

## **Bluetooth Enabled Hospital Solution for Patient Safety**

**Relevant skills: Internet-of-Things (IoT), Low power Bluetooth, sensors and microprocessors, app development, Machine learning, Cloud computing, Big data**

### **Background**

Hospitalized patients in the United States experience falls at a rate of 2.6 to 17.1 per 1000 patient-days, with the majority occurring when a patient is moving to, from, and around the bed. Each fall with injury costs an average of US \$14,000. In Maryland the cost of falls is much greater.

### **Objective**

The aim is to conduct a technology evaluation, including feasibility, usability, and user experience, of a medical sensor-based Internet of things (IoT) system in facilitating nursing response to bed exits and bathroom entrance/exit in an acute care hospital. Subsequently, the system will be able to track the movement of medical professionals to optimize for distance of care and reduce in-facility transit times.

### **Methods**

The JHU student team will work closely with a world leader in low energy Bluetooth technology to design a patient fall detection system for the hospital environment. The team will consequently pair up with one or two hospitals in the greater Baltimore city area for the data collection process. During this project, the patients will be equipped with Bluetooth enabled fall Beacons (sensors) which can be clipped to their garment or worn on their wrist. The sensor is positioned to monitor movement from patients' starting with the bathroom. The System is evaluated for monitoring patient movement and delivering timely alerts to nursing staff via mobile devices when there appears to be a bathroom entry or room exit under conditions. Sensor data is collected automatically from the system. The primary outcomes include reduction of the number of falls. Data on patient movements must be aggregated and a self-learning system must be created to identify when a patient moves compared to when a patient gets up.

Aggregate data relating to falls will be collected by the fall's committee in conjunction with the Hospital Performance Oversight Committee. Explanatory variables include room locations (zones 1-3), day of the week, nursing shift, fall history, etc.

### **Conclusions**

A medical IoT system can be integrated into the existing nursing workflow and may reduce patient bed fall risk in acute care hospitals, a high priority but an elusive patient safety challenge. By using an alerting system that sends notifications directly to nurses' mobile devices, nurses can equally respond to unassisted bed/room/bathroom -exit attempts wherever patients are located on the ward. Collecting motion data in conjunction with medical information and creating an intelligent system will allow the system to learn from continuous use. Each person who uses the system will add to that knowledge base and their specific circumstances will assist the system to become more intuitive about when to react and when not to react.