SOFTWARE SPECIFICATIONS

Painkiller Injection System

Group 16
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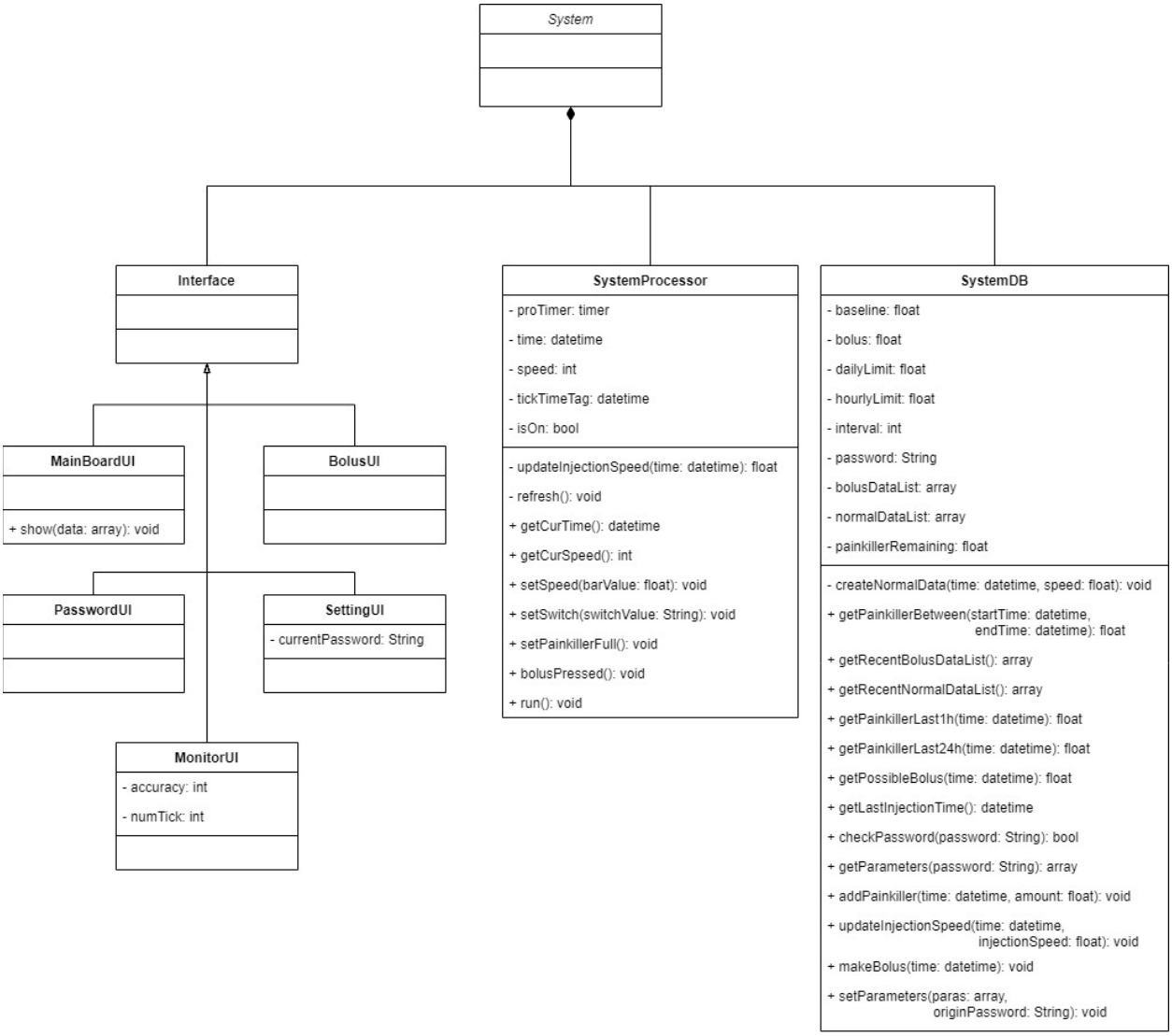
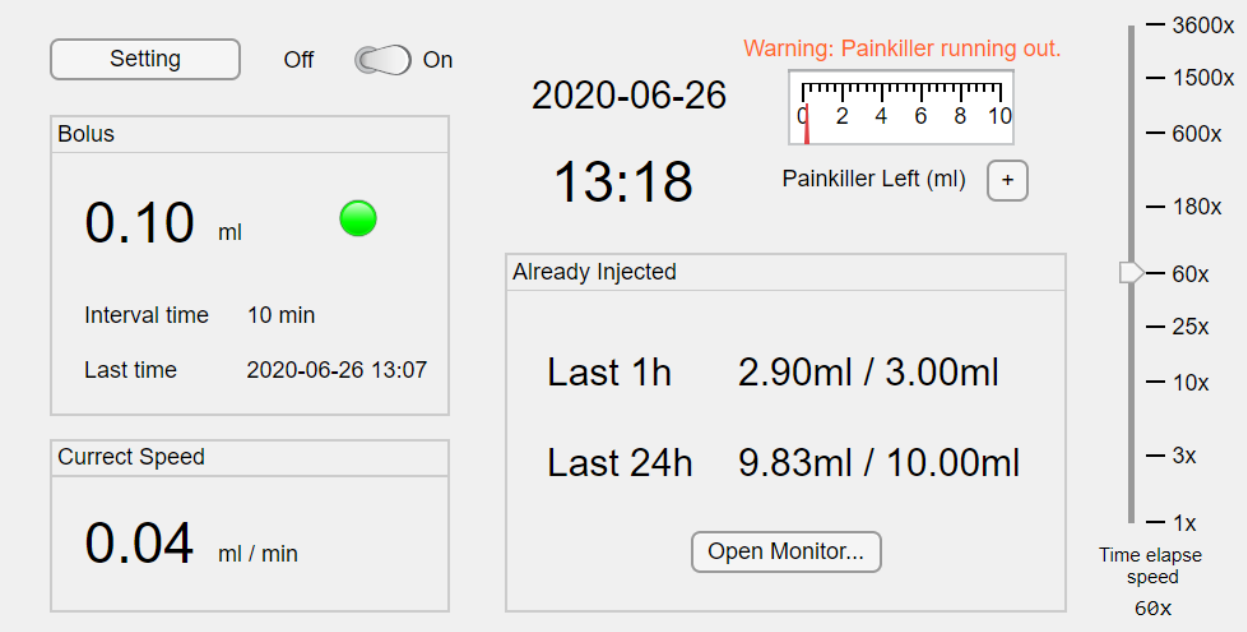
System Architecture

The system architecture is shown below:

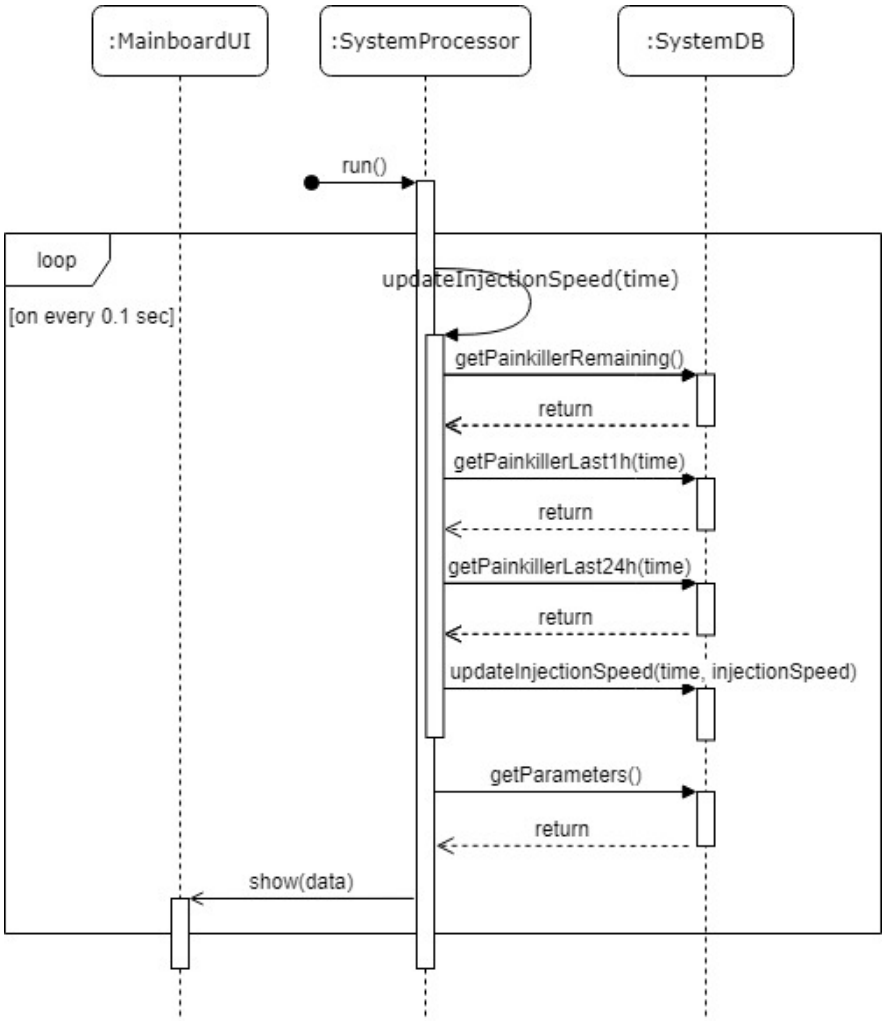


Software Specifications

S1: MainboardUI implementation



S1.1: Display Basic Information



- S1.1.1 Run Machine and Refresh Data

1. Run the system processor
2. Initialize the time and speed parameters to current time and speed 1, then start the timer to call refresh function every 0.1 second. Below are on refresh function:
   a) Update the machine time via adding last time point by speed times passed time interval
   b) Call updateInjectionSpeed() function
      i. Get remaining painkiller, painkiller injected last 1h, painkiller injected last 24h, along with the limit from the data base
      ii. If machine is on, and painkiller remaining is above 0, and painkiller injected last 1h and 24h doesn't not exceed the limit, update the data base injection speed as baseline
      iii. Else update the data base injection speed as 0
   c) Get all parameters from the data base, and show them on the main board UI
      i. Database will return setting parameters directly
      ii. Database will go over all the injection records and calculate the painkiller injected or remaining based on the current time

iii. Database will check the limit and interval time compared to current time to determine possible bolus to inject

d) If no possible bolus or the machine is off, disable the bolus button

e) Else enable the bolus button

- S1.1.2 Show the data on main board

1. Display baseline, date, time, interval time, bolus, last 1h injection, last 24h injection, last time injected, painkiller left, speed information on main board
2. If no possible bolus or the machine is off, show red lamp. Else show green lamp
3. If painkiller left less than 1 ml, show warning message. If painkiller left is 0, show red warning message. Else do not show any warning message
4. If painkiller left is full, disable the add to full button. Else enable the add to full button

- S1.1.3 Get Remaining Painkiller

1. The remaining painkiller is the remaining painkiller at the check time point minus the painkiller between check point and current time
2. If the value smaller than 0, update it to 0
3. Return the remaining painkiller amount

- S1.1.4 Get Painkiller between Time Points

1. Set result to 0
2. For all the bolus data
   a) If the bolus was made between two time points, than add the bolus amount to the result
3. For all the normal data
   a) If the baseline injection record starts before the latter time point, and continues till now:
      i. The time duration should be the latter time point minus the later one of the record start time and the former time point
      ii. Add the result by the record injection speed times the time duration
   b) Else, if the baseline injection record starts before the latter time point, and ends before the former time point:
      i. The time duration should be the earlier one of the latter time point and the record end time, minus the later one of the record start time and the former time point
      ii. Add the result by the record injection speed times the time duration
4. Return the result

- S1.1.5 Get Painkiller for last 1 hour

1. Return the painkiller injected between 1 hour ago and now

- S1.1.6 Get Painkiller for last 24 hours

1. Return the painkiller injected between 24 hours ago and now

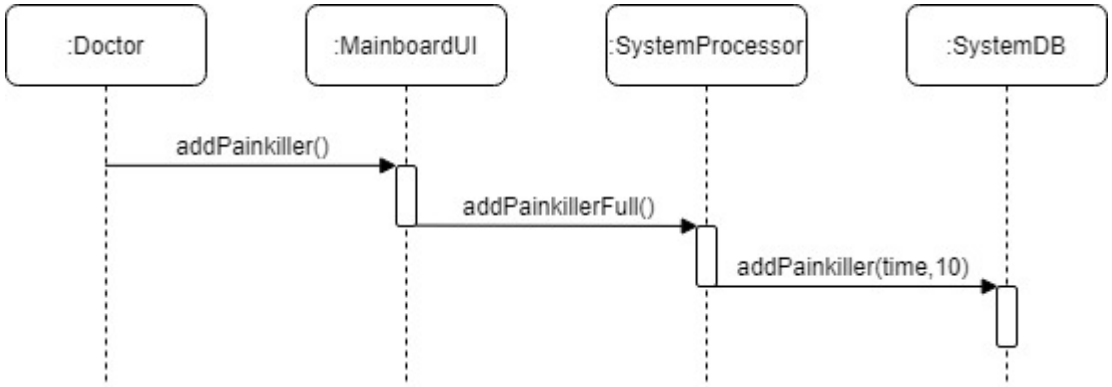
- S1.1.7 Update Database Injection Speed

1. If the normal data list is empty
    a) If the injection speed is not 0
        i. Create a new normal data with current time and injection speed
2. Else, if last record shows the injection last till now, and the record injection speed differs from the one currently
    a) Set the last record end time to current time
    b) If current injection speed is not 0
        i. Create a new normal data with current time and injection speed
3. Else, if last record shows the injection has been stopped, and current injection speed is not 0
    a) Create a new normal data with current time and injection speed

- S1.1.8 Get Possible Bolus Currently

1. If the time between current time and last injection is smaller or equal to the bolus interval, return 0
2. Return the minimum one of bolus setting, hourly limit minus painkiller injected last 1h, daily limit minus painkiller injected last 24h, the amount of remaining painkiller

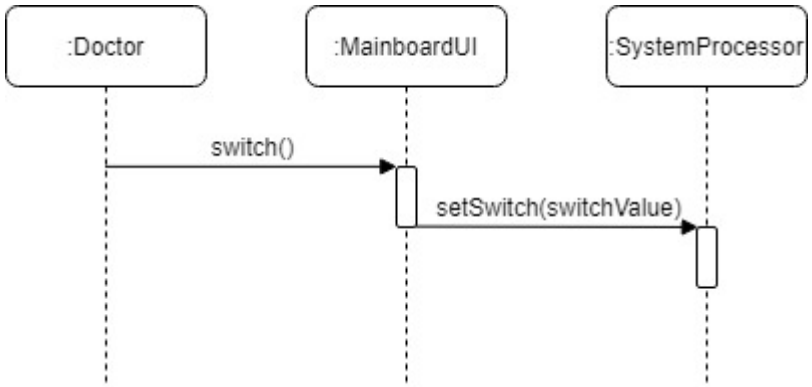
S1.2: Add Painkiller



1. Add painkiller button clicked
2. MainboardUI called addPainkillerFull() in processor
3. Processor called the database to add the painkiller remaining to 10 ml
4. Database set current time as check point and set painkiller remaining to 10 ml

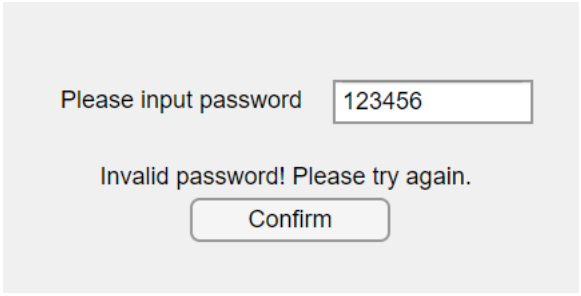
(This will hide the database structure from UI. Directly calling function in database will increase coupling.)

S1.3: Turn On/Off

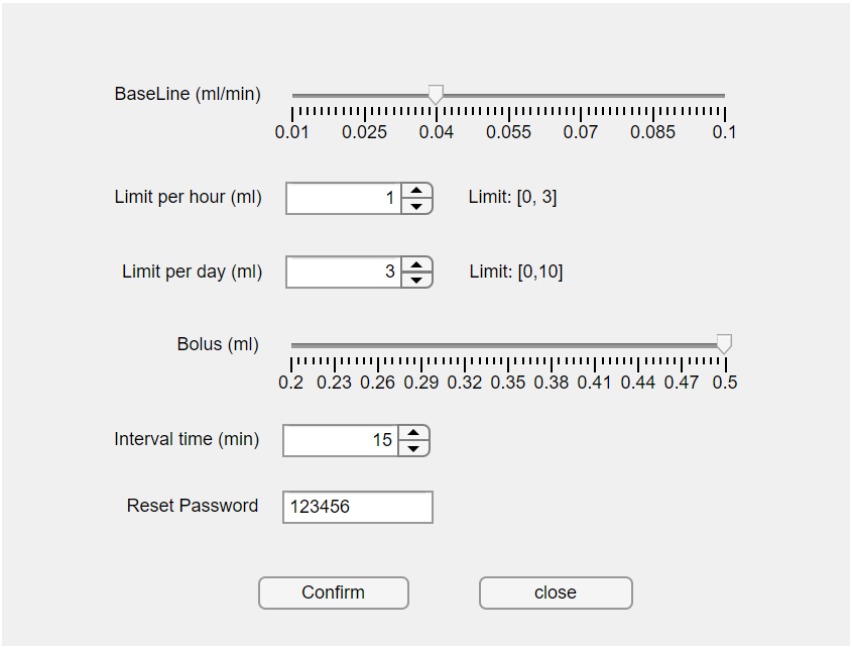


1. Switch clicked
2. MainboardUI send the switch value to the processor
3. If the switch value is 'On', processor set the machine state on
4. Else set the machine state off

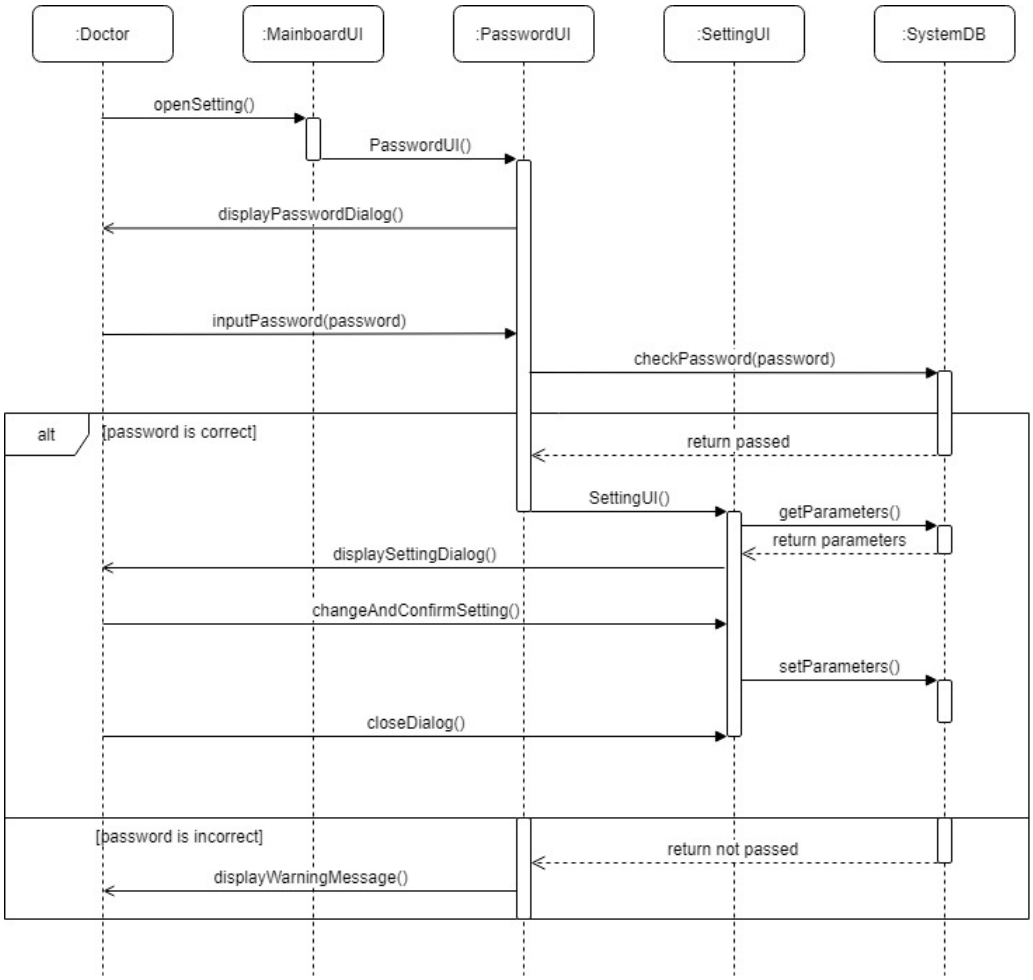
S2: PasswordUI Implementation



S3: SettingUI Implementation

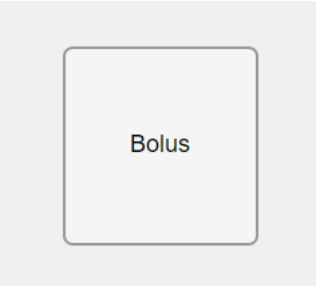


S3.1 Update Setting

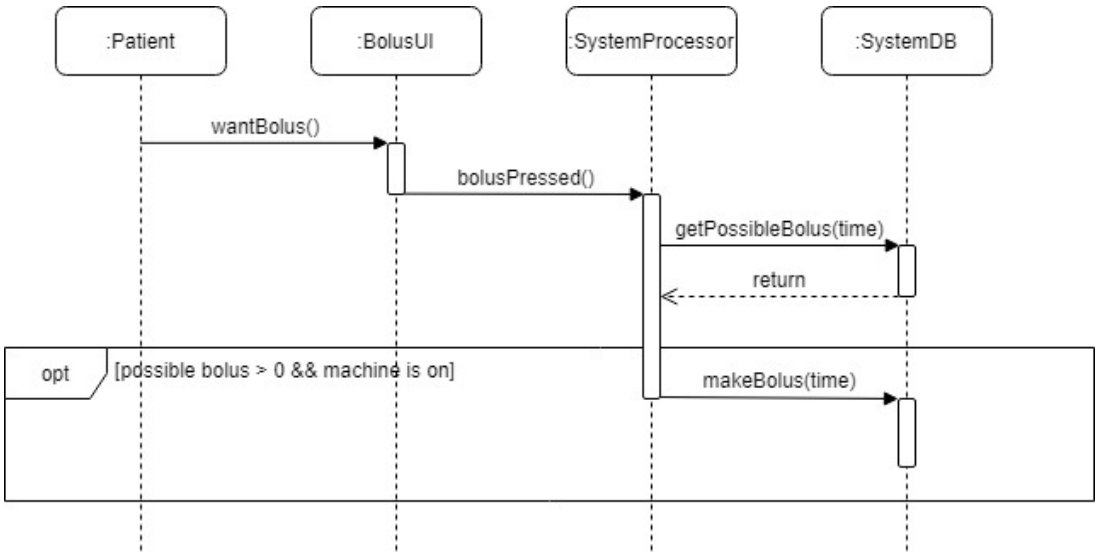


1. Setting button on MainboardUI clicked
2. Display the password dialog and disable the setting button on main board
3. Once the user confirms the password, check the password in the database. If the same, return passed. Else return not passed
4. If password passed, close password dialog and display setting dialog
    a) Initialize all parameters by querying from the database, with the password just checked
    b) Once the user confirms the changes, set the parameters to the database, with the password before change happens
    c) If user closes setting dialog, enable the setting button on main board
5. If password not passed, display a warning message
6. If user closes password dialog, enable the setting button on main board

S4: BolusUI Implementation

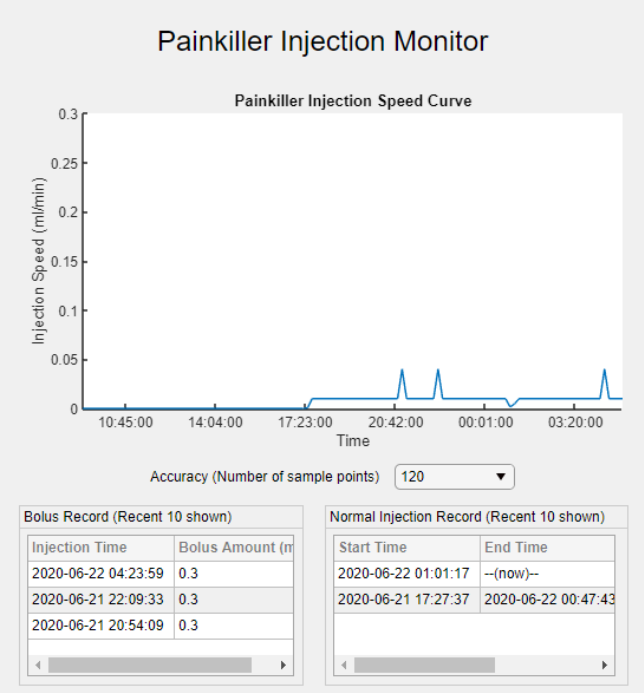


S4.1 Make a bolus

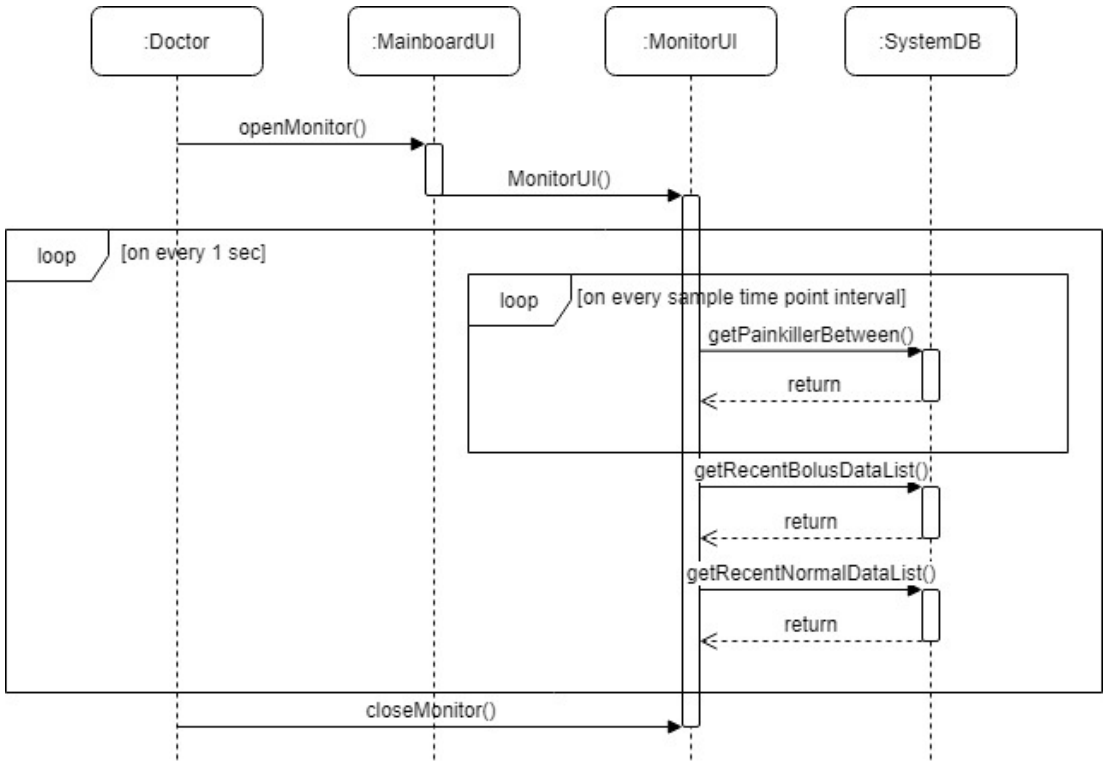


1. Patient clicks the bolus button. Notice if no possible bolus available, patient cannot press the button
2. The bolusUI calls the processor
3. Processor checks the possible bolus to be greater than 0 again and ensure the machine is on
4. If all meet the requirements, make a bolus and inform the database
5. Database add a bolus record consists of current time and bolus amount to the bolus data list

S5: MonitorUI Implementation



S5.1 Open Monitor



1. Click on the button “Open Monitor…”
2. Disable the open monitor button on the main board
3. Monitor initializes with a timer and refreshes every 1 sec. Below are on refresh function:
    a) Generates the time sequence to draw the injection speed curve
    b) For every adjacent time points
        i. Get the painkiller injected during that time period from the database
            1. The database will go over all the injection records to determine the painkiller injected in that time period
        ii. Divide the painkiller amount by the time interval to obtain the injection speed at that time period
    c) Plot the injection speed curve
    d) Get the recent bolus data records from the database
    e) Get the recent normal (baseline injection) data records from the database
    f) Show the data on the monitor
4. If the doctor closes the monitor, stop and delete the timer, and enable the open monitor button on the main board