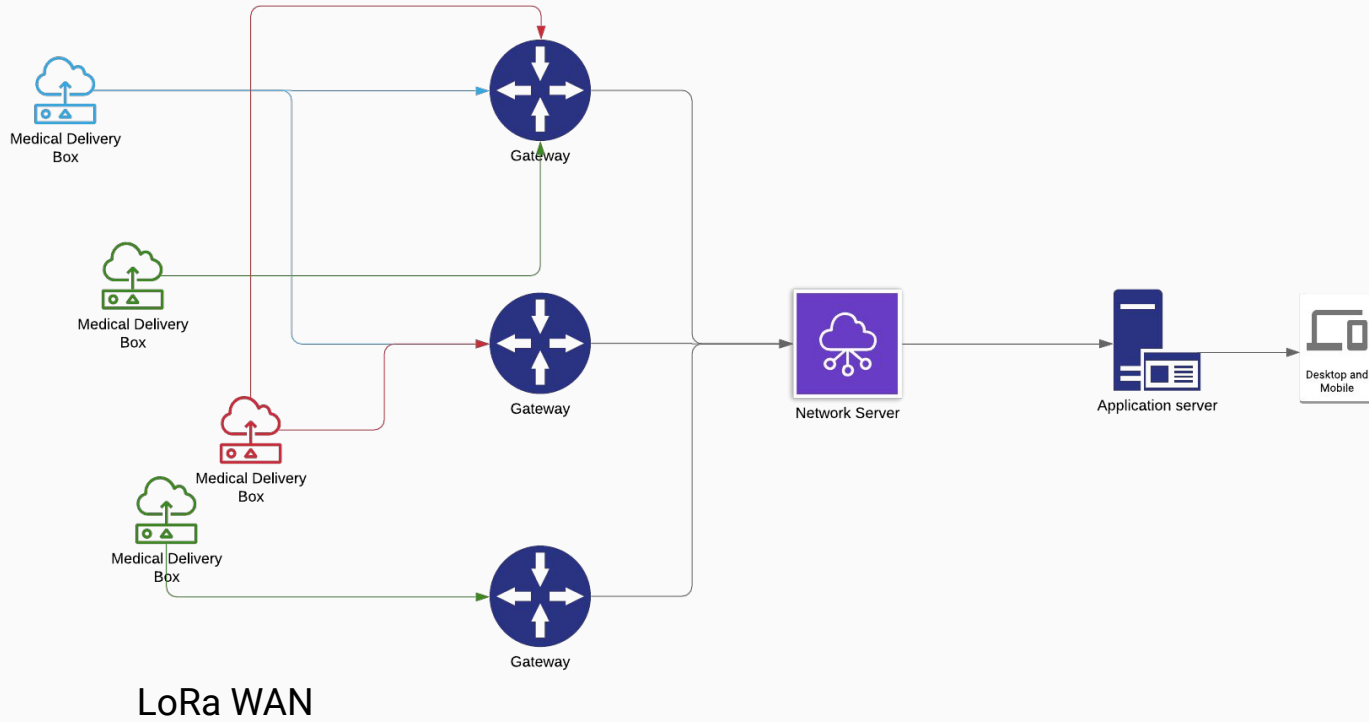


Medical Delivery

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

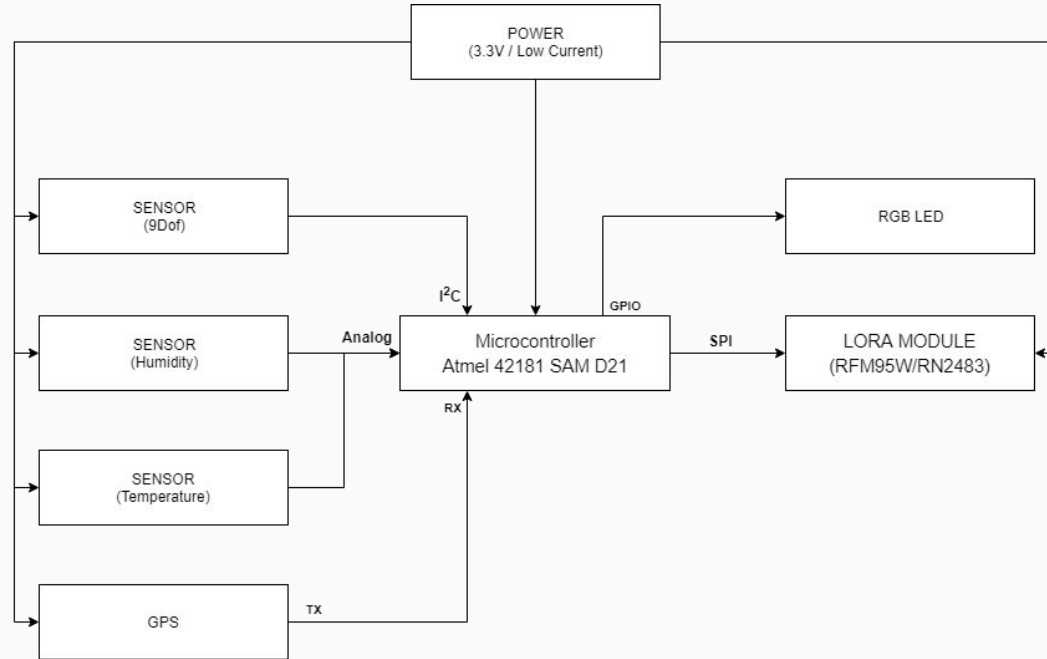


Marktonderzoek

	Medicalcouriers	Hydropac	Worldcourier	Actioncourier	Zipline	TNT Healthcare section Supplies
Sensors	?	?	Ambient temperature, internal temperature, light, tilt, pressure and physical shock sensors.	?	?	Ambient temperature and internal temperature sensors
Tracking	Tracking APP, Tracking center	/	GPS (Customer Resource Center (CRC))	Digital Log Tracking, GPS	3D satellite map and manual ground surveys	GPS
Temperature control	/	Can choose min and max of temperature	controls ambient and internal temperature	/	/	Realtime tracking of temperature
Communication protocol	/	/	BLE, GSM	/	SMS	/
App Control	Realtime data, Dashboard	/	Realtime, monitoring	Monitoring	On-demand through a simple app, when they need it, monitoring, realtime data	Realtime data, 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 service	Blood delivery by drone	Transport

Detail Analyse

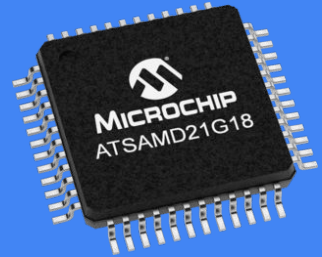
Blokschema



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 μ A/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	<i>LnaBoost</i> Off, higher bands	-	10.8	-	mA
		<i>LnaBoost</i> On, higher bands	-	11.5	-	
		Lower bands	-	12.1	-	
IDDT	Supply current in Transmit mode with impedance matching	RFOP = +20 dBm, on PA_BOOST	-	120	-	mA
		RFOP = +17 dBm, on PA_BOOST	-	87	-	mA
		RFOP = +13 dBm, on RFO_LF/HF pin	-	29	-	mA
		RFOP = + 7 dBm, on RFO_LF/HF pin	-	20	-	mA

GPS Module

MTK339

Low power

10 posities per second

Ingebouwde antenne



Temperatuursensor

LMT87

Gemiddelde nauwkeurigheid 0.5°C

Bereik van -50°C to 150°C



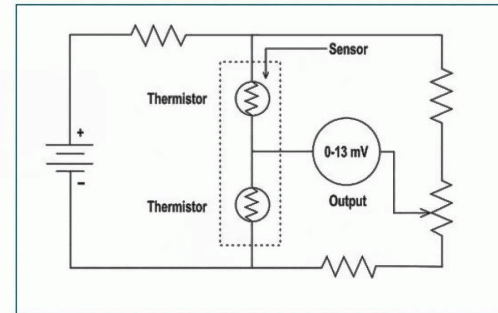
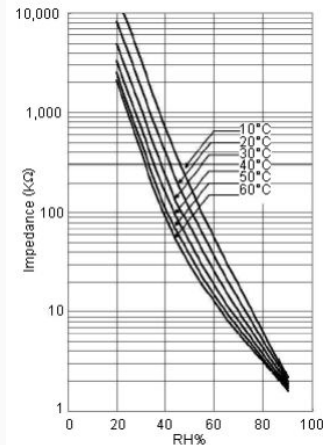
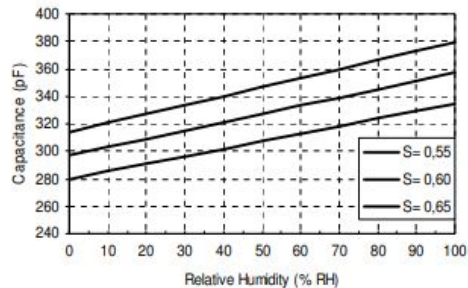
Humidity sensor

Capacitive, Resistance and Thermal

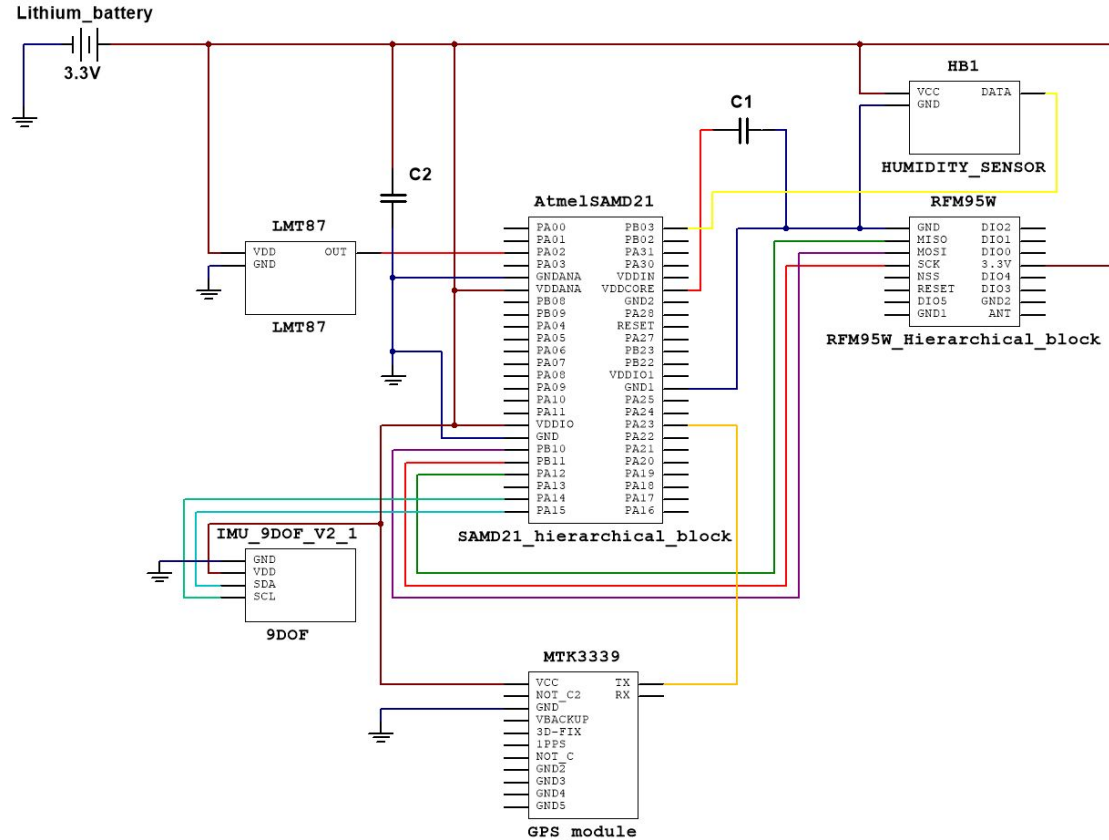
$$C_c = C_s + S \cdot (X_{rh} - 55)$$

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

Basic Characteristic of HS07



Elektrisch schema

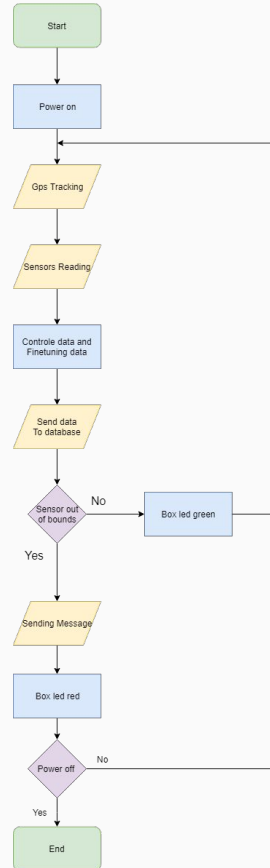


Diagrammen

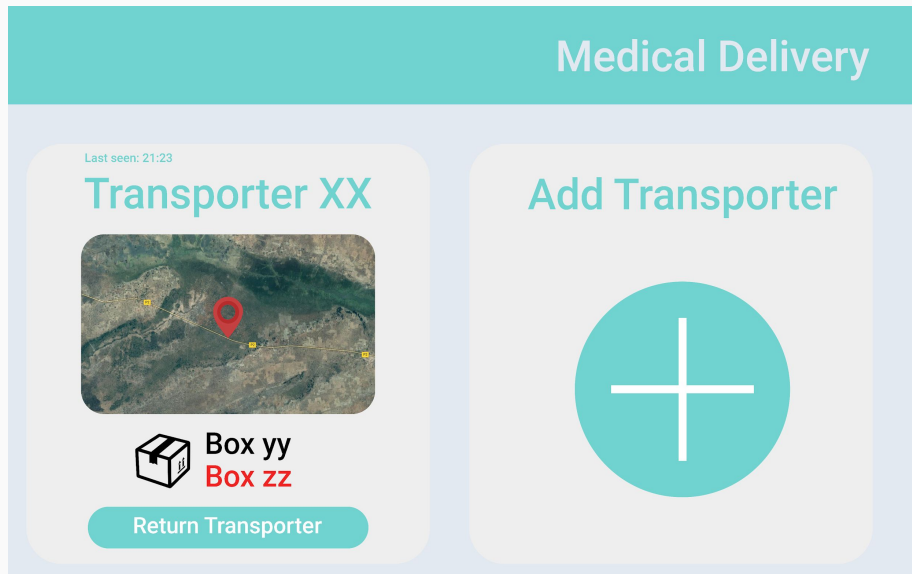
State diagram



Flowchart

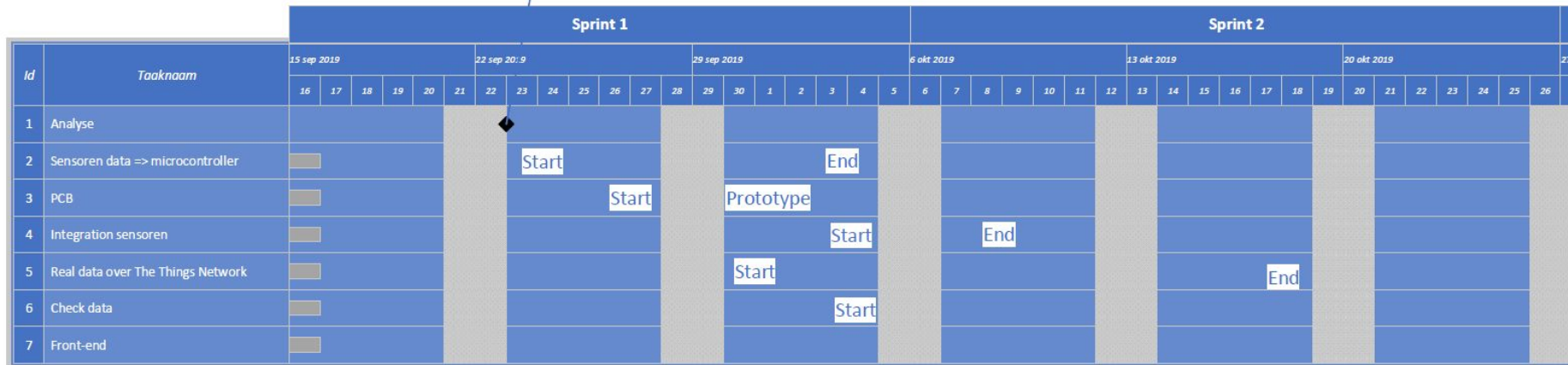


Mock up



Release plan

Presentatie analyse



AtmelStudio

Firebase

