



Blo.

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IoT and 3D Intelligent Systems

Introduction



 **10%**



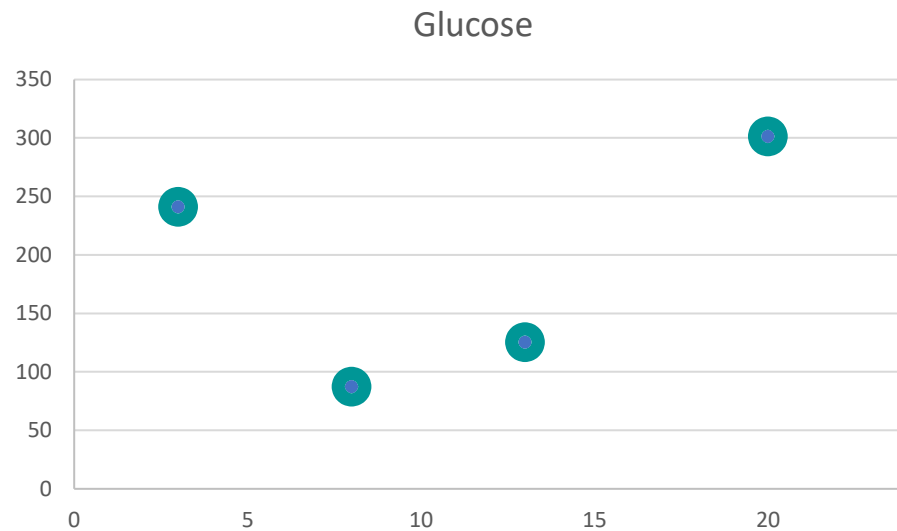
463 million people affected by diabetes

10% of people with diabetes have Type 1
T1 diabetes is caused by an autoimmune
reaction that can affect people at any age and
mostly during childhood

The number of people with T1 diabetes
worldwide equals the population of entire Spain

Technology for diabetes - History

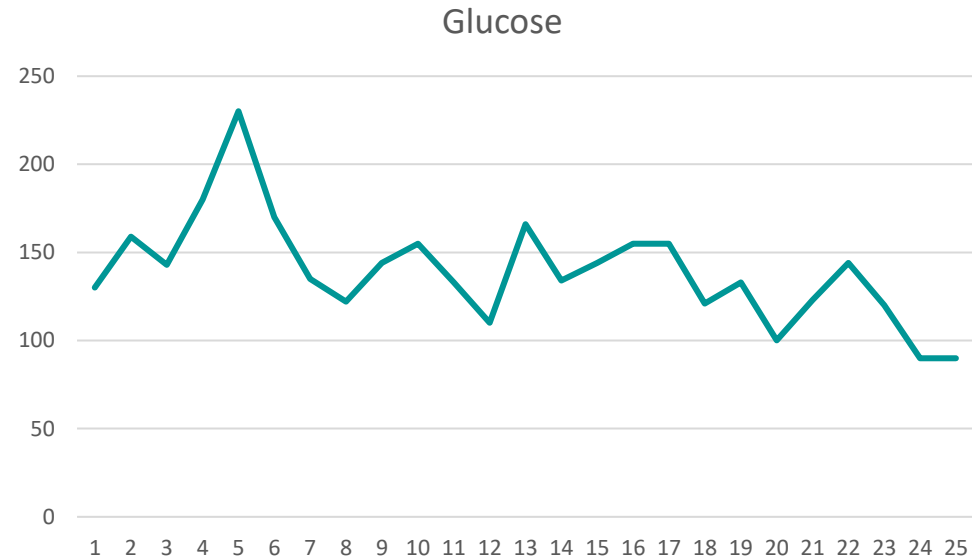
- 1971 - Glucometer
- 1974 - Insulin pump



1970

2000

- 1999 first CGM
Continuous Glucose Monitoring



2021



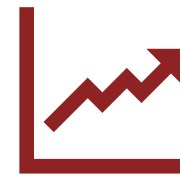
The problem

Clinical data is not enough!

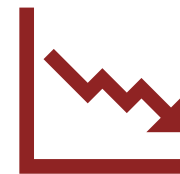
Insulin amount and glucose levels depend heavily on:



The Integration of life-related information could bring terrific advantages to patients by avoiding:

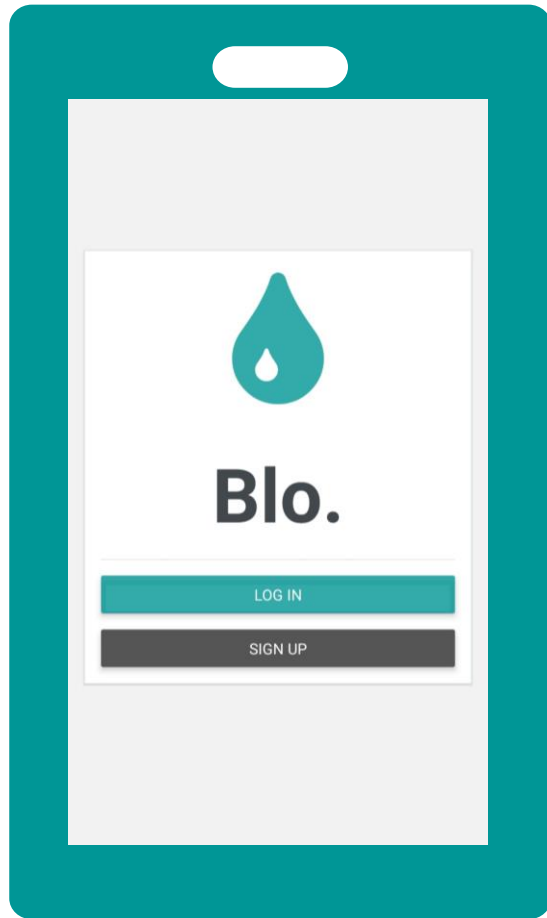


HYPERGLICEMIA



HYPOGLICEMIA

The solution



**ALL-IN-1
MOBILE APP**

Collect & analyze data



GLUCOSE



INSULIN



HEARTBEAT

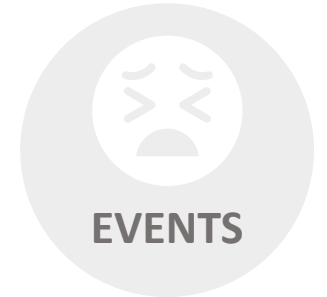
Track life-related information



FOOD



SPORT



EVENTS

Combine them to predict

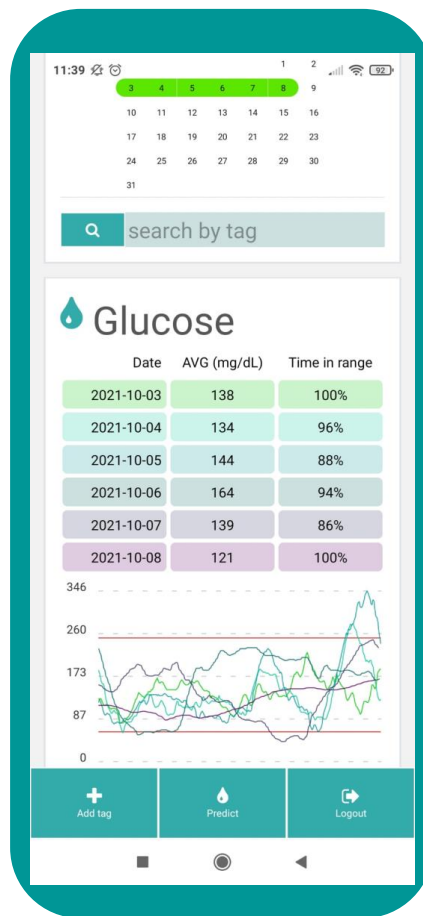


GLUCOSE
LEVELS

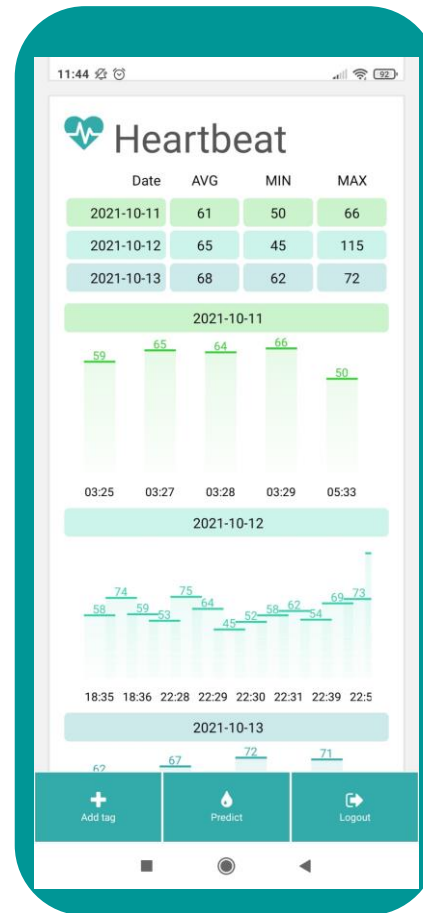


INSULIN
NEEDS

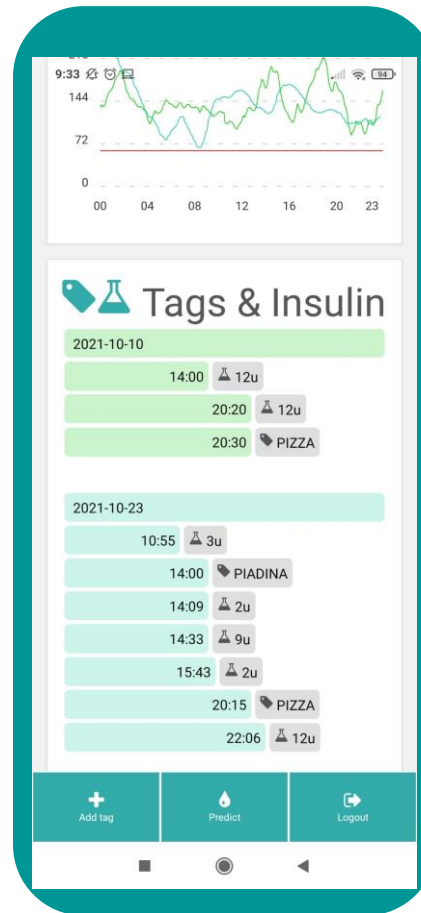
Features overview



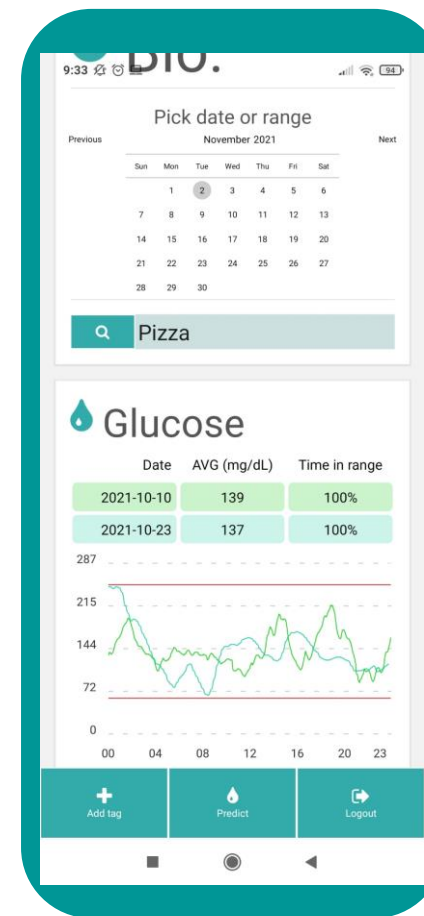
Glicemic diary



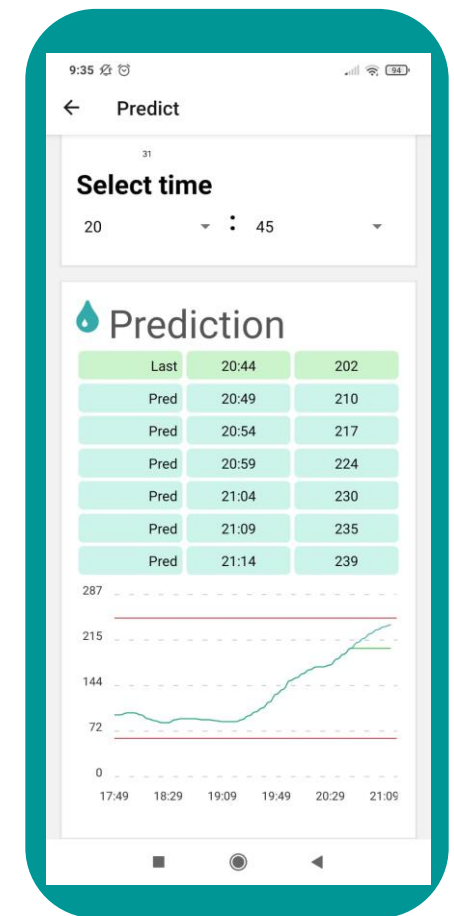
Heartbeat monitoring



Meal & insulin tracking



Meal search



Glucose prediction

Prototype architecture



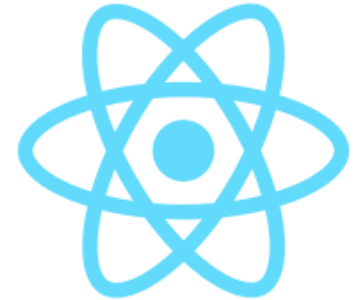
Heartbeat
sensor



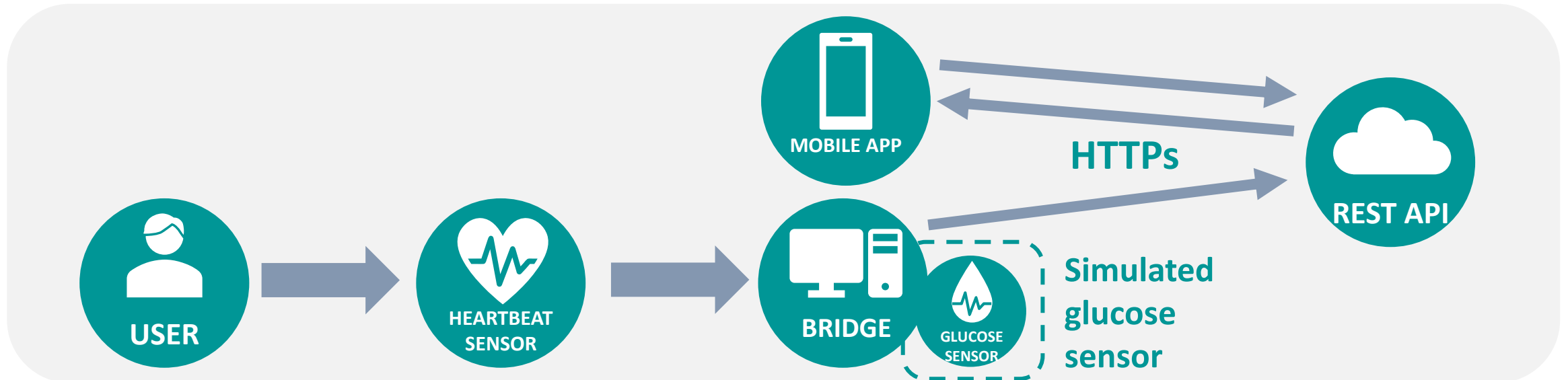
Bridge



REST API

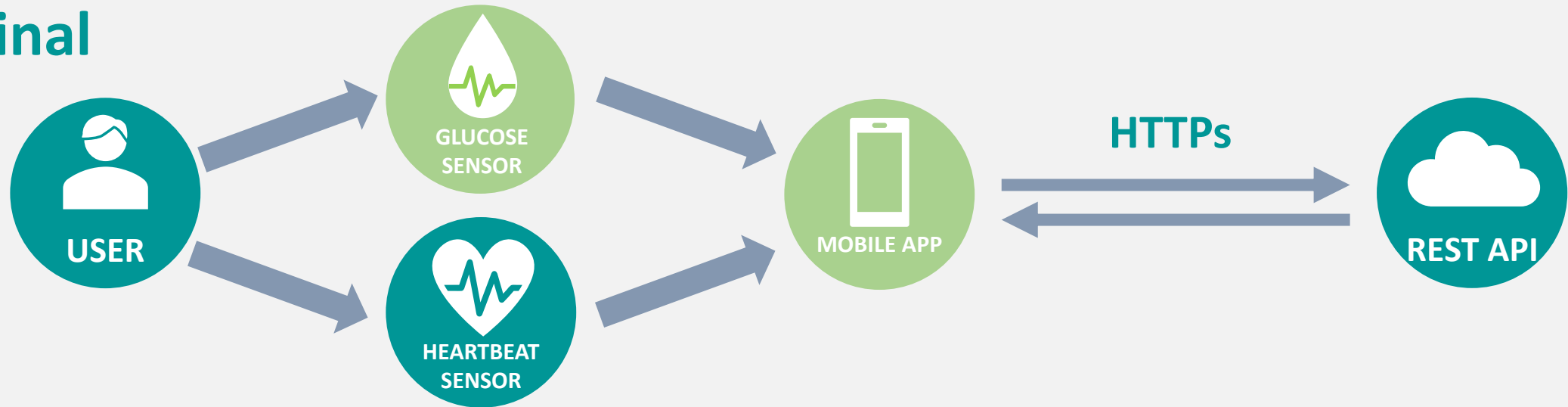


Mobile
app

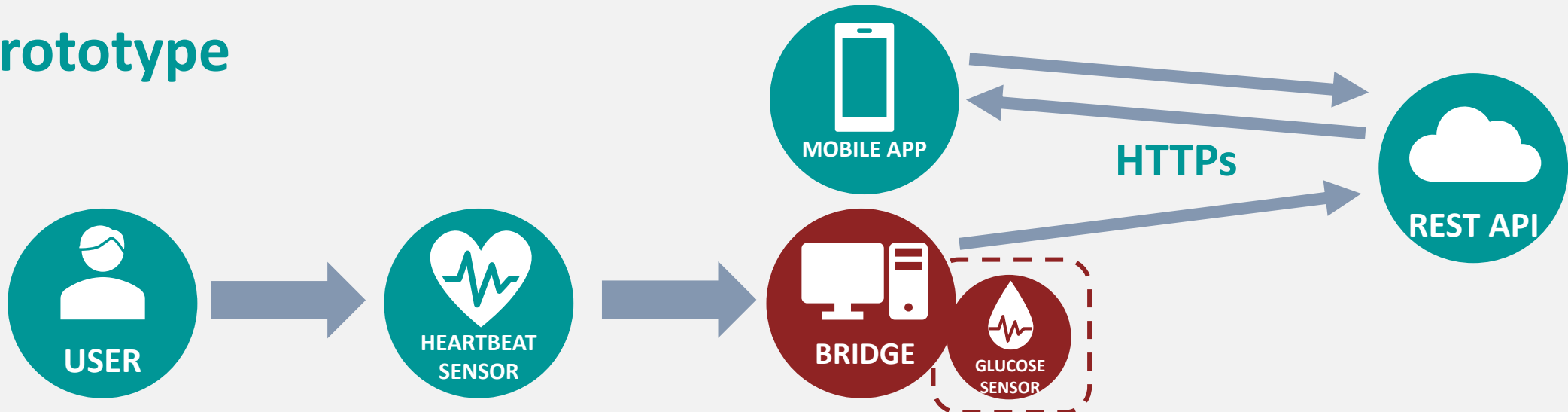


Final product architecture

Final

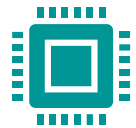
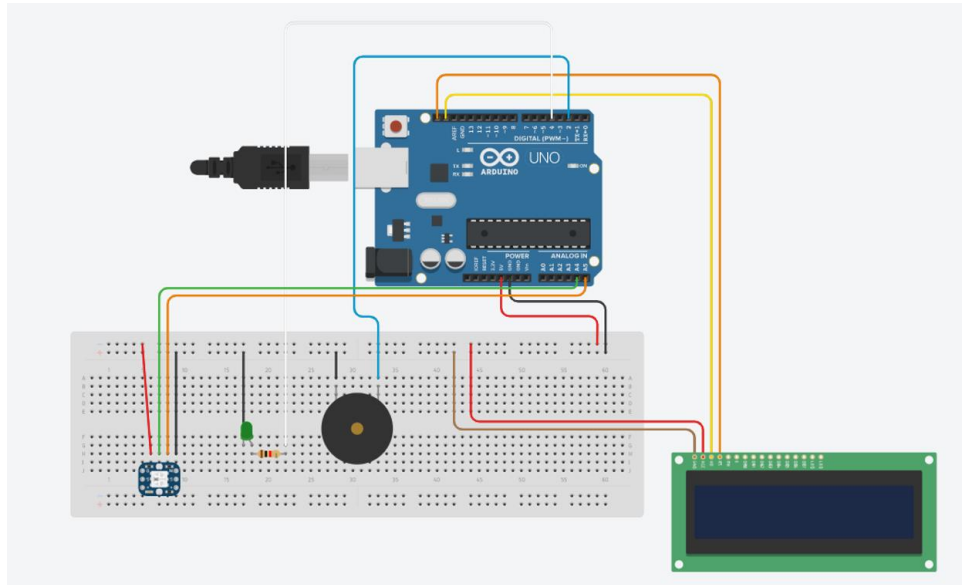


Prototype



Components: Microcontroller & Bridge

Configuration scheme



ELEGO UNO R3 board

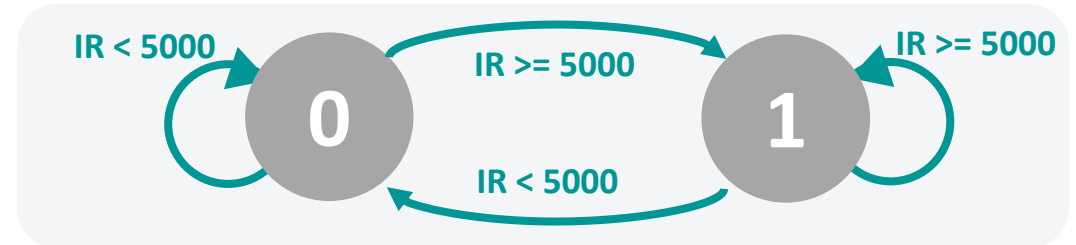


MAX30102 sensor



Serial LCD display

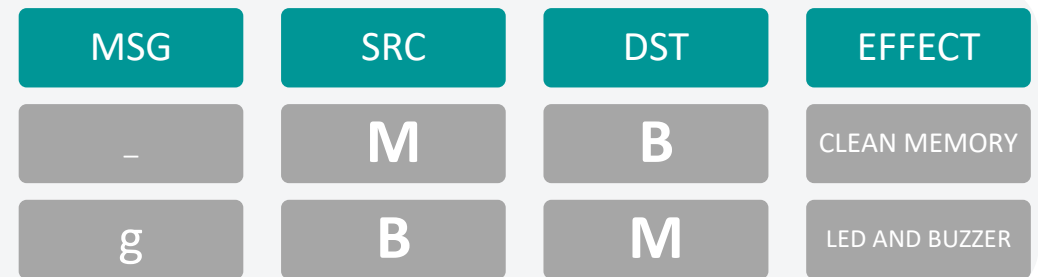
Finite state machine



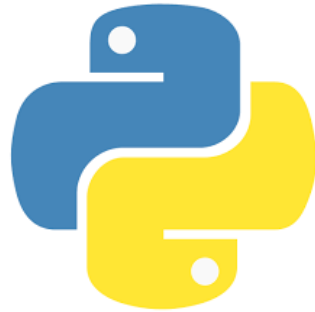
Signal structure



Control messages



Components: REST API



ORM - Object Relational Mapping



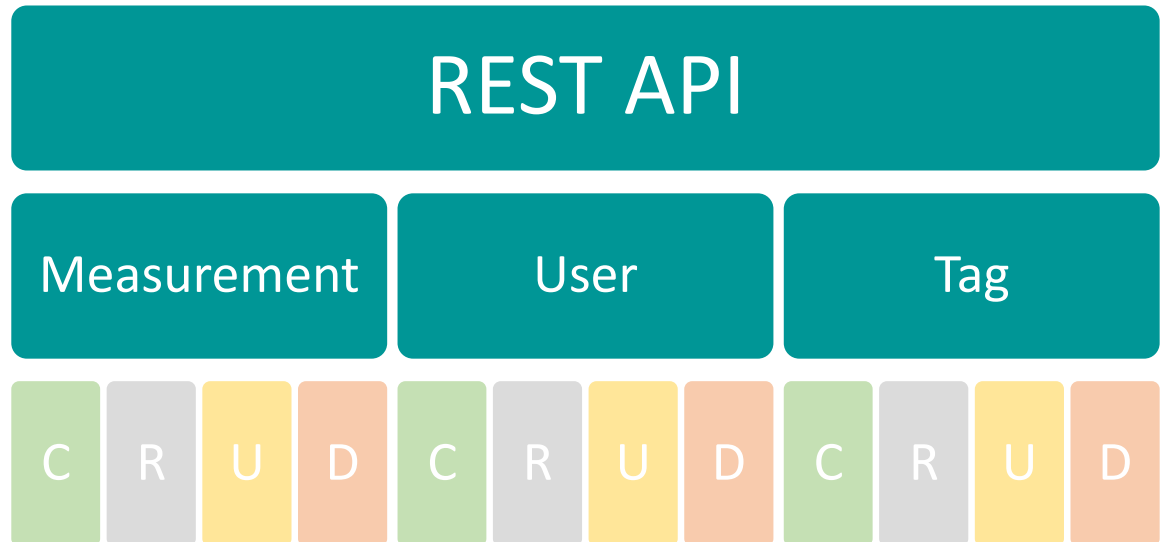
REST Framework



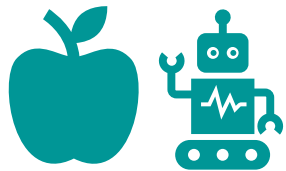
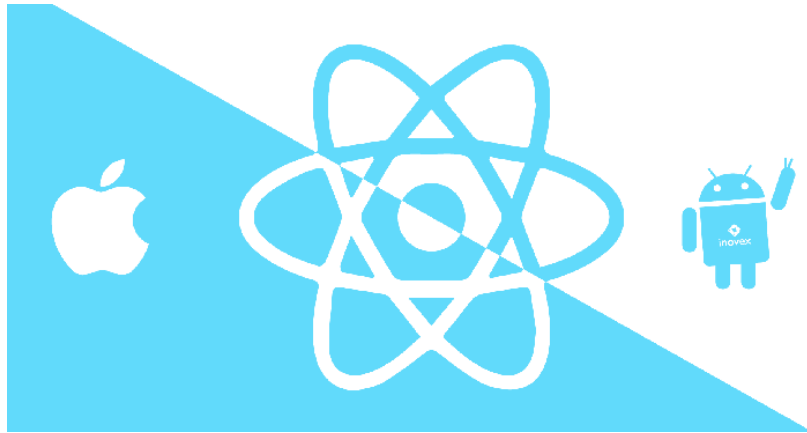
Scalability



Security



Components: Mobile Application



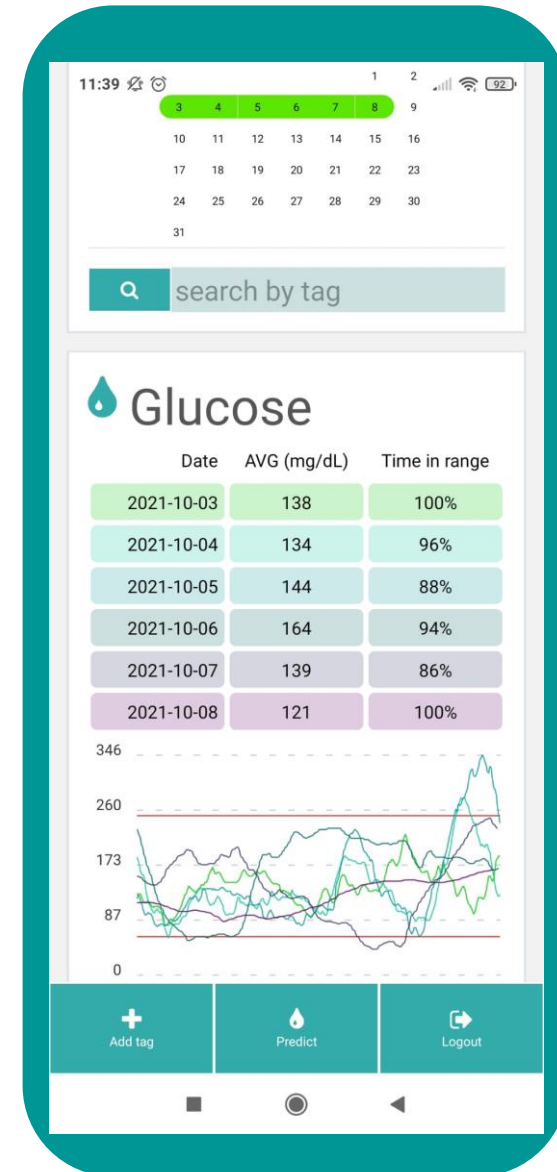
Cross platform



Great performance



Hot reloading



Time series forecasting

Cross-validation

- **N** = 120 000 measurements
- **f** = 5 minutes
- **p** = 1/100 of evaluating model

Episode evaluation

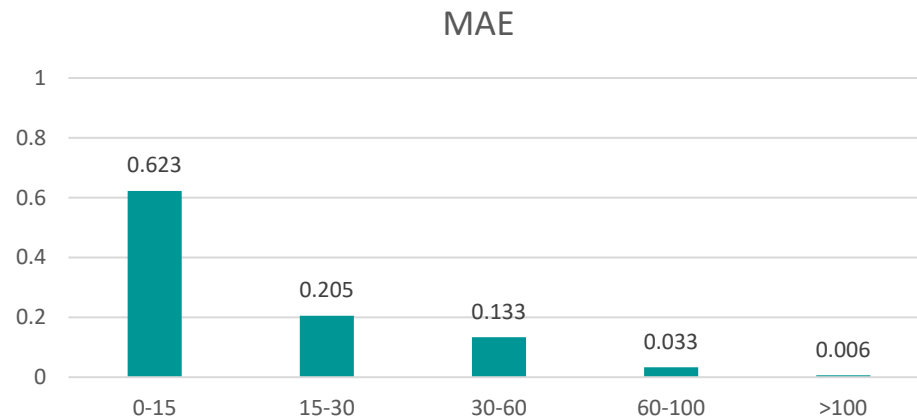
48 measurements (4h)

- 36 for training (3h)
- 12 for testing (1h)

ARIMA

MAE = 16.33

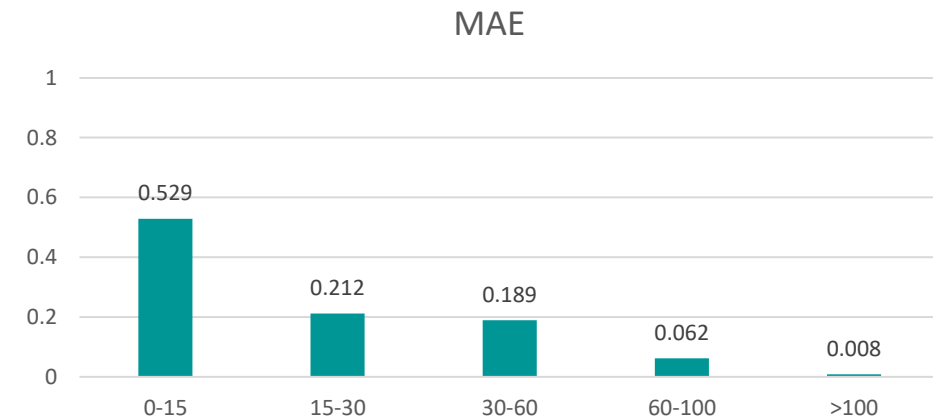
75% = 22.08



fbprophet

MAE = 21.32

75% = 30.06



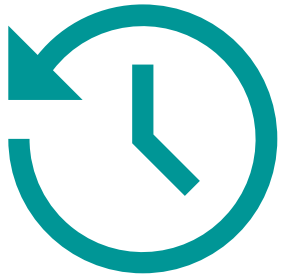
Areas of improvement



Glucose sensor simulated
due to complexity and cost of the resources



HTTP response time affected by
free hosting service SLA



Glucose prediction based only
on recent past measurements



Thank you!