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D1NAMO NTF

FNSNF

D1NAMO: Diabetes type 1 Non-invasive Activity MOnitoring

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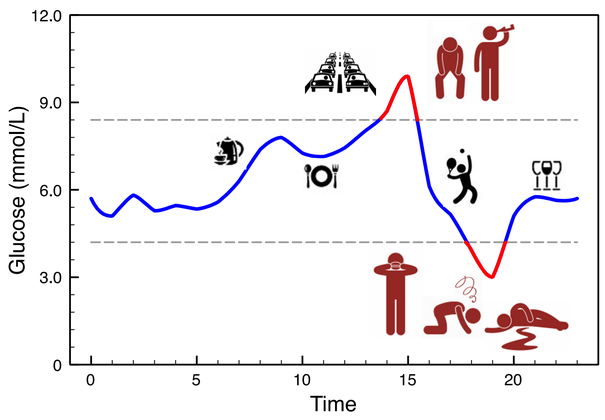
Problematic

Diabetes Type 1 is an autoimmune disease that affects the insulin level of a patient.

Once a patient is affected by diabetes type 1, the only possible treatment is injecting insulin shots several times a day to keep the insulin level under control and keep the risk of hypoglycemia low. Unfortunately, intensively controlled glycemia levels allow patients to have a better outcome from the perspective of microvascular and macrovascular complications of diabetes type 1, meaning that there exists a trade-off between limiting the amounts of hypoglycaemias of the patient and limiting the occurrence of cardiovascular diseases later in the patient's life.

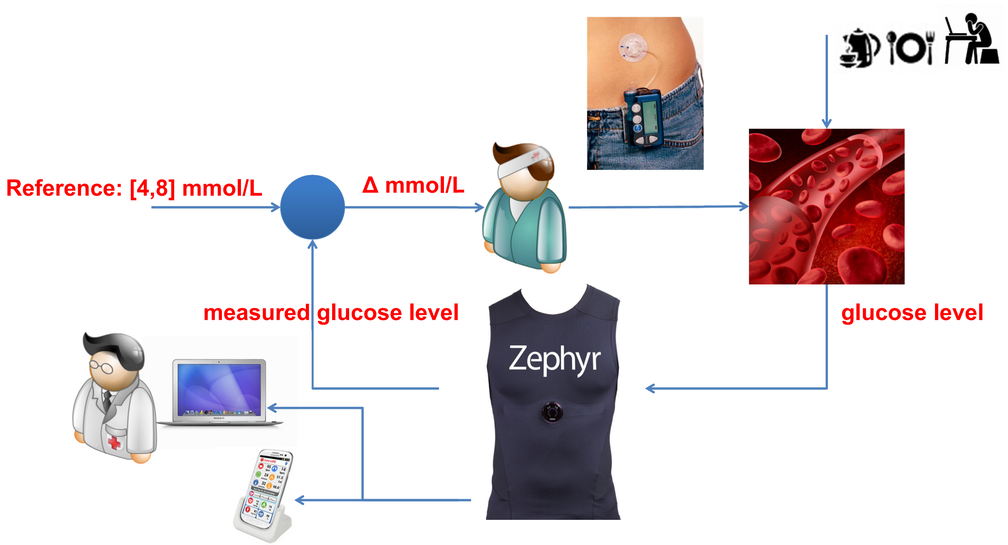


Consequently, understanding the physiological counter-regulatory responses caused by hypoglycemia with respect to the usage of insulin would allow to improve the management of hypoglycemic episodes. Also observing the physiological values of patients before, during and after occurrences of hypoglycemia would permit to have a better understanding of the phenomenon, as well as allowing a non-invasive prediction of hypoglycemic episodes. Furthermore, being able to predict hypoglycemia given the level of activity of the patient during the day and the week would allow doctors to act pre-emptively toward the hypoglycemias.

Proposed solution

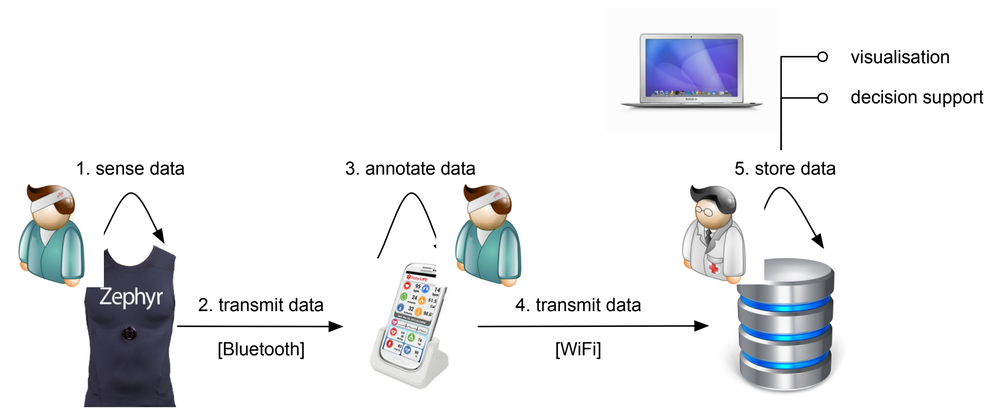
The D1NAMO project aims to develop a pervasive personal-sensing application for patients with diabetes Type 1 that will make use of advanced wearable devices to monitor the physiological data of the patient such as heart rate, ECG and breathing rate. This would allow to:

- Monitor the activity of the patient.
- Provide informative feedback to the patient and the doctor about the physical activities performed and their impact on diet and medication.
- Detecting symptoms of hypoglycemic attacks in order to provide early alerts to the doctors.



Goals / Challenges

- **[WP1] Data collection platform**
  - Analysis of requirements for patients and doctors
  - Platform design and implementation (Zephyr BioHarness™ 3)



- **[WP2] Data analysis**
  - Physical activity characterization
  - Recognition and prediction of hypoglycemic episodes

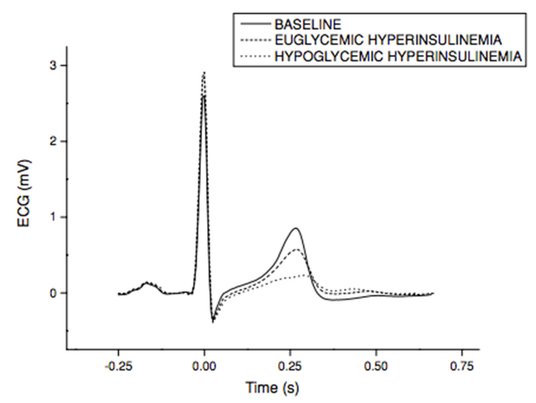
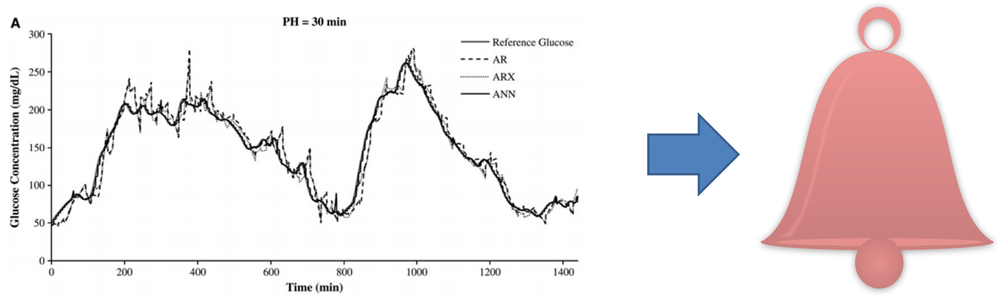


Figure 1. A representative case showing a slight amplification of the R wave, a decrease in the ST segment, a remarkable flattening of the T wave, and a slight prolongation of the QT interval as characteristic electrocardiographic changes in response to euglycemic and hypoglycemic hyperinsulinemia.

- **[WP3] Knowledge-based complex event processing**
  - Logic rules that monitor the stream of physiological data to alert the doctor and the patient
  - Graphical interface to specify events of interest to be monitored
  - Adapt the sensing configuration according to therapeutical needs



- **[WP4] Field tests**
  - Months 1 to 5: Patient selection
  - Months 6 to 11: Data collection, data annotation (ground truth), model selection
  - Months 12 to 17: Implementation
  - Months 18 to 24: Field tests