École Polytechnique de Montréal

Cour INF6600 - Conception et analyse des systèmes temps réel

Travail Pratique N°4 : Implémentation sous le RTOS QNX

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Introduction:

The goal of this laboratory is to implement the Insulin Pumping system under QNX. The QNX is running on the platforms such as x68. which we used it for the system architecture. The QNX has number of threads in a task. The kernel checks when thread can use the cpu. In order to use the CPU with many threads the scheduling algorithm will apply in kernel.

According to solution of the controller/Environmental simulation figure in the guide document for this laboratory, the scheduling algorithm is based on FIFO.

Implementation:

Our system is working with 6 different threads :

- **patient** : calculating the glycemia from the previous glycemia and the glucose and insulin injection.
- **pompeInsuline**: handle the insulin injection and the pump level.
- **pompeGlucose**: handle the glucose injection and the pump level.
- **controleur**: coordinate the system depending on the glycemia value.
- **controleAntibiotique**: handle the recurring antibiotic and anticoagulant injection.
- **ResetSeringue**: handle the pump filling (reset)

In order to make communication between threads we are using message queues and shared variables:

Shared variables:

- **glycemie**: shared level of glycemia.
- **txInsuline**: insulin level in the pump.
- **txGlucose**: glucose level in the pump.
- **glucoseIsRunning**: boolean to know if glucose is being injected to the patient
- **insulineIsRunning** : boolean to know if insulin is being injected to the patient.
- **isReset**: boolean to know if pump have been filled.

All the shared variables are protected by a mutex.

Message Queues:

- **glucoseInjectionQueue:** Message queue used from the glucose syringe to the patient.
- **insulineInjectionQueue:** Message queue used from the insulin syringe to the patient.
- **insulineSeringueQueue:** Message queue used from the controller to the insulin syringe.

- **glucoseSeringueQueue:** Message queue used from the controller to the glucose syringe.

notes: This design has been chosen because of some difficulties in the implementation of a FIFO (named pipe).

Improvements: Many amelioration point could have been developed:

- Using a Fifo to deliver message to a display thread.
- Using a signal handler to make a clean exit on ctrl+c signal.
- Using a signal handler to make the reset (not an interval).
- implement a more realistic patient algorithm.

Example

As we were not able to present our work during the lab, we will provide some screen capture of our program display during a run.(all files are in annexe)

case 1 hypoglycemia:

The patient first step is hypoglycemia, we are watching how our system will respond until beeing in the normal mode (between 120 and 60):

case 2 hyperglycemia:

The patient first step is hyperglycemia, we are watching how our system will respond until beeing in the normal mode (between 120 and 60):