**System Overview**

The system consists of the following physical entities:

**Smart Watch**

* Wearable embedded system which includes actuation and sensing:

**Sensors:**

* **Heart Rate Sensor:** Measures heart rate using photoplethysmography. Red and green LEDs at the back of the watch flash at high frequency against the skin. Photodiode sensors measure the reflection of light from the skin. This is measured as an electrical current.
* **3-Axis Accelerometer:** Measured acceleration along 3 axes. Readings are used to detect steps based on arm movement.
* **GPS Receiver:** Measures position as longitude and longitude using the process of triangulation. Readings are used to track the user’s exercise route.
* **Sp02 Sensor:** Measures blood oxygen level using pulse oximetry (measuring the light absorption of the blood). Readings can be used to detect sleep apnea.
* **ECG:** Measures electricalsignals generated by heart pulse. ECG gathers data based on user request for a 30 second window. The gathered data is offboarded and visualised on the user’s mobile device.

**Actuators:**

* **Linear Vibration Motor:** A DC motor which will vibrate when voltage is applied. This component facilitates alarm notification.
* **Capacitive Touch OLED Display:** User input is received. The display also provides the user with gathered and computed health information.
* **Micro SD Card**: Sensor readings are stored for a short time duration. These readings are visualized via the OLED display, and offboarded via the Bluetooth module periodically.
* **Lithium Ion Battery:** Provides energy storage, which allows the device to be powered while in use.
* **Bluetooth Module:** Facilitates offboarding of sensor readings to the mobile device. Commands and notifications from the server/phone can also be received via the module.
* **Application Software:** A software application runs on the mobile device which facilitates the following:
* Menu navigation
* Displays time & statistics (heart rate, step count, distance travelled, etc.)
* Set alarms
* Exercise detection & tracking
* Etc.

**Mobile Device**

* **Bluetooth Module:** Allows the mobile phone or tablet to be paired with the smart watch. Receives offboarded data of gathered data from the watch. Commands and notifications from the server/phone can also be received via the module.
* **Wifi Module:** Forwards data from smart watch sensors to be stored on the server. Receives notifications from the server.
* **Mobile Application:** A software application runs on the mobile device which facilitates the following:
* Visualization of user data stored on the server such as:
* Exercise routes
* Daily heart rate profile
* Weekly sleep profile
* Data gathered from 30 second ECG profile
* Etc.

**Server**

* **Wifi Module:** Receives data sensor data forwarded from the mobile device. Transmits notifications computed from the server software application based on computations on stored data.
* **Long-Term Data Storage:** Stores the user’s data offboarded from the smart watch. The stored data can be cleared at the request of the user.

**Charger**

* Mains charger with USB charging cable. When connected to the smart watch, the charger delivers power to the smart watch’s onboard lithium ion battery.