- Include Central Role bluetooth capability (dependent on release of S130 SoftDevices mbed support)
- Include support for uploading applications via Bluetooth