Wearable Movement Sensor Design for IoT Application

The company, KinometriX LLC (www.kinometrix.com) requires the design and optimisation of an embedded sensor system for a Healthcare Internet of Things (HIoT) application. The sensor will be an essential part of KinometriX's overall system architecture shown in Fig. 1 below.

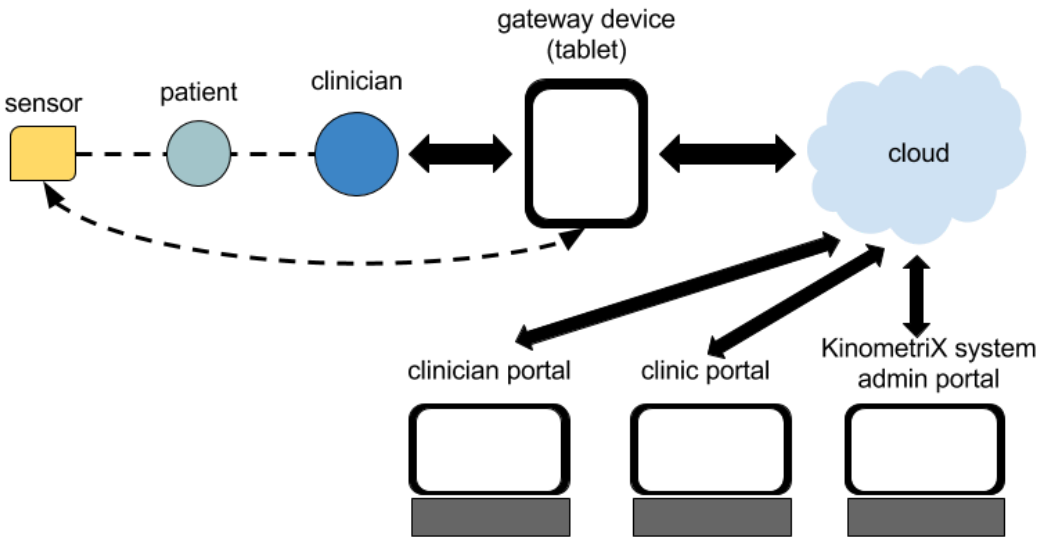

Fig. 1: Platform Architecture showing the embedded wearable sensor attached to a patient. A clinician interacts with the sensor through a gateway device (a tablet in this case).

The small, light weight sensor shall consist of:

1. An innertial measurement unit (IMU) with nine degrees of freedom (9-DOF)
2. A microcontroller (low power)
3. A radio transceiver Bluetooth Low Energy (BLE) or WiFi
4. A rechargable battery that can be recharged through a USB micro port
5. An on/off switch
6. A means to "tare" the sensor
7. An LED that conveys information about the status of the sensor
8. The ability to transmit data to and receive instructions from an Android App.

A good example of components for this sensor is the Adafruit ESP32 Feather Huzzah (https://learn.adafruit.com/adafruit-huzzah32-esp32-feather) combined with either a Bosch

IMU (https://learn.adafruit.com/adafruit-bno055-absolute-orientation-sensor, https://learn.adafruit.com/search?q=IMU&), an Invensense IMU (https://www.invensense.com/products/motion-tracking/9-axis/mpu-9250/) or an STMicro IMU (http://www.st.com/content/st_com/en/products/mems-and-sensors/inemo-inertial-modules/lsm9ds1.html).

The task is to wisely choose a microcontroller/IMU/RF transceiver combination that satisfies the requirements of low power, motion sensing intelligence, taring, wireless communication and interface (API) with an Android tablet or smartphone. The size of the combined solution must be smaller than 1" x 2" x 0.5", but need not be rectangular.

Built-in motion sensing intelligence could be used to count the number of repititions of a particular movement and to identify the different movements.

The protocols for RF communication that we'd like you to evaluate for reliability and security are BLE vs WiFi-direct.