Sentinam Innovations

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The following test plan will be implemented in the final phases of the development of Sentipump:

Test Plan

Sentinam Innovations intends to perform rigorous unit and integration tests to ensure our system design meets our high functional standards and expectations. Ensuring that the system delivers an accurate infusion rate is the highest priority. After the main feature is tested, we will then test the side features, such as additional sensor attachments and WiFi connection to mobile/desktop applications. As features are modified, connected features will have to be retested as well to ensure new changes do not break the other components.

We will be using bottom-up testing to systematically ensure Sentipump functions properly. Components will first be tested individually with a range of valid and invalid input values, that simulate values to be obtained from other connected components. Then we will perform integration testing to make sure the system functions correctly when the components are connected together.

For our prototype, tests will be conducted by pumping water into a container with a known volume size, in place of a person. Measurements will be carried out on the container to ensure the system accurately delivers the correct amount of substances. For the final versions of our product, more realistic substances will be used to simulate the different drugs that can be delivered to patients.

1.1 Unit Test Cases

Components will be tested individually in this stage of testing. The following tests will be performed to ensure each component functions as required.

- **Pump hardware control:** Verify that the system controls are responsive and reliable, and pushing the buttons causes an interrupt to occur with little delay. Verify that the patient health status is indicated by an LED, and the alarm triggers when thresholds for vital health statistics are reached. The power from a wall outlet must be sufficient to drive the system without the system shutting down.

- **Pump software control:** Verify that the software runs smoothly. Verify that the components of the GUI corresponds to the correct functionality, and the display values match the infusion pump values. Verify that the software handles a range of valid and invalid inputs accurately, and values that go out of range are prevented by displaying an error message. Verify that the system triggers the alarm when thresholds for vital values are reached.
- **IV tubing and bag:** Verify that the tubes and bags are compatible and the fluid flows inside them seamlessly. Verify that they can be recycled and easily replaced.
- **Peristaltic pump:** Verify that the pump can be controlled to deliver the required infusion flow rate.
- **Mobile app:** Verify that the app communicates with the microcontroller and handles data accurately. Verify that the software runs smoothly. Verify that the components of the GUI correspond to the correct functionality, and display values match the infusion pump values. Verify that the software handles a range of valid and invalid inputs accurately, and values that go out of range are prevented. The app shall enter into error mode if any components are not working correctly. Verify that when thresholds for vital values are reached in error mode, the infusion pump becomes manually adjustable only, the flow of any fluids is halted, and the patient's caregiver is alerted through the device.

1.2 Integration Test Cases

Once each component passes unit tests and is determined to be functioning properly, we move to integration tests. The following tests will be carried out to evaluate how well components of the system work together.

- **Infusion pump control test:** Verify that the motor is capable of delivering values that match the system input parameters, by attaching infusion pump to a container and measuring the substances delivered to the object.
- **Bluetooth connection test:** Verify that the system can establish a stable connection to the supported devices and desktops, and can function with low connection speeds. Infusion pump primary features should function properly even without the Bluetooth connection. Verify that the Bluetooth can connect with the user's device at a range of up to 9 meters, by slowly moving the device away from the microcontroller.

- **Infusion pump mobile app control test:** Verify that the infusion rate of the infusion pump can be controlled from a mobile device using our app, by attaching infusion pump to an object, and measuring the substances delivered to the object through the app. Verify that the motor is capable of delivering values that match the system input parameters.
- **Stability test:** Verify that the infusion pump must be able to run continuously without maintenance by leaving it running continuously for 2 days.
- **Sensor accuracy test:** Monitor the sensors and verify they are able to send signals to the microcontroller, and the values displayed on the LCD are accurate.
- **Peripheral sensors:** Temperature and pulse sensors will be tested on 2 to 3 persons to check the accuracy.