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Designing an UML-RT Model of an Insulin-and-Glucagon Pump System with Papyrus-RT

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HIS - Project

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Outline

- Introduction
- Papyrus-RT and UML-RT modeling language
- Insulin-Glucagon pump system
- Live Demonstration
- Conclusion & Future Ideas

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Introduction

- In this project, we created a model of the Insulin-Glucagon pump system using Papyrus-RT and the UML-RT modeling language.
- By using scientific knowledge of modeling and formal verification, we can prove that our model meets the pre-defined specifications and working correctly.

Papyrus-RT

- An open source, complete modeling environment for the development of complex, software intensive, real-time, embedded, cyber-physical systems (1).
- Provides an implementation of the UML-RT modeling language together with editors, code generator for C++ and a supporting runtime system and model-compare capabilities.

Figure 1: Papyrus- RT (1)

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UML-RT Modelling language

- Provides a common framework for modeling object-oriented systems.
- Helps clarify the relationship between the object paradigm and real-time systems.
- Supports the notion of service ports and includes a built-in services library that provides communication, timing, logging and dynamic structure services (2).

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Insulin-Glucagon Pump Requirements

- All system components must initialize to their respective stable state. The user can read the glucose level in real-time.
- When the glucose level gets higher or lower than a certain threshold, the system notifies the user and automatically injects insulin/glucagon to normalizing the glucose level.
- Initialized battery value and Insulin/Glucagon will be check before the simulation began.

Model Design

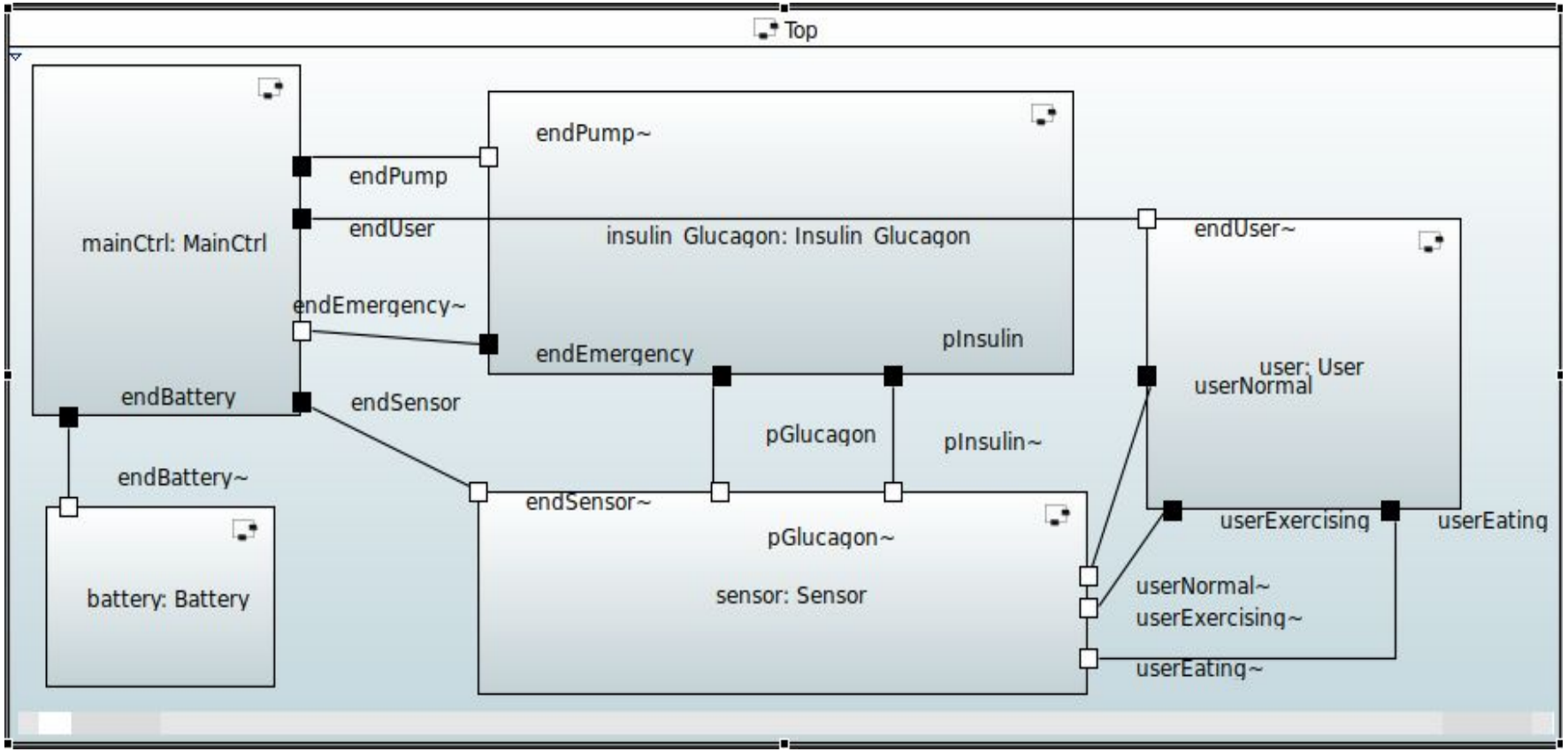

Figure 02: Our UML model in Papyrus RT

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Live Demonstration

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Conclusion & Future Ideas

- Through this project, we learn a lot about Model-Driven-Engineering and gain hands-on experience in developing and verifying high-integrity software.

- Things we want to improve: Improve the design to simulate and verify other scenarios that not mentioned in the test cases sheet. For example, create a scenario where the sensor provides an invalid reading value outside the normal range like 0 or negative values.

References

1) https://wiki.eclipse.org/Papyrus-RT

2) https://www.eclipse.org/papyrus-rt/