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Health Monitoring
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HeartSync: Mobile Pacemaker Failure Detector

Problem

People with heart problems use devices called pacemakers to electrically stimulate their heart. The pacemaker helps those with irregular or faulty heartbeats to keep a rhythmic pumping of their heart. It does this by housing a battery, a computer to keep the beats at regular intervals and monitor heartbeats, and wires that lead to different parts of the heart depending on the person's particular heart problem.

One of the major fears that a person living with a pacemaker has is a pacemaker malfunction. For example, leads can migrate, or erode. In some cases, the pulse generator can malfunction. This can cause the pacemaker to not provide electric stimulus at the desired intervals or it can keep the pacemaker from providing any electric stimulus at all. This can result in hospitalization or death.

Proposal

Applications like Remote-K-Viewer help patients monitor their heart rate remotely through mobile devices. People also use devices made by companies like Garmin, FitBit, and Jawbone to monitor their heart rate though a wearable monitor. HeartSync would monitor both devices heart rates and look for any discrepancies between the two sets of heart rate data. HeartSync could alert the user if it thinks it has detected a failure.

We will test the feasibility of the application by using simulated pacemaker data and matching it against heart rate data stored in Apple's HealthKit. The simulated pacemaker data will be stored in Apple's Core Data. There will be multiple sets of this dummy data. Some sets will be consistent with the stored HealthKit data, while other sets will return an inconsistency with the health data.

HeartSync will use an API to post data to a .NET server. It will do this using two methods. The first method will push all the available data to the server and act as a control method. Both the heart rate monitor data and pacemaker data will be written to the database without analysis. The webpage will show the heart rates from both devices with the BPM and the time of the reading.

The other method involves allowing the user to view the data for each device. The application will look at the heart rate monitor data and the pacemaker data and compare each data piece minute-by-minute. If the heart rate from the monitor differs from the heart rate from the pacemaker then an alert will appear. It will also

display both the heart rate monitor data and the pacemaker data. At that point the user can choose to send the data to a server for access by medical professionals. The discrepant data will be flagged for viewing. Doctors or users will be able to view data remotely in order to make informed medical decisions.

Using the first method, users and doctors would have to manually go through the data and look for any discrepancies in order to ensure the pacemaker is working effectively. The second method would produce a set of data that eliminates duplicates. If data is found that didn't match up, both sets of data would then be written to the server and flagged as a mismatch.

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