Software Project Management

Lab 2

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Fall Monitor

1. A description of why you chose your topic, which can include an introduction to the topic's idea, the problems your topic is tackling and what you hope to accomplish with it.

Our team chose this topic because it presents a level of complexity that involves hardware and software components and presents a challenge that affects the lives of people on a daily basis. Falls and injuries associated with them present a serious problem to the elderly, especially if they live on their own and are unable to obtain assistance in a timely manner.

After preliminary research and discussion on design, our team decomposed the challenge into several steps. First, the fall monitoring device must be small, portable, easy to use and convenient to carry around. A practical choice for these criteria would be designing the fall monitor as a necklace. It must be able to detect the fall accurately and distinguish it from regular physical activity and movement. It must also be able to sense the heartbeat of the person wearing it to distinguish between conscious/unconscious states and a more serious medical issue, such as fall due to cardiac arrest, for example.

The necklace must be waterproof, so the user is able to wear it in the shower or while taking a bath. This is an important criterion, because a lot of serious falls and injuries for the elderly occur in the bathtub or the shower, due to slippery and curved surfaces.

Another challenge would be to implement a proper protocol for communicating with the emergency services in the case of the fall and user requiring assistance. Ideally, the device should have extended battery life to last for close to 24 hours and have a rapid charging station to reduce the time it is unavailable to the user because it is charging. Since the elderly may have difficulty remembering routines, the device should make a soft beeping sound once it is charged and ready to be worn, so the user remembers to put it back on.

To accurately detect the fall, the device should have sensors to measure a change in velocity, height, and orientation. The heartbeat can be monitored from the changes in the electromagnetic field of the body as the heart muscle contracts and relaxes. A built-in SIM card may be used to maintain a reliable connection in case an emergency service is needed.

The necklace fall monitor is an embedded device and a convenient user interface should be provided to make interaction with the device easy for its users who often have limited tech skills. As a solution to this challenge, our team will develop a web application interface to the user account associated with a registered device. The web application will provide a range of services, such as storing biomechanical statistics collected by the device sensors, checking user eligibility for a free device, and providing alerts in case of emergencies. This web interface will require HIPPA certification to comply with Canadian privacy and health regulations

2. Clearly outline your project's objectives. Some objectives may seem generic, but you must also include objectives that are relevant to what your project is doing.

Listed below are the objectives our team identified for this project:

- The device must detect the fall with a gyroscope, height sensor, and accelerometer
- The device must accurately detect and measure the heartbeat of the user
- The web application should provide a simple and intuitive user interface
- Developing team must obtain HIPPA certificate for the website
- Develop a web application interface that will use the user's health records to determine eligibility for a free device
- Implement a quick response protocol to alert emergency services of a fall by using a SIM card to send a reliable signal to a 911 dispatcher
- The device should push notification of a fall to authorized family members
- Develop and deploy an app to store, analyze and display information from the client's personal fall monitor (heart rate, charge of monitor, past falls, etc)

3. Outline your project's measures of success. How would you say that your objectives are being met?

Our team discussed the following measure of success for our fall monitor device and its web application:

- The app protects patient privacy and only allows access to patient health information to authorized persons.

- If a person falls, the device detects the fall within 5 seconds.

- Once the fall is detected, the customer is connected with 911 dispatcher services to determine whether assistance is required.

- The application has less than 1-hour downtime a year.

- The false-positive rate of fall detection is at most 5%.
- The false-negative rate of fall detection is 0%.

- The emergency services arrive when needed 100% of the time.

4. Finally, state the infrastructure, be it hardware or software, you'll need for your project. Include at least 4 points. You do not need to go into specifics (e.g. the exact kind of sensor you will need to use), just what you'll generally need (e.g. a sensor to measure heart rate for a health monitoring system)

Here is the first draft of a list of infrastructure required:

- Application and database servers
- Data collection: fall sensors (height, velocity, orientation), speaker, mic, GPS, heartbeat sensor
- Charging station for the necklace
- The light-weight without sharp edges devices
- Cellular connectivity (mobile provider infrastructure)