A screenshot of a cell phone

Description automatically generated

System Design Document

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# History of the design

For the most part the design was given to us by our client. We suggested some features like wireless communication and a visualization of the air conditioning algorithm that were added later on.

Of course the situation around the COVID epidemic really slowed us down when it comes to testing and working on our project. It also changed the design of our app, so instead of using the ZigBee module to communicate with the other groups we will be using an HTTP server.

In order to get the data from each sensor we are using a service called ZEROTIER in order to simulate a local network and send the data from each sensor using a smaller C# app connected to the main C# application.

# Hardware:

## Embedded board:

* Embedded board (STM Nucleo 64) – Arm Cortex M3/M4

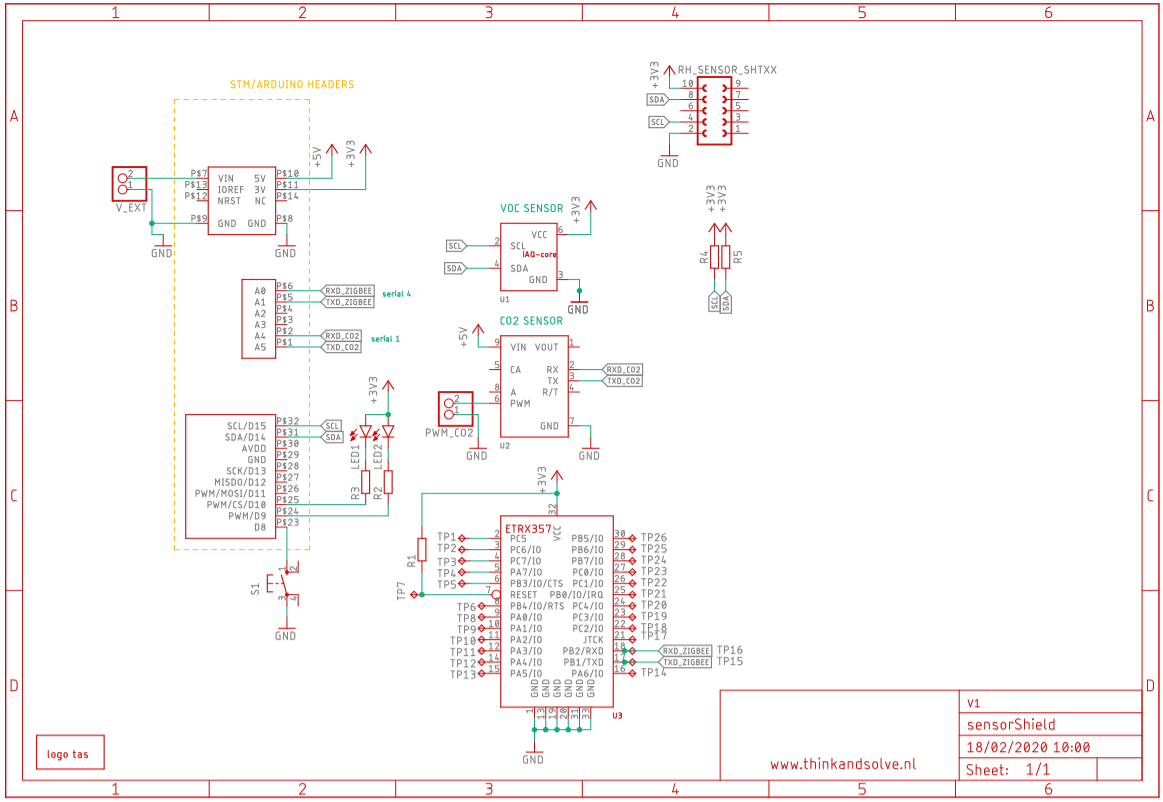
## Sensors:

* Cubic CM1106 CO2 sensor (UART)
* Sensirion SHT20x humidity/temperature sensor (I2C)
* Sensirion SPS30 Particulate Matter sensor (I2C/UART)

## Communication:

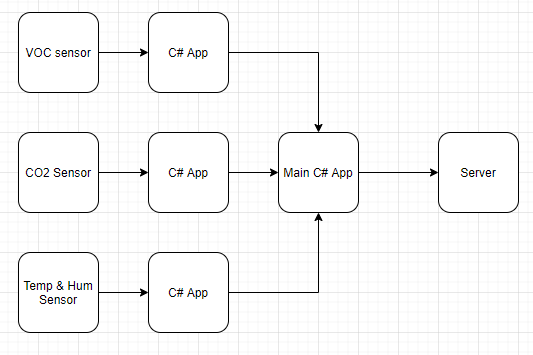
* ETRX357 Zigbee module (UART, AT-Commands)

## Wiring diagrams:



# System design

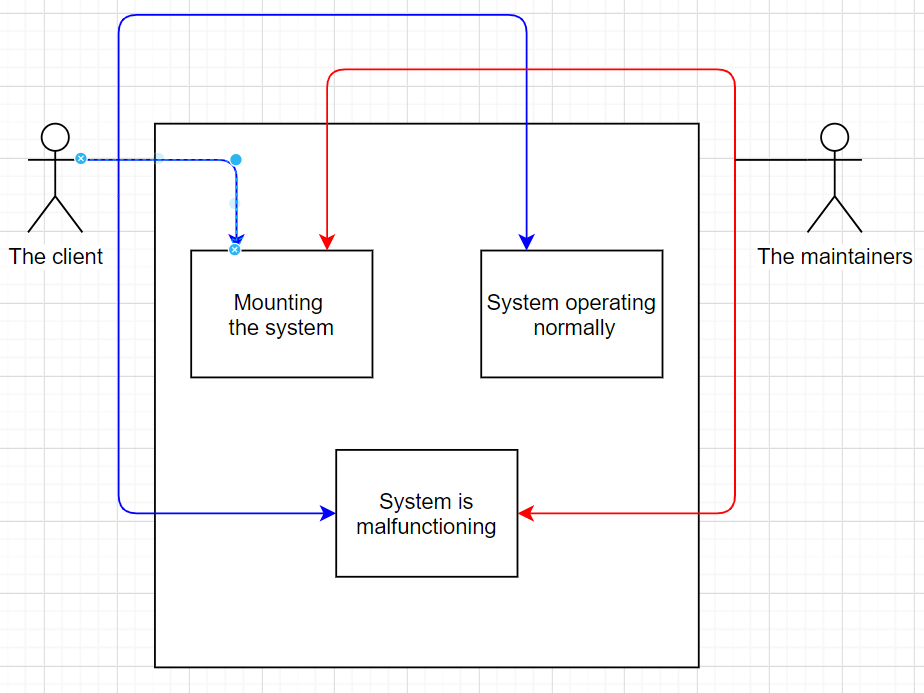
## System architecture diagram



## System context diagram

Our system contains both the embedded board with the connected sensors and ZigBee module and the C# app with the simulated fan.

Our external entities will be the client and the maintenance team (us).



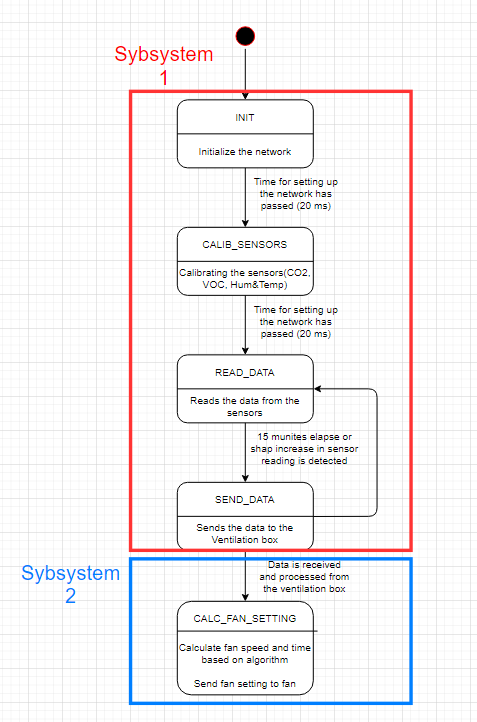
# Communication protocols

Messages are sent every 15 minutes and at sharp changes of CO2, matter, temperature or humidity.

STM Nucleo – master;

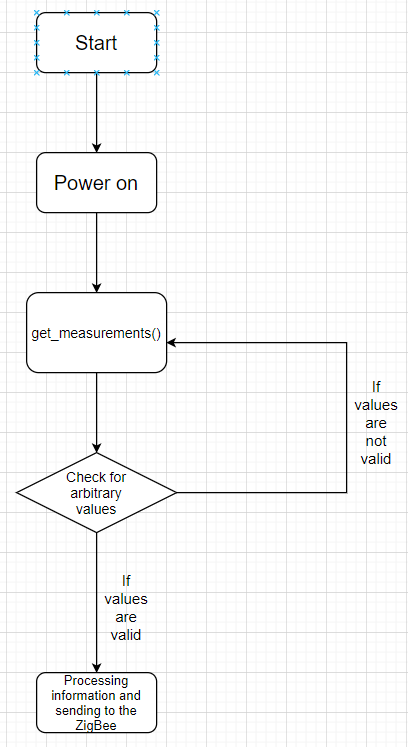
ZigBee Module – slave;

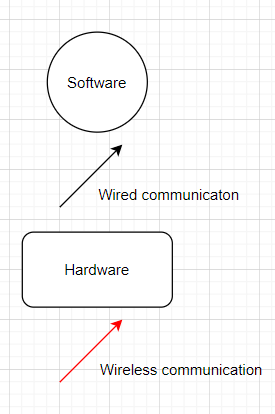
State diagram



# Control flow charts

* The control flow chart for the communication between the modules and the ZigBee.





* The control flow chart for the communication.

# 

# References:

<https://www.st.com/resource/en/user_manual/dm00105823-stm32-nucleo-64-boards-mb1136-stmicroelectronics.pdf>

<https://www.mouser.com/datasheet/2/682/Sensirion_Humidity_Sensors_SHT3x_Datasheet_digital-971521.pdf>

<https://www.mouser.com/datasheet/2/588/iAQ-core_Datasheet_EN_v1-775852.pdf>

<http://www.gassensor.ru/data/files/carbon_dioxide/CM1106%20CO2%20SENSOR%20MODULE%20INTRODUCTION.pdf>

<https://www.ti.com/lit/ds/symlink/cc2520.pdf?ts=1591563160998>