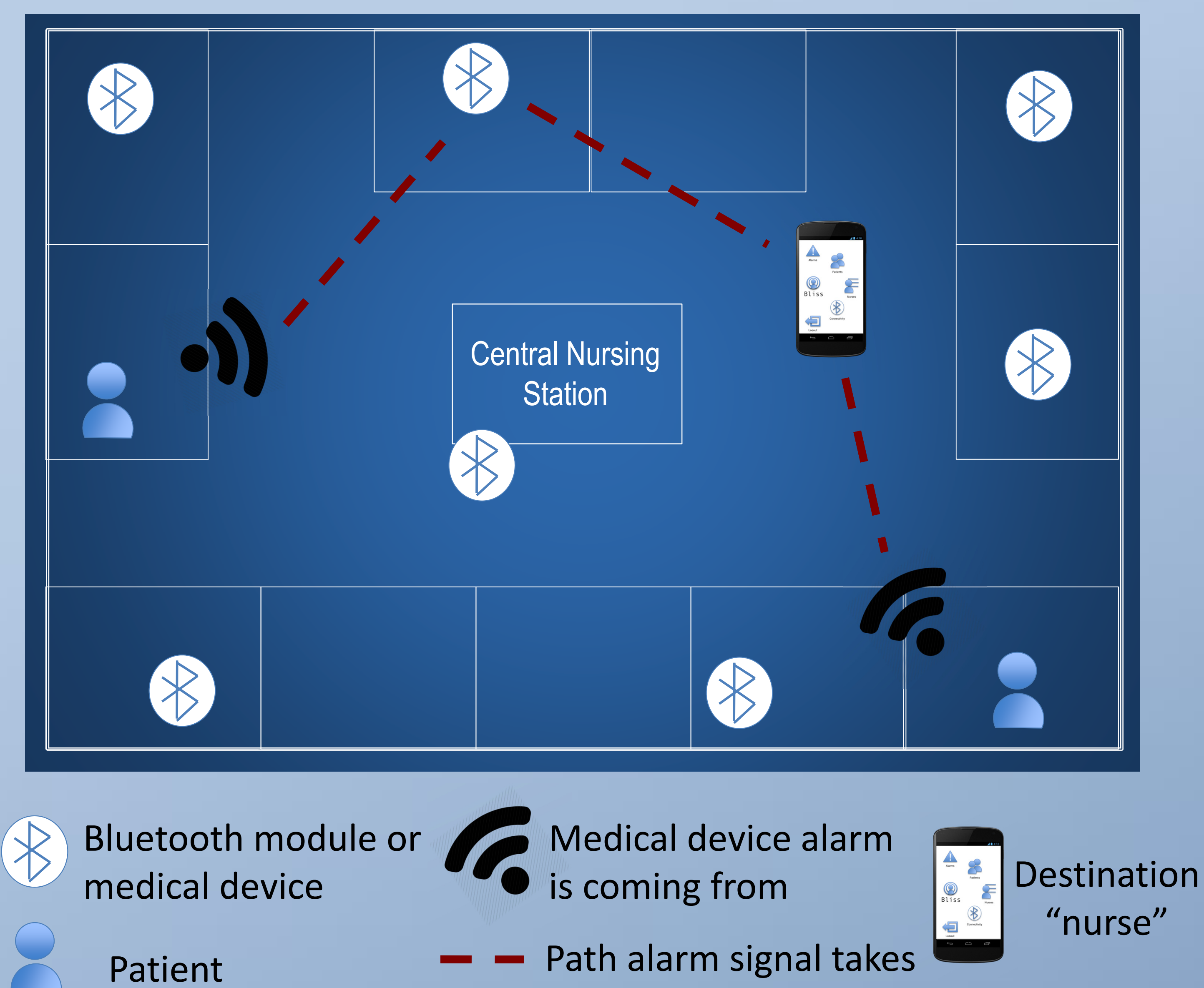


### An Alarming Issue

Patients in the Intensive Care Unit (ICU) of a hospital have to endure the alarm sounds that come from the several medical devices they are connected to. These loud noises can cause them to develop delirium, stress, or panic attacks, which take a significant toll on their already vulnerable state.

Our aim is to remove the irritating noise from the ICU by transmitting alarms wirelessly to a mobile handheld device, thereby improving the quality of life for these patients. To do this, we developed hardware that mimics alarms of an IV Pump (a common medical device) and Bliss, an Android application that communicates with the device and alerts the user when the alarms are triggered.

### ICU Representation



### Bluetooth Advantages

Bluetooth design is convenient for our application because of its simplicity and practicality. We use Bluetooth v2.1 since v4.0 is not readily available on many devices yet. Bluetooth advantages include:

- Low Power Consumption
- Bluetooth 4.0 is approved for medical devices
- Ensures patient's security with "trusted devices"
- Mesh Network allows for extended range and reliability
- Device to device communication allows for an independent system

### Proof-Of-Concept

To approach our solution we devised a proof of concept demonstration to test the feasibility of Bluetooth connection between multiple medical devices and an Android phone.



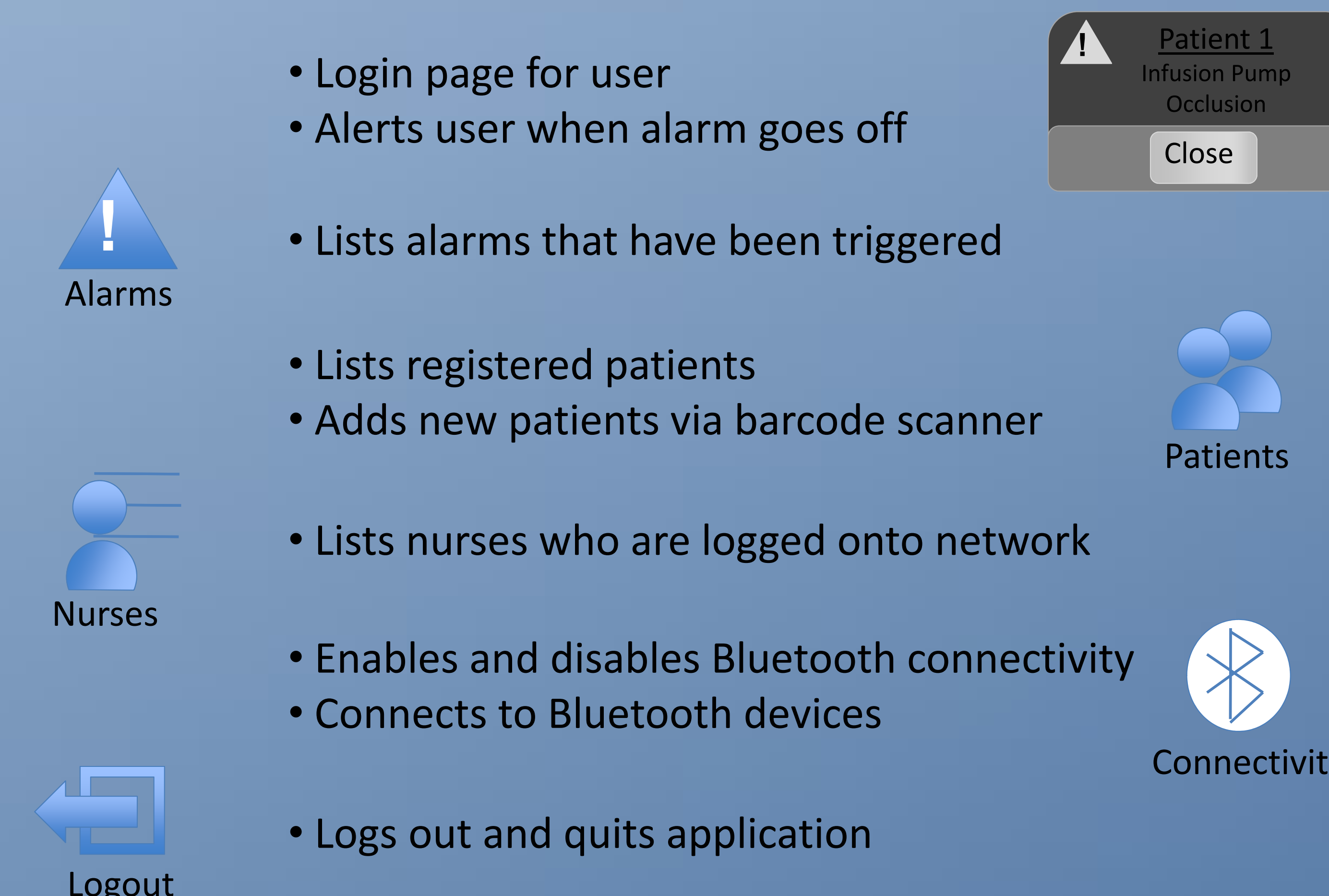
#### Hardware:

- Pair of boxes that simulate the same signals given off by alarm sensors of various medical devices
- Each box simulates an analog and digital sensor signal that is processed by a microcontroller and sent wirelessly via Bluetooth

#### Software:

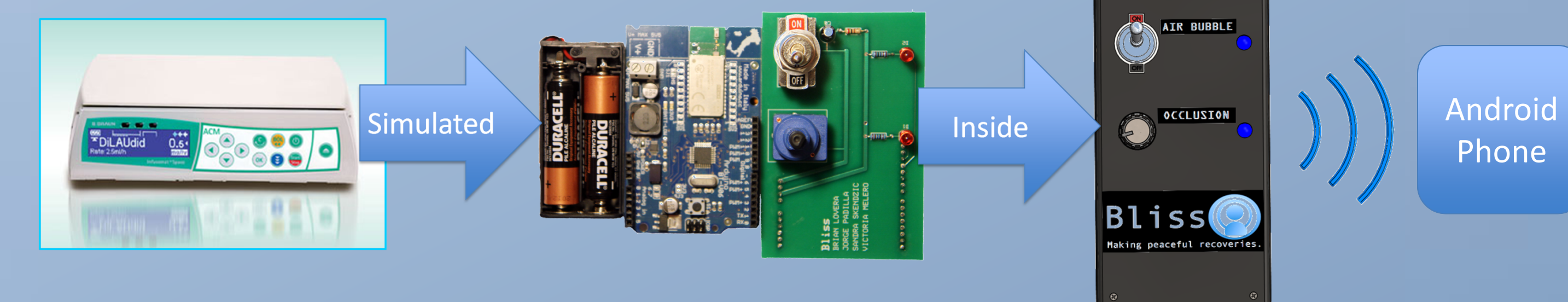
- Android application that receives the signals and displays the appropriate alarms
- User can then identify the specific problem and the device that triggered the alarm

### User Interface



### System Flow

Inside each project box there is a circuit simulating a medical device. The hardware inside consists of a printed circuit board (PCB) where the components (switches, LEDs, etc.) are mounted, and an Arduino board containing the Microcontroller and Bluetooth antenna. Power is supplied by two AA batteries to the voltage regulator of the Arduino.



### Benefits

#### Noise isolation:

- Alarm no longer sounds in room
- Patient's door can close off other outside noise

#### Audibility:

- Allows alarm to notify nurses at extended distances

#### Response:

- Removes problem of staff becoming desensitized to alarm noises
- Improves response time sensitivity

#### Health:

- Reduces stress and apprehensiveness of patients and visitors
- Shortens patient's hospital stay
- Decreases risk of developing Delirium and Insomnia

### Future Plans

#### Safety:

- Install backup system to account for possible malfunctions

#### Implementation:

- Convince companies to adopt new wireless alarm system
- Bluetooth must be incorporated into existing medical devices

#### Mesh Network:

- Transmission of alarms and data from device-to-device

#### Data Storage:

- Set up a database system for storing and managing information

#### Optimize software application:

- Storing and accessing patient profiles/charts
- Transferring patients to other nurses
- Scanning patients/devices/etc. to network
- Reminder alarms

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