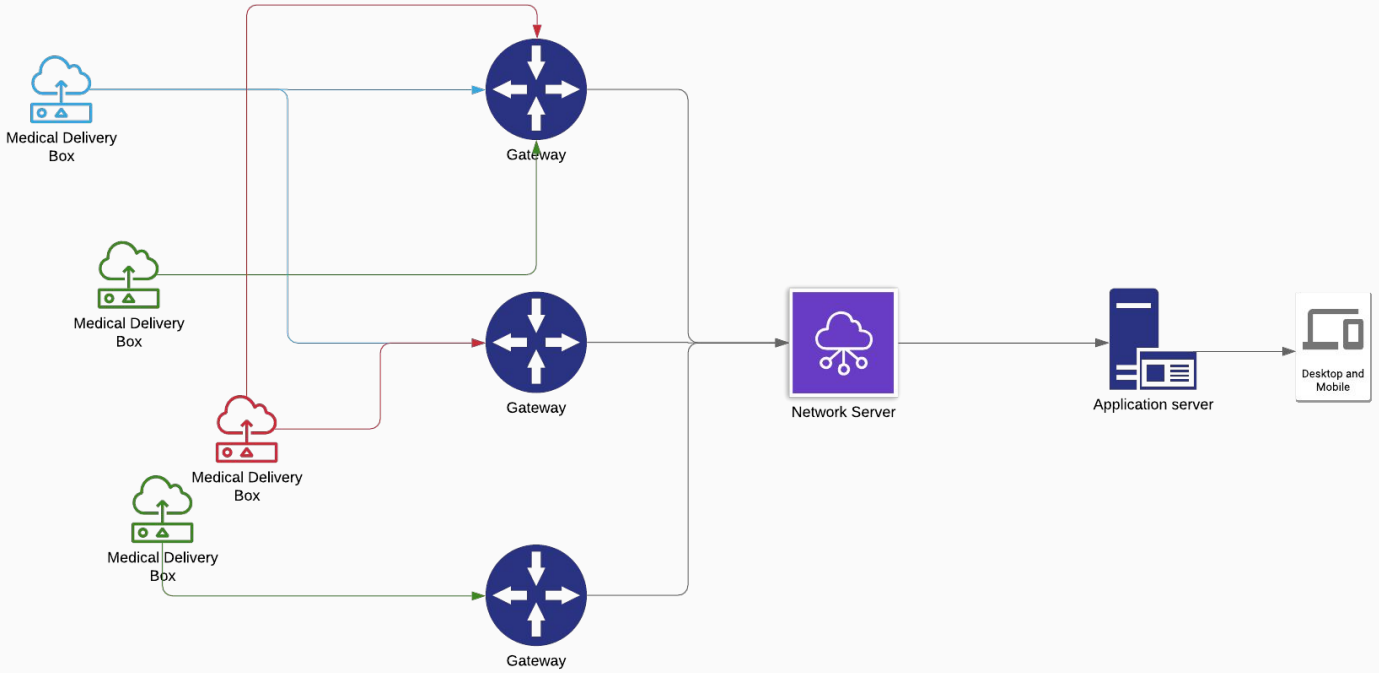
Medical Delivery

IoT

Zijn producten nog bruikbaar na het transport door verschillende omstandigheden?
Hoe kunnen leveranciers weten dat ze tijdens transport moeten ingrijpen?
Wat moet er gebeuren indien producten onbruikbaar zijn geworden tijdens het transport?

Algemene Architectuur



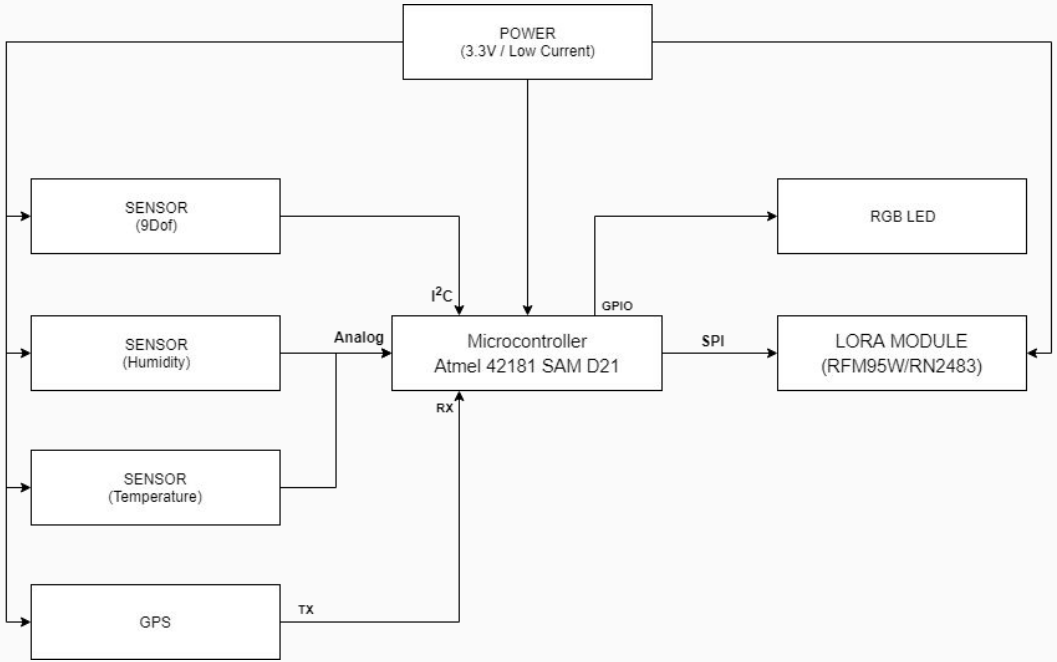
LoRa WAN

Marktonderzoek

	Medicalcouriers	Hydropac	Worldcourier	Actioncourier	Zipline	TNT Healtcare section Supplies
Sensors	?	?	Ambient temperature, internal temperature, light, tilt, pressureand physical shock sensors.	?	?	Ambient temperature and internal temperature sensors
Tracking	Tracking APP, Tracking center	/	GPS (Customer Resource Center (CRC))	Digital Log Tracking, GPS	3D sattelite map and manual ground surveys	GPS
Temperature control	/	Can choose min and max of temperature	controls ambient an internal temperature	/	/	Realtime tracking of temprature
Communication protocol	/	/	BLE, GSM	/	SMS	/
App Control	Realtimedata, Dashboard	/	Realtime, monitoring	Monitoring	On-demand through a simple app, when they need it, monitoring, realtime data	Realtimedata, Monitoring
Transit time	/	Adjustable	/	Non-stop delivery	30 - 45 min delivery	Sameday Delivery (ophaling en levering via de weg, na ophaling rechtstreekse levering bij de opgegeven ontvanger), Onboard courier (zendingen die persoonlijke aandacht eisen), Air charter (dringende zendingen)
Type	Medical Courier	Insulated Shipping Systems	Medical logistics	Medical Courier serivce	Blood delivery by drone	Transport

Detail Analyse

Blokschema


POWER
(3.3V / Low Current)
SENSOR
(9Dof)
SENSOR
(Humidity)
SENSOR
(Temperature)
GPS
I²C
Analog
TX
RX
Microcontroller
Atmel 42181 SAM D21
GPIO
SPI
RGB LED
LORA MODULE
(RFM95W/RN2483)

Componenten

Microcontroller
Atmel SAM D21G

“The Atmel® | SMART SAM D21 is a series of low-power microcontrollers using the 32-bit ARM® Cortex®-M0+ processor, and ranging from 32- to 64-pins.” - Datasheet ATMEL SAM D21

Atmel SAM D21	Werkspanning	1.62V	3.63V
	Low-power verbruik	<70 µA/MHz	

Heeft tot 6 Serial Communication Modules (SERCOM) die elk geconfigureerd kunnen worden als een USART, UART, SPI of I²C.

LoRa Module
RFM95W

Werkspanning: 1.8V-3.7V

Low power

Symbol	Description	Conditions	Min	Typ	Max	Unit
IDDSL	Supply current in Sleep mode		-	0.2	1	uA
IDDIDLE	Supply current in Idle mode	RC oscillator enabled	-	1.5	-	uA
IDDST	Supply current in Standby mode	Crystal oscillator enabled	-	1.6	1.8	mA
IDDFS	Supply current in Synthesizer mode	FSRx	-	5.8	-	mA
IDDR	Supply current in Receive mode	*LnaBoost* Off, higher bands *LnaBoost* On, higher bands Lower bands	- - -	10.8 11.5 12.1	- - -	mA
IDDT	Supply current in Transmit mode with impedance matching	RFOP = +20 dBm, on PA_BOOST RFOP = +17 dBm, on PA_BOOST RFOP = +13 dBm, on RFO_LF/HF pin RFOP = + 7 dBm, on RFO_LF/HF pin	- - - -	120 87 29 20	- - - -	mA mA mA mA

GPS Module
MTK339

Low power

10 posities per second

Ingebouwde antenne

Temperatuursensor
LMT87

Gemiddelde nauwkeurigheid 0.5℃

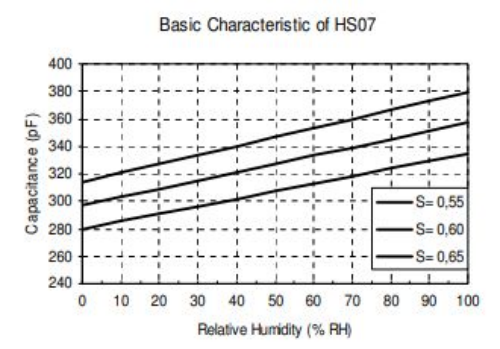
Bereik van -50℃ to 150℃

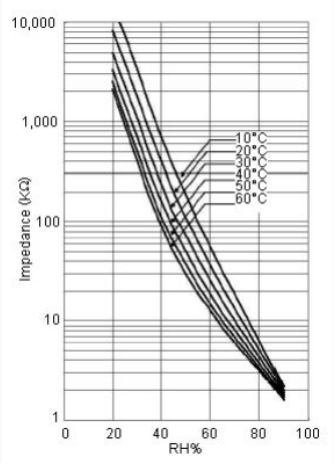
Humidity sensor

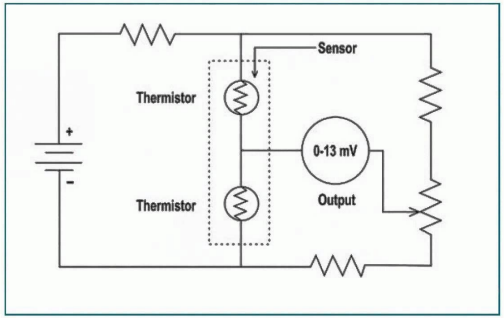
Capacitive, Resistance and Thermal

$$C_c = C_s + S\,*(X_{rh} - 55)$$

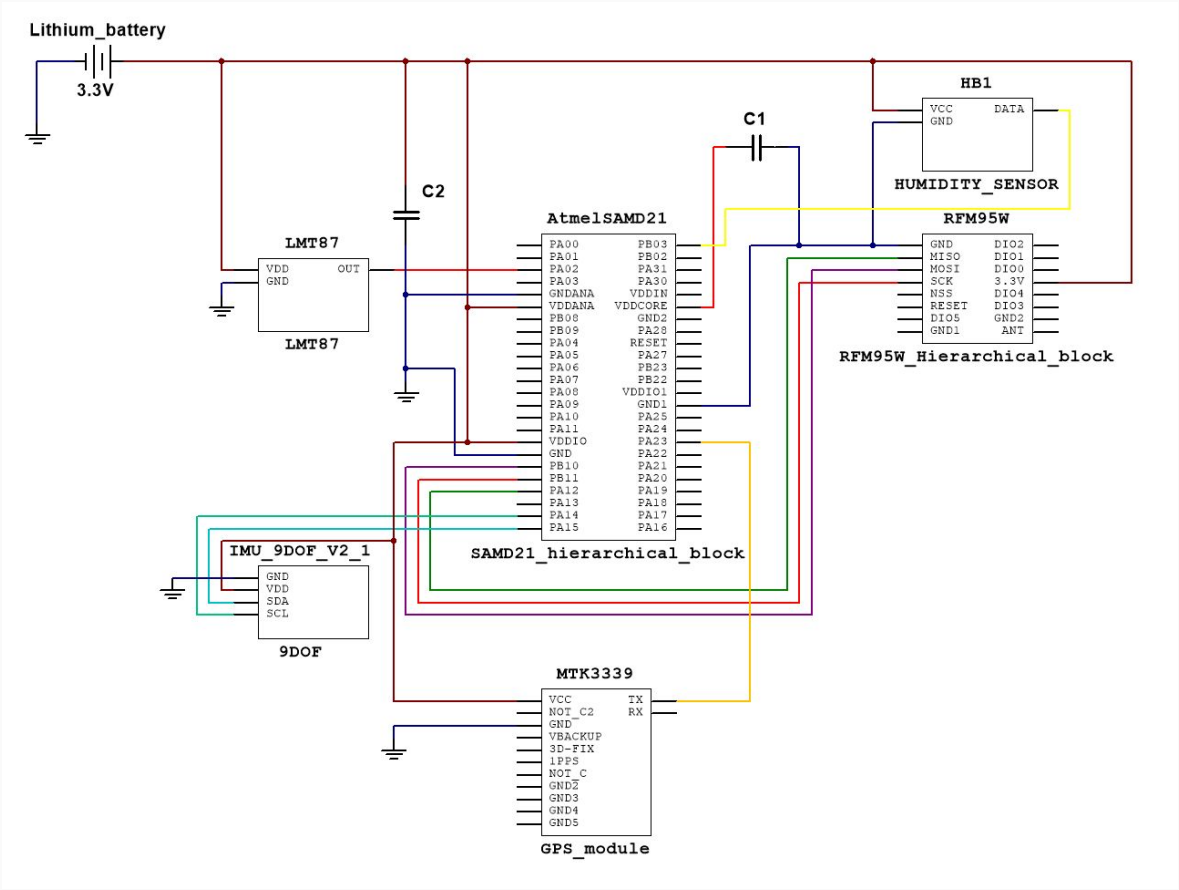
With: C_c = measured capacitance(pF)
C_s = capacitance value at 55% RH (pF)
X_{rh} = measured Relative Humidity(%)
S = sensitivity







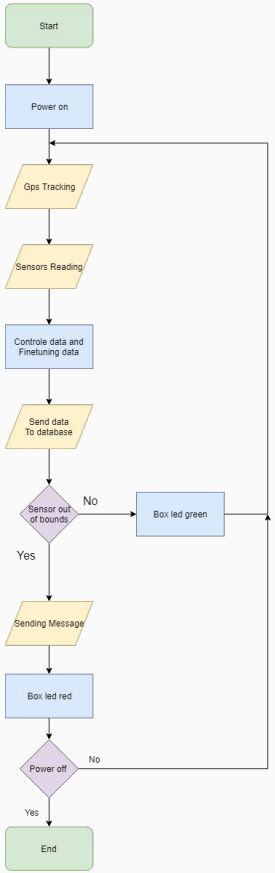
Elektrisch schema



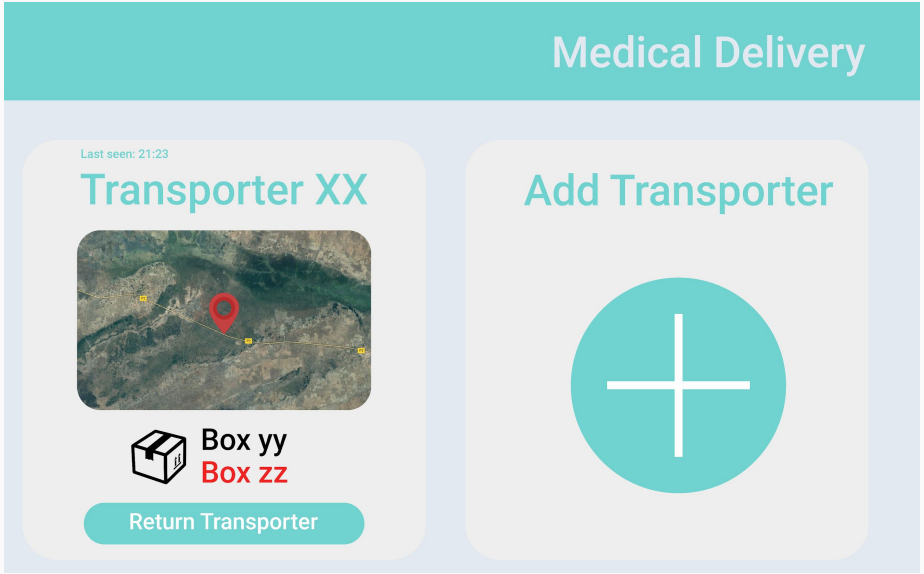
Diagrammen

State diagram

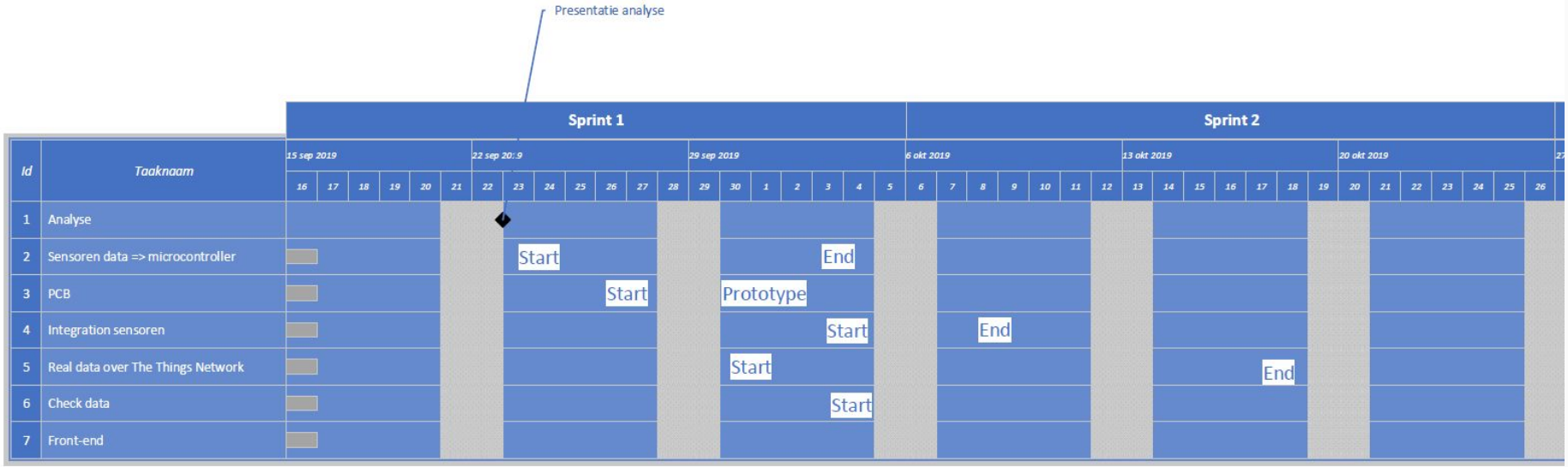
Flowchart


Start
Power on
Gps Tracking
Sensors Reading
Controle data and Finetuning data
Send data To database
Sensor out of bounds
No
Box led green
Yes
Sending Message
Box led red
Power off
No
Yes
End

Mock up


Medical Delivery
Last seen: 21:23
Transporter XX
Box yy
Box zz
Return Transporter
Add Transporter

Release plan



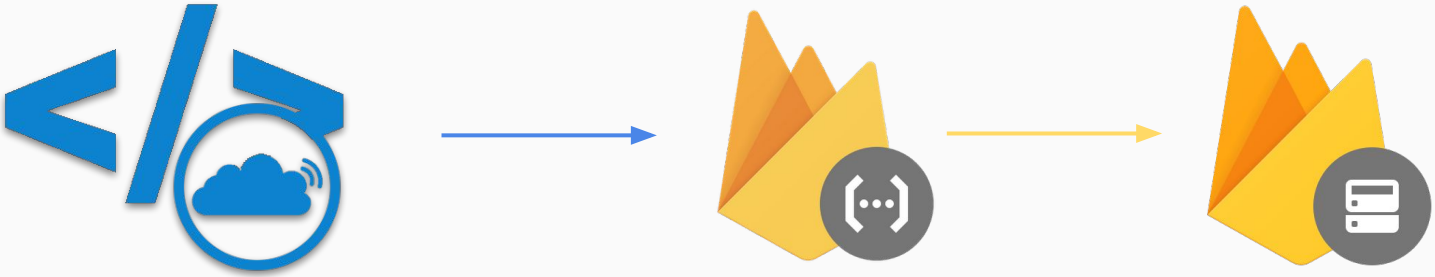
Software

Software

AtmelStudio

Firebase

Angular



The Things Network

Cloud Functions

Database

Database Model