(Medesign track)
Design and Prototyping of the Decision-Making Component of an IPSC Automation System with Human-in-the-Loop AI Integration

Master's Thesis Description:
This master's thesis project aims to contribute to the automation of the production of human induced Pluripotent Stem Cells (hiPSC) by **designing and prototyping a decision-making component for an iPSC machine** called the RXF system (http://resolver.tudelft.nl/uuid:3dc6b272-f319-4511-9a68-673a3543c0ce). hiPSCs are pluripotent embryonic stem cells that can be generated from skin or blood cells through a reprogramming process. They offer the possibility to model human diseases and study their behavior. They help scientists discover early disease-causing events in cells and are therefore used in discoveries about premature aging, congenital heart disease, cancer, and disorders connected to fetal development. Because of their characteristics, pluripotent cells can create any body cell to study disease but can also be manipulated to manufacture healthy cells for transplants. The generation of iPSCs is very labor-intensive, requiring daily monitoring and handling of iPSCs. To help scale up hiPSC cell production, researchers at **the iPS Core Facility at Erasmus MC** are developing the RXF system, which combines several automation technologies to streamline the production process.

The primary objective of this research is to design a human-centered intelligent decision-making component that seamlessly integrates the diverse technologies within the RFX machine. The decision-making system will act as the central nervous system of the RXF, orchestrating the execution of tasks and adapting to dynamic changes in stem-cell growth requirements. The thesis will delve into the crucial aspect of incorporating the latent knowledge of the iPS Core Facility scientists and technicians who are currently manually growing stem cell cultures. By developing a human-in-the-loop AI decision-making system, we seek to harness the expertise and insights of experienced technicians, bridging the gap between automation and human expertise. The system will be designed to learn from technician inputs, adapt to evolving protocols, and continuously improve its decision-making capabilities over time.

The methodology employed will involve an in-depth analysis of existing technologies. Prototyping and testing of the decision-making component will be carried out to validate its effectiveness and integration with the RXF system. The outcome will contribute to advancing iPSC automation technology, towards a more efficient and adaptive system that can revolutionize hiPSCs production.

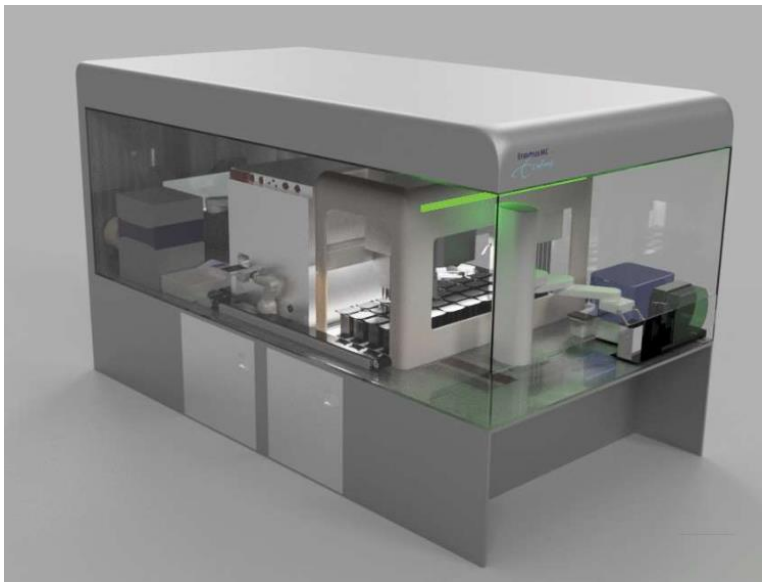

Image: The RXF reprogramming module – concept design by Natasa Rikalo

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