Project Statement
Vital Signs Monitor and Fall Detection Device
Team #5
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**Statement of Need:**

Vital signs are an important feedback tool in giving doctors a better idea into the patients needs in addition to monitoring the numerous conditions of any and all patients either in the clinic or at home. Currently, there is no tool that consolidates all of these signals into one comprehensive view of the patient’s vital signs. These signals, which include airway obstruction, blood glucose level, blood oxygen level, blood pressure, core body temperature, ECG, EMG, motion detector (for falls), respiration rate, and patient’s weight while individually give the doctor an adequate view into a patient’s condition, are not always taken at the same time, or may take specialized, expensive equipment to measure. This limits the the patients accessibility to such care, and in many cases, the availability of up to date and accurate information on demand on the part of the doctor. Further, many patients are unable to afford some of the specialized observation current instruments may provide. The vital signs monitor will provide a consolidated, continuous, and archived reports of the patient’s health status for the use of the patient, nurses, physicians, and any future caretaker. This allows the patient’s history of vital signs to be analyzed as the patient progresses through certain health conditions, rehabilitation or just normal life. Each of these vital signs are important in monitoring the patient’s health as well as the ability to call for aid if needed.

**Introduction and Overview:**

The purpose of this monitor is to detect the different vital signs mentioned above and send the information to be processed, displayed to anyone who needs it. In the case of an emergency, This device could also notify emergency contacts, doctors, and paramedics. More specifically, this device will run through Microsoft tablet application form which collects the patient’s vital sign data via Bluetooth from the multiple sensors. Size and weight of each sensor needs to be accounted for, as the patient could be actively mobile. This monitor is unique in that it is accessible by having a simple user interface for patients at home, yet is versatile and has a wide variety of uses which can be implemented in the home of a patient, in a clinician’s office, or hospital. This may one day minimize the need for the constant observation of in-home nurses, while simultaneously giving doctors more in depth and up to date knowledge of a patients health.

**Realistic Constraints:**

Constraints for this device limit the device in such a way that it should be cost effective yet efficient in not only collecting data but sending it and processing it. Each sensor is expected to be in direct contact with the patient, potentially for prolonged periods of time, therefore the material must be bioinert and not harmful to the user in the case of feedback. In addition to cost effectiveness and safety, each sensor must be interchangeable, non-allergic and/or disposable to accommodate physicians with multiple patients, avoid contamination, avoid irritation and avoid transmittable disease.

The base station receiving information from the biosensors and relaying it to the tablet should be within wireless range for the bluetooth to efficiently transfer information. In the case of a portable base station, it should be able to comfortably fit on a belt strap or in a backpack safely and comfortably.
**Other information:**
Previously designed sensors will be implemented into the overall design. New sensors added to the device must comply with and not interfere with the usage of existing sensors.

**Questions:**
In order to determine the necessary battery life of each biosensor, which biosensors need the capability of continuous monitoring as opposed to monitoring during specific exercises and activities?
In the case of a portable base station, will the base station be continuously uploading information to the tablet and/or internet or will it require being at the home base station for internet connection?
What is the budget for the project as a whole and/or for each specific biosensor?
Is there a formal process for testing each biosensor or can we use ourselves as test patients?
What is the expected lifetime of each biosensor? Will any maintenance be needed?
Is there a way to make the core body temperature sensor reusable to make it more economical?

**Specification:**
**Blood Glucose monitor:**
This device will measure the blood glucose of the user at preset intervals
This information will be communicated to the Vital Signs base station via either a wired connection or bluetooth

**Core body temperature sensor:**
The temperature sensor will measure the core body temperature of the patient possibly via a pill that will communicate to the base station.
It must be cheap and easy to produce in the event that a disposable method must be used.

**Fall Detection device:**
This device will be able to detect when a user is off balance but has not yet fallen.
It should provide feedback, either auditory, or tactile, to the user in the event that their balance is compromised.
The module should be usable by a wide variety of patients with no discrimination towards or against any user.
The device must also be able to track and log the users progress towards correcting their own balance throughout its use, and send the data to either a personal trainer or a doctor.

**Respiration Rate Monitor:**
This device will measure the rate of airflow into and out of the patient and communicate this information to the base station.

**Mechanical:**
**Size:**
Dependent on sensor
Microsoft Surface:9.2x5.2x.57in
| **Weight:** | Dependent on sensor (each must be portable)  
|            | Microsoft Surface weight (1.99 Lb) |

| **Electrical:** |  |
| **Battery Life:** | 42 Watt-hours on the Microsoft Surface  
|                  | 24 - 48 Watt hours on each device |

| **Wireless:** |  |
| **Frequency:** | 1.0-3.7 GHz  
| **Range:** | 5 – 20 feet  
| **Protocol:** | Bluetooth |

| **Environmental:** |  |
| **Storage Temperature:** | 0 - 150° F  
| **Operating Temperature:** | 68 - 90° F  
| **Operating Environment:** | Most sensors indoors, some sensors outdoors |

| **Software:** |  |
| **User Interfaces:** | Biosensors including blood glucose, core body temperature, fall detection device, respiration rate monitor  
| **Hardware Interfaces:** | Microsoft Surface  
| **Communication Protocols:** | Bluetooth  
| **Features:** | LabView |

| **Safety:** |  |
| | New test strip for the blood glucose meter with each use to avoid transmittable disease.  
| | Proper maintenance to avoid electrical shock. |

| **Maintenance:** |  |
| **Device:** |  |
| **Blood glucose:** | Clean, sanitary test strips  
| **Core body temperature:** | One time use pill capsules  
| **Fall detection device:** | Proper calibration and scheduled testing  
| **Respiration rate monitor:** | Proper calibration and scheduled testing  
| **Microsoft Surface:** | Clean screen, entirely dry apparatus |