AQUATIME

AQUATIME Intelligent drinking glass

By Kim Toft Madsen, CEO and Founder

Our Mission:

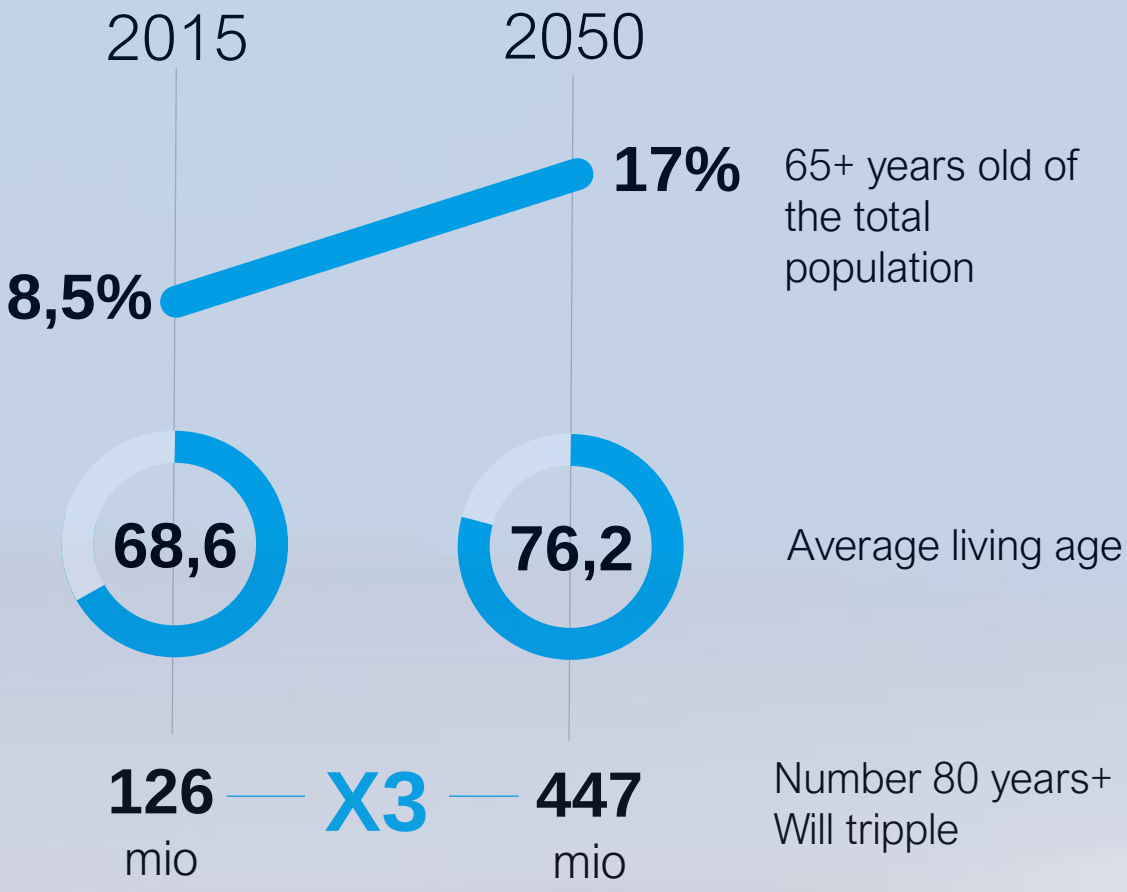
”To give Elder people, Hospitals and Nursing homes a way to protect against dehydration”

By using data and analytics we can protect, motivate and warn elder people and employees in the sector against dehydration¨

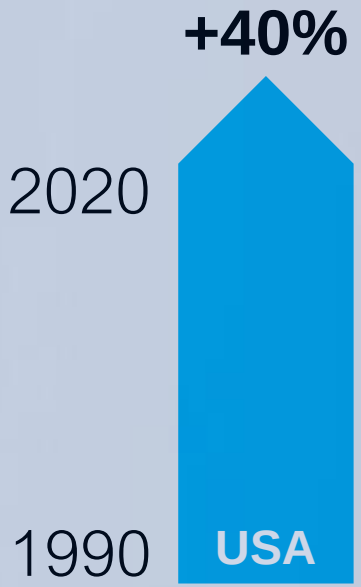
Out of 460.000 hospitalations in Denmark in 2016, for people above 65 years old, 6.700 was purely related to dehydration and could have been avoided. This would have saved Municipalities for 134 Mill. DKK (18 Mill Euro.) Data from the Danish Ministry Of Industry, Business and Financial Affairs.

Dehydration – A growing problem

The elder population (above 65Y) will grow dramatically In The next 30 years. (data source)



Based on registrated trends, Number of hospitalisations because of dehydration is espected to increase…



10%
DK

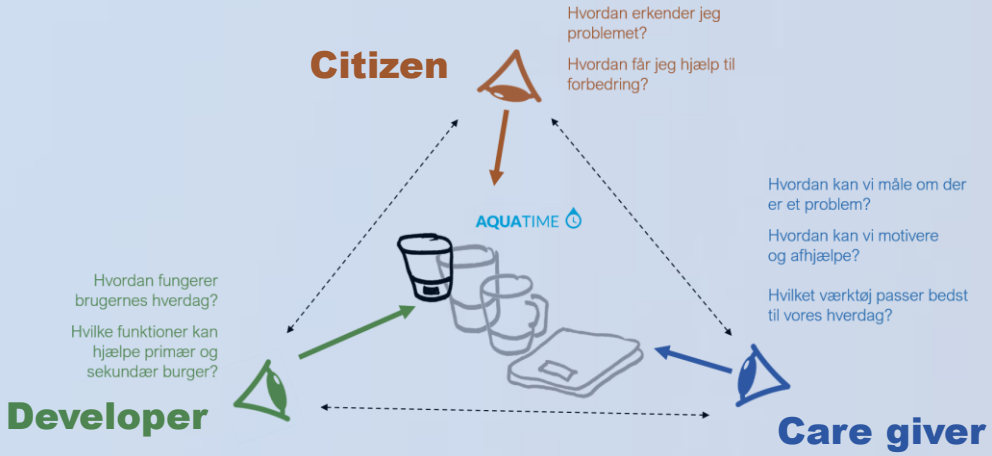
10% of all elder (65+) hospitalisation in Denmark is solely related to dehydration

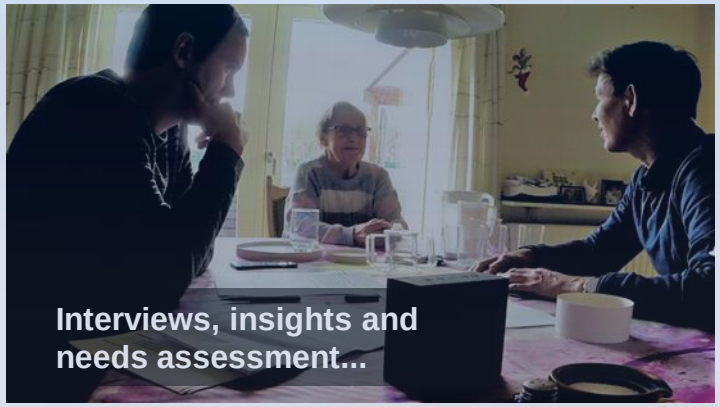
Background...

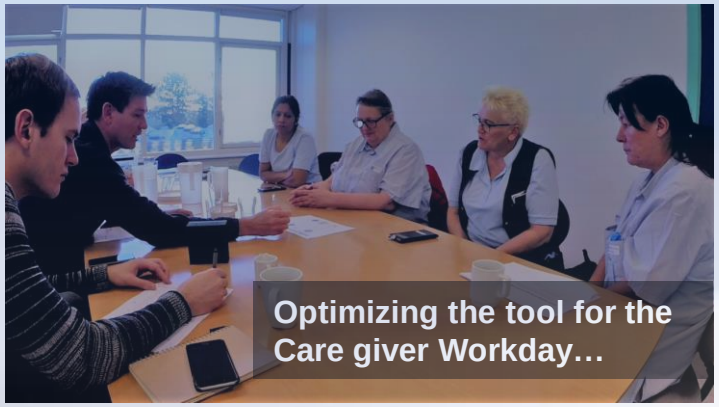
AQUATIME is the result of an Innovation Partnership tender by “Markedsmodningsfonden” (The Market Maturation Fund), which was won by the Danish consortium ‘Aquatime’, in the spring of 2018. The development was financed with 500.000 Euro from EU funds.

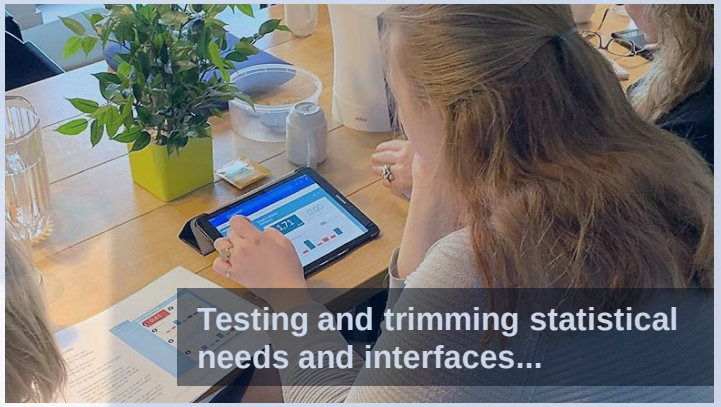
AQUATIME has been developed in four years close collaboration with citizens, health & care staff and decisionmakers in the Danish municipality; Albertslund.

Albertslund Kommune









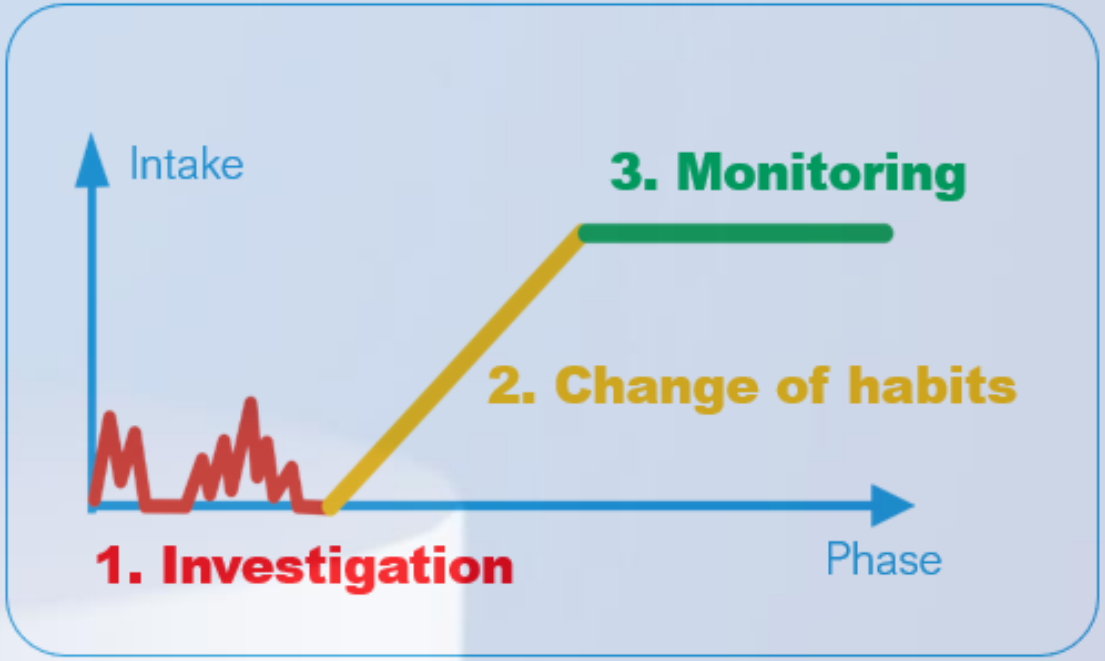
Aquatime - Idea

AQUATIME is a cloud-based CareTech solution for the prevention of dehydration among the elderly.

AQUATIME is an intelligent drinking glass that continuously monitors fluid intake, shows drinking status on the glass and sends data to caregivers, health professionals and relatives.

AQUATIME is…

- Detecting potential dehydration (**Investigation phase**)
- Encourage older people to drink (**Habit change phase**)
- Maintain drinking routines (**Monitoring phase**)



Aquatime - Overview

Measures liquid intake “24/7”
Recognizes drinking movement versus pouring out movement, and only registers liquid intake.

Stimulate the elderly to drink
The nudging function can be set individually

Sends data every hour
Aquatime dashboard creates useful overviews on status and patterns
Aquatime can integrate into public systems used in the care sector

Weekly Charging
Adapter w. magnet cable, charge 2-3 hours.

Remote updating
New software can be transmitted to the Pucks all over the world

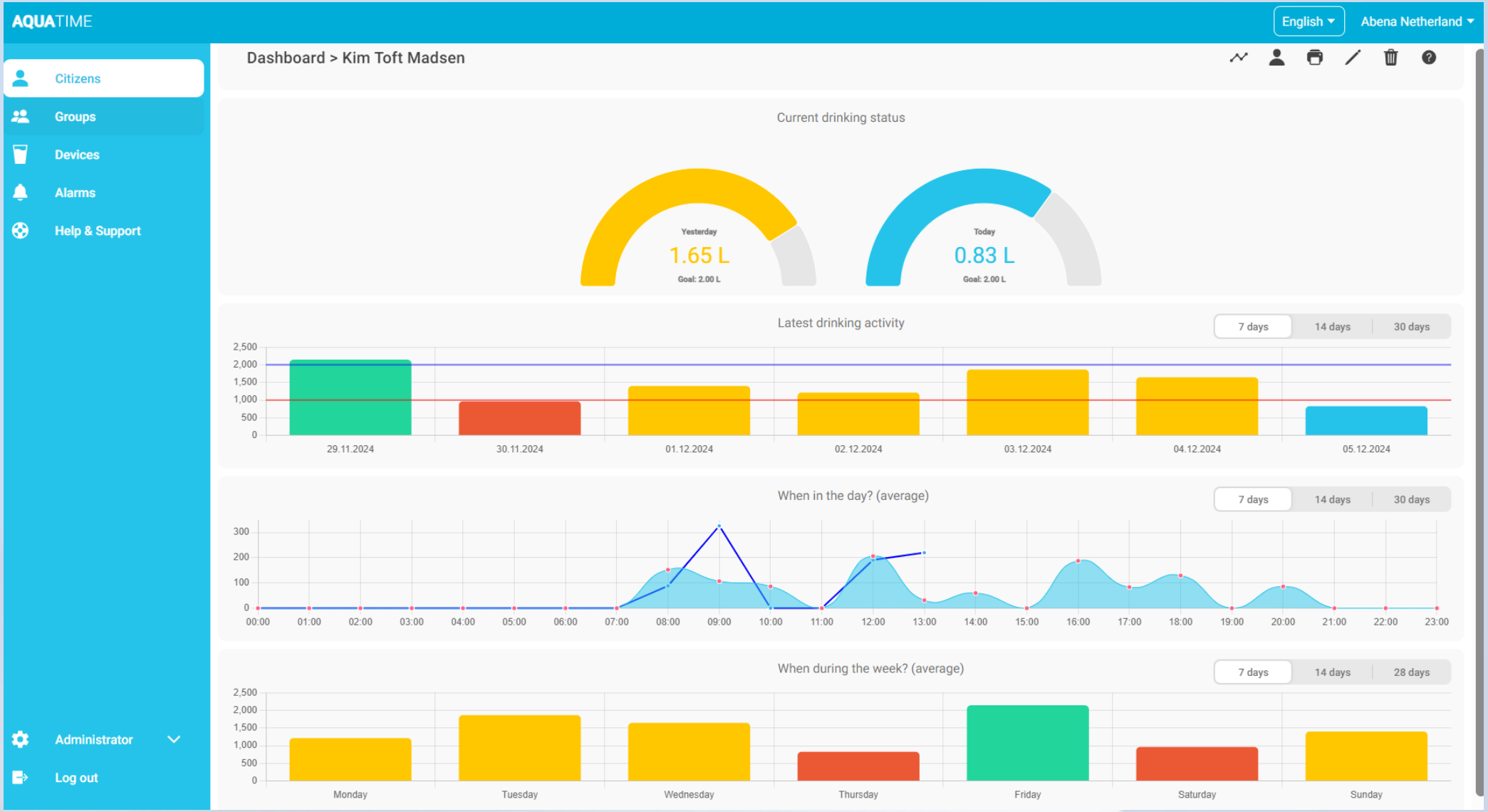
Weight 140 g

An Aquatime solution consists of
- Drinking Glass (2 pcs.)
- Intelligent Puck

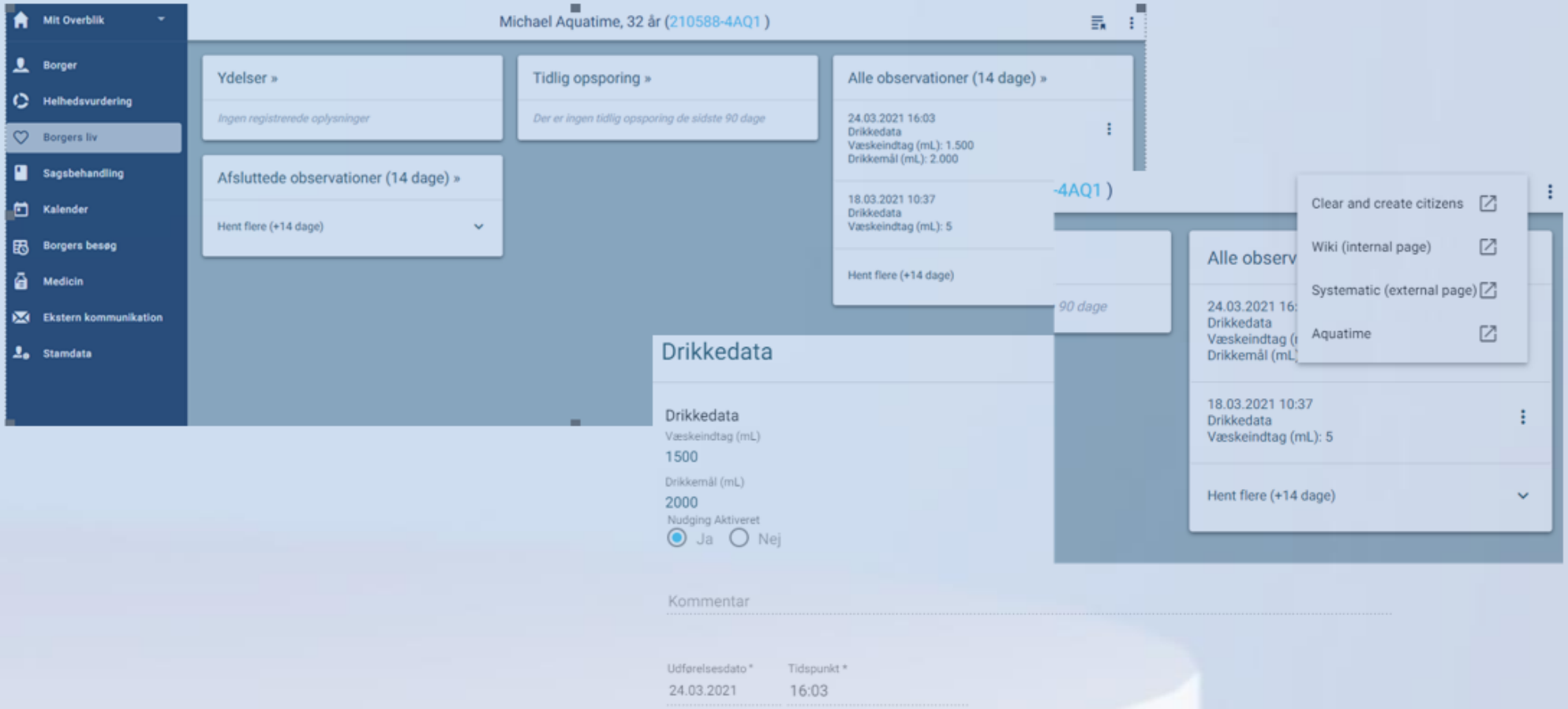
Drinking Glass
- Tritan plast
- Contains 300 ml.
- Dishwasher safe up to 90^{0}C
- Mountable heat protective sleeve

Intelligent Puck
- Display w. identification and status
- Built-in speaker & LEDS’s (for nudging)
- Dishwasher alarm if device is put into dishwasher
- Built-in SIM card (No need for WIFI or Bluetooth)

Aquatime - Administration & Dashboard



Integrationer – CURA eksempel



The target endusers includes:

- Elderly suffering from dehydration with prescribed fluid chart processes
- Elderly who often suffer from urinary tract infections and other urinary diseases
- Elderly suffering from kidney diseases
- Elderly who frequently experience constipation
- Elderly who often fall
- Elderly who are often passive, in a bad mood, or frequently bedridden
- Elderly who drink excessively
- Elderly entering into the care sector
- Elderly returning from hospital stays

"Thank you for giving me my father back" – The importance of proper fluid intake for improving functional capacity in elderly individuals living at home.

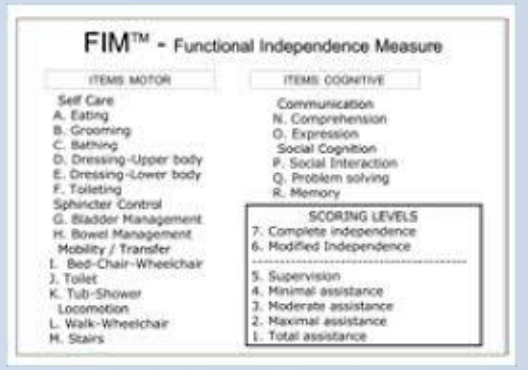
AARHUS KOMMUNE

Conclusions – from the Aquatime Project at Aarhus Municipality

AQUATIME

Physical and Mental Health

The majority of participants (**63,0%**) **have increased their functional capacity** during the project. This improvement is attributed to increased fluid intake, particularly due to the positive impact of the nudging feature with a “DING” sound.



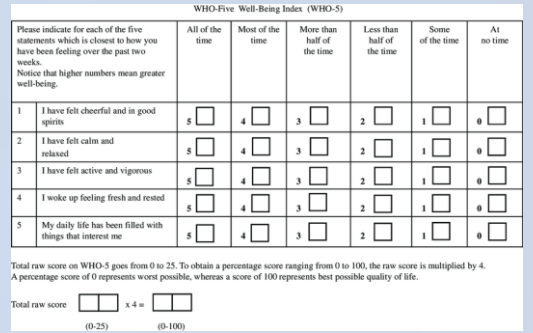
FIM™ - Functional Independence Measure

ITEMS MOTOR	ITEMS COGNITIVE
Self Care	Communication
A. Eating	N. Comprehension
B. Grooming	O. Expression
C. Bathing	Social Cognition
D. Dressing-Upper body	P. Social Interaction
E. Dressing-Lower body	Q. Problem solving
F. Toileting	R. Memory
Sphincter Control	
G. Bladder Management	
H. Bowel Management	
Mobility / Transfer	
I. Bed-Chair-Wheelchair	
J. Toilet	
K. Tub-Shower	
Locomotion	
L. Walk-Wheelchair	
M. Stairs	

SCORING LEVELS
7. Complete independence
6. Modified Independence
5. Supervision
4. Minimal assistance
3. Moderate assistance
2. Maximal assistance
1. Total assistance

Quality of life

Furthermore, most participants (**59,2%**) have also shown an **increase in their WHO-5 well-being scores**. Key factors contributing to this well-being include the security associated with adequate fluid intake, reduced stress levels, and the ability to be more present and engaged with their families.



WHO-Five Well-Being Index (WHO-5)

Please indicate for each of the five statements which is closest to how you have been feeling over the past two weeks. Notice that higher numbers mean greater well-being.		All of the time	Most of the time	More than half of the time	Less than half of the time	Some of the time	At no time
1	I have felt cheerful and in good spirits	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐	0 ☐
2	I have felt calm and relaxed	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐	0 ☐
3	I have felt active and vigorous	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐	0 ☐
4	I woke up feeling fresh and rested	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐	0 ☐
5	My daily life has been filled with things that interest me	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐	0 ☐

Total raw score on WHO-5 goes from 0 to 25. To obtain a percentage score ranging from 0 to 100, the raw score is multiplied by 4. A percentage score of 0 represents worst possible, whereas a score of 100 represents best possible quality of life.

Total raw score ☐☐ x 4 = ☐☐

(0-25) (0-100)

Business Case – Fluid Balance Chart Process

Savings with the Aquatime Glass* vs. Manual Paper Process

Using the Aquatime Glass instead of paper forms results in a **time saving of 29,8%**

”Thank you for getting my farther back”

AQUATIME

Case Study: Preben, Age 85

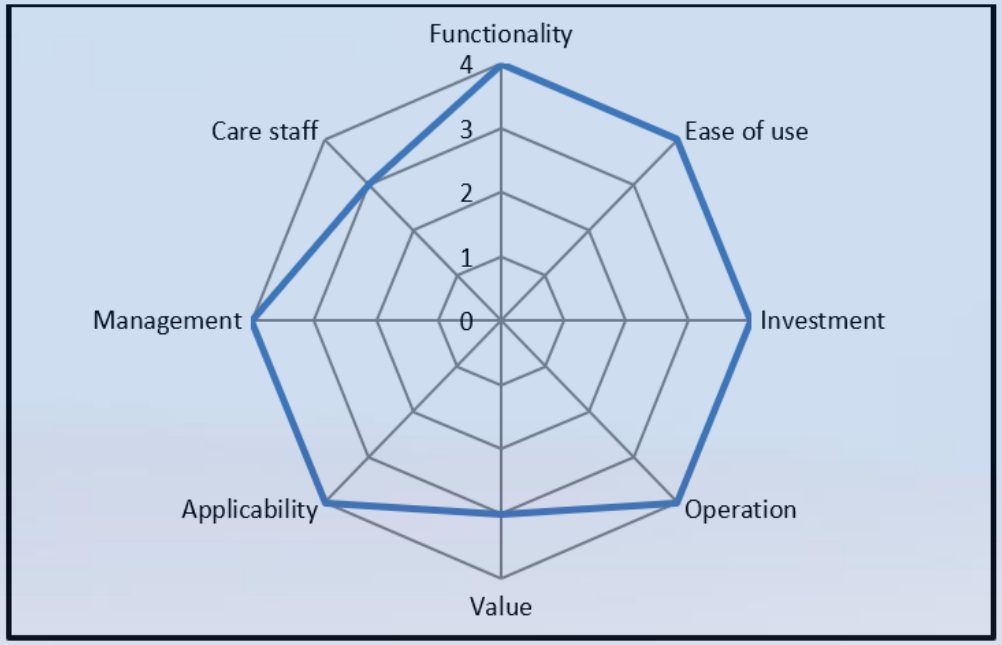
Diagnosis/Challenges: Preben faces cognitive challenges, including memory loss and a lack of initiative for basic tasks. Previously skilled in drawing due to his background as a typographer, he is now unable to draw despite his wife’s encouragement. His wife handles the majority of his care and household responsibilities, including those directly related to Preben's needs. Additionally, his daughter has repeatedly contacted home care services, expressing concern that he is not receiving adequate hydration.

Implementation of Aquatime: Two weeks after initiating the Aquatime program, Preben's daughter reported a significant improvement. Preben, who had been completely inactive, now independently puts on his shoes and ties his shoelaces while at her home. She observed a notable transformation. A week later, she called again to share that she had believed Preben had lost his ability to draw. Remarkably, he has resumed drawing as he did before. Furthermore, he is now showing a renewed interest in his family and grandchildren, inquiring about them actively.

What Customers say?

Esbjerg Kommune

The figure below shows how the total points distribution relates to the product. A more visual display of the rating of Aquatime. The product has a very high or a high score in all categories, with a point score from 4-3.



Conclusion

From observations made at Esbjerg Residential Rehabilitation and from the statements of employees, they can't be concluded that Aquatime is a good tool against dehydration. The use of the glass helps to give a more accurate picture of how much the citizens actually drink. The glass liveris valid numbers and documented in real time, which is instrumentalin minimizing the staff's task of remembering to note the exact fluid uphandfluid intake on the fluid chart. Unfortunately, this is often forgotten in a busy everyday life and in addition, it is not documented if the citizen himself pours up during the day.

The glass and associated back-end administration can fully replace the liquid balance chart currently used in Esbjerg Municipality. Replacing fluid charts will probably ensure a more accurate and real-time recording of the citizen's fluid intake.

Recommendation

Aquatime will be a good aid for the future in Esbjerg Kommune and can help to raise the quality of work with citizens with dehydration. This will give employees more valid documentation of citizens' fluid intake and thus the employees will be better able to support the citizens in their own treatment.

Target Group

Based on the cognitive condition of the elderly, the care sector can be segmented and prioritized as follows in a business context:

- Primary Priority: Home Care.
- Protected Housing/Senior Residences (2nd Priority)
- Rehabilitation Centers and Similar Facilities (3rd Priority)
- Nursing Homes (4th Priority)
- Hospitals (5th Priority)

AQUATIME – Prismodel - NOK

Der er to prismodeller for anskaffelse af Aquatime løsninger:

Prismodel 1 omhandler udelukkende Aquatime abonnementet.

- Obligatorisk Aquatime abonnement NOK 430 pr. måned pr. device
  - Aquatime intelligent device
  - 2 stk. Aquatime drikkeglas (Tritan plast)
  - Aquatime adapter m. magnetkabel
  - Digital Aquatime Brugervejledning
  - Software abonnement
  - Software opgraderinger
  - Hosting & Datakommunikation
  - Telefonsupport (Hverdage fra 09:00 til 16:00)
  - Udskiftning af ødelagte Aquatime devices (i rimeligt omfang).

Prismodel 2 omhandler køb af Aquatime produktet med tilhørende obligatoriske Aquatime abonnement.

- Køb af Aquatime produkt NOK 3.050,-
  - Aquatime intelligent device
  - 2 stk. Aquatime drikkeglas (Tritan plast)
  - Aquatime adapter m. magnetkabel
  - Digital Aquatime Brugervejledning
- Obligatorisk Aquatime abonnement NOK 275 pr. måned pr. device
  - Software abonnement
  - Software opgraderinger
  - Hosting & Datakommunikation
  - Telefonsupport (Hverdage fra 09:00 til 16:00)
  - Udskiftning af ødelagte Aquatime devices (i rimeligt omfang).

Krav til anskaffelses antal Aquatime devices ved opstart: Minimum 10 stk.

Opstart er vederlagsfrit og inkluderer:

- Implementering og opsætning af devices og administrator
- Introduktions – og oplæringskursus (varighed ca. 1 time).

Optioner:

- Køb af ekstra Aquatime drikkeglas (Tritan plast) NOK 75,-
- Køb af ekstra Aquatime adapter m. magnetkabel NOK 120,-

Aquatime Abonnement påbegyndes måneden efter implementering og faktureres 12 måneder forud.

Alle priser excl. Moms
Valutakursen er baseret på at 1 NOK = 0,64 DKK

A Partnership Made for Improving Healthcare

ABENA has teamed up with AQUATIME who has developed The Digital Drinking Glass.
AQUATIME is a welfare technology solution that fits perfectly into ABENA's "Tomorrow's Care" concept.

AQUATIME

Let's work together for a brighter future
in healthcare for both residents and caregivers.

Business Case Calculator (Fluid balance chart)

Aquatime Business Case Calculator

Process:	Investigation and monitoring of dehydration in home care													
Duration: 25 days	25 days													
	AQUATIME							Paper-based Fluid Balance Chart						
Activity #.	Activity	Executing party	# of times	Time minutes	Total minutes	Rate EURO	Cost EURO	Activity	Executing party	# of times	Time minutes	Total minutes	Rate EURO	Cost EURO
1	Suspected dehydration	Health Care assistant	1,0	2,0	2,0	51,2	1,7	Suspected dehydration	Health Care assistant	1	2	2	51,2	1,7
2	The citizen is entered into the Aqautime application	Nurse	1,0	3,0	3,0	54,6	2,7							
3	Aquatime implementation in home	Health Care assistant	1,0	2,0	2,0	51,2	1,7							
4	Instruction to the citizen	Health Care assistant	1,0	3,0	3,0	51,2	2,6							
5	Aquatime in operation for 25 days	Aquatime	25,0			1,2	30,0							
6								Fluid balance chart is created	Nurse	4	5	17,9	54,6	16,3
7	Professional assesment of fluid intake requirements (gender, body wiight, season etc.)	Nurse	1,0	5,0	5,0	54,6	4,6	Professional assesment of fluid intake requirements (gender, body wiight, season etc.)	Nurse	1	5	5	54,6	4,6
8	Nudging to drink	AquaTime	100,0	0,0	0,0	0,0	0,0	Nudging to drink (when staff is there)	Health Care assistant	125	1	125	51,2	106,7
9	Liquid is offered	Health Care assistant	125,0	0,5	62,5	51,2	53,3	Liquid is offered	Health Care assistant	89	0,5	45	51,2	38,1
10	Manuel cleaning of drinking glass	Health Care assistant	25,0	2,0	14,0	51,2	11,9	Consumtion is noted in the Fluid balance chart	Health Care assistant	75	2	150	51,2	128,0
11								Fluid balance charts are collected	Health Care assistant	11	1	11	51,2	9,1
12	Consolidating data	AquaTime	600,0	0,0	0,0	0,0	0,0	Conolidation of data	Health Care assistant	25	1	25	51,2	21,3
13	Fluid balance is calculated per day	AquaTime	10,7	0,0	0,0	0,0	0,0	Fluid balance is calculated per day	Health Care assistant	25	1	25	51,2	21,3
14	Feedback to nurse	AquaTime	600,0	0,0	0,0	0,0	0,0	Feedback to nurse	Health Care assistant	25	1	25	51,2	21,3
15								Fluid balance chart is scanned/entered into the journal system	Nurse	11	5	54	54,6	48,8
16	After 1-2 days: Conclusion: OK or corrective actions	Nurse	3,6	5,0	17,9	54,6	16,3	After 1-2 days: Conclusion: OK or corrective actions	Nurse	4	5	18	54,6	16,3
17	Extra Nudging	AquaTime	100,0	0,0	0,0	0,0	0,0	Extra Nudging	Health Care assistant	11	2	21	51,2	18,3
18	Involve doctor	Nurse	1,0	15,0	15,0	54,6	13,7	Involve doctor	Nurse	1	15	15	54,6	13,7
19	Extra monitoring	AquaTime	600,0	0,0	0,0	0,0	0,0	Extra monitoring						
20														
21								New Fluid charts are photocopied/printed	Nurse	1	1	1	54,6	0,9
22	Aquatime preparation for next citizen	Nurse	1,0	5,0	5,0	54,6	4,6							
					124,4		**143,0**					**539,1**		**466,3**

Aquatime – System Architecture

AQUATIME

Data Exchange

A Delivers the graphical user interface for the application.
B **Users**, **organization groups**, **subjects**, **devices** and **data** within the user's organizations.
C Data exchange with 3rd part integrations, see specific integration for details.
D Full access to users, organizations, devices, subjects, data, organization groups and administration groups.
E Only used to download files like new graphics or sounds or when downloading a new firmware version.
F Raw data from devices and debugging data calculated by the service.
G Devices sends data packages with **drinking data** and the **device state** and receives command packages with **device settings** or update instructions.
H Delivers the graphical user interface for the device admin.

B - Access, Transmission, Storage and Data Specification

ADMINISTRATOR Full access to everything
USER Full access within organization(-s), except underlined data points

Authorization is handled using a JWT (JSON Web Token) with a lifespan of 1 hour.

Data transmission to/from the services are SSL/TLS encrypted.

These data are stored unencrypted at Netic's servers. Only developers with deployment responsibilities have access to these servers.

Hardware Versions
- id (ex. 2.5)
- note

Firmware Versions
- id (ex. 2.0.111)
- note
- crc16
- filename
- hardware version

Organizations
- label

Devices
- id (ex. 000-00123)
- username
- password (hashed with salt)
- note
- organization
- device settings*

Subjects
- label
- organization
- organization group

Organization Groups
- label

Administration Groups
- label
- parent administration group

Users
- name
- password (hashed with salt)
- email
- role (USER / ADMIN)

Data
- logged
- type (DRINK / TOSS / SPILL / FILL / OBJECT)
- weight
- csq (signal quality)
- cops (operator details)
- temp
- signal
- ratio
- battery level
- battery voltage
- device
- subject
- firmware version

G - Access, Transmission, Storage and Data Specification

DEVICE Can send and receive packages

Authorization is handled using device credentials.

Data transmission is handled using a custom protocol.

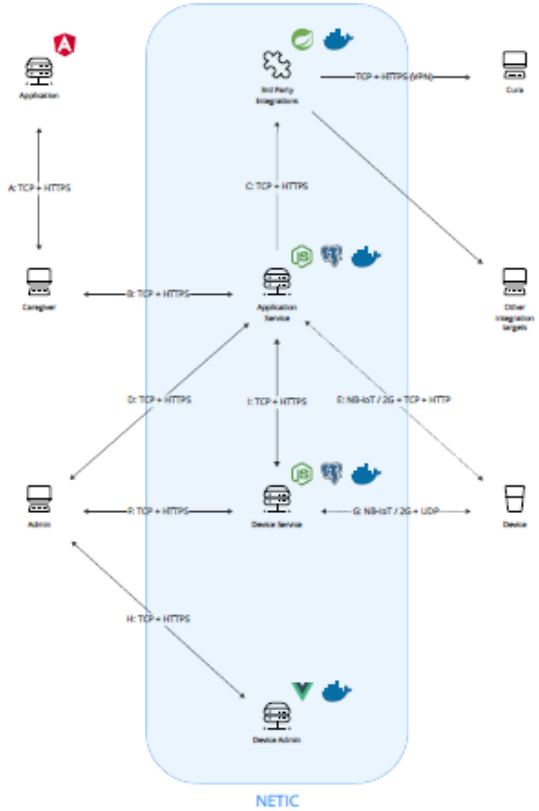
Drinking data is stored unencrypted on the device until they are sent to the server, settings are stored until updated or deleted from the server.

Heartbeat (from device)
- id (ex. 000-00123)
- version (ex. 2.0.111)
- imsi
- imei
- iccid
- csq
- cops
- temp
- signal
- ratio
- battery voltage
- battery level
- timestamp

Change (from device)
- id (ex. 000-00123)
- type (DRINK / TOSS / SPILL / FILL)
- weight
- version (ex. 2.0.111)
- imsi
- imei
- iccid
- csq
- cops
- temp
- signal
- ratio
- battery voltage
- battery level
- timestamp

Configure (from server)
- melody
- volume
- hysteresis
- interval
- target
- flight mode
- light
- name
- nap interval
- nudge

Update (from server)
- version
- host
- path
- crc16
- nudge



F - Access, Transmission, Storage and Data Specification

ADMINISTRATOR Full access to everything

Authorization is handled using a JWT (JSON Web Token) with a lifespan of 1 hour.

Data transmission to/from the services are SSL/TLS encrypted.

These data are stored on a encrypted filesystem (AES-256) at Netic's servers. Only developers with deployment responsibilities have access to these servers.

This service has all communications between devices and services using **G** in a raw format logged for development and debugging. Data here is short lived (one month).

Internals

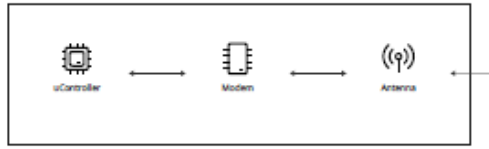
Device Service

The **device service** handles the communication with the **device**. It receives data packages to interpret and sends out commands for setting up devices and updating using OTA.

It saved all data in the raw received and sent format for short time debugging. Even data with errors.

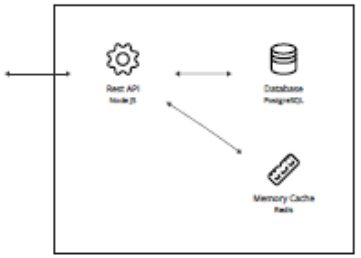
It communicates with the **application service** to know what to send to which devices and to relay data from the **device** in an interpreted format.

Device



The **device** uses either NB-IoT or 2G to communicate with both the **application service** and the **device service**. Most communications will be with the **device service**, as the **application service** is only used to acquire new files.

Application Service



The **application service** handles all the application state; users, organizations, devices, subjects, groups, data etc.

Everything is saved in the service database and manipulated using a rest API.

When the **application service** becomes distributed, it may be necessary to use a memory cache to handle inter-process state sharing.

AQUATIME

Thank You…

AQUATIME Intelligent drinking glass

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