Heart Alert

Project Proposal

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Project Title: Heart Alert

Abstract:
This project is a heart rate monitor designed to contact someone in the event of an emergency based on the activity of the user’s heart. The wireless heart rate monitor system will read the heart rate of the user via a finger, toe or ear lobe plethysmograph. Once the measurement has been taken, it will be analyzed to look for irregularities. Based on the target range specified by the user, the program handling the data will alert send alert of the irregularity. My vision is for something similar to “Life alert”, where the computer would alert a company that will call the user and make sure that the alert was justified, versus being accidentally triggered, such as improper removal or temporarily loss of the monitor from the reading area. As the operator contacts the user, emergency response can simultaneously be dispatched.

Project Description:
This heart rate monitor will use plethysmograph technology to measure tissue blood volume in the finger, toe, or ear lobe. Once the pulse data is obtained from the plethysmograph, the data will be analyzed by the board to be worn on the person. The analyzer will be programmable in the sense that the user can specify the range of acceptable heart rates. The analyzer will constantly receive the data and check to make sure the users heart rate is within these set limits. In the event that the analyzer detects the user’s heart rate is outside this range, a local alert will signal to board to wirelessly transmit the alert to the partner Zigbee board. The extent of this project is to have the alert ready to be sent off to some kind of emergency response, be it 911, or some company, similar to a “Life Alert” operator, to handle the responsibility of calling for emergency help and or contacting the user to ensure there are no problems. There are several irregularities the analyzer will attempt to detect each time it cycles. In addition to a specific range that has been specified by the user, the analyzer will look for skipped beats and very rapid changes in heart rate.

Background and Benefits:
This project is essentially the combination of multiple products. Hospitals have very sophisticated medical equipment in order to obtain and analyze the activity of the heart. This setup is not easily obtainable by someone to put in their home. There are also very simple heart rate monitors that track the heartbeat and display it in order to make the user aware of their heart rate. The purpose of most of these types of monitors is for exercising purposes, not health issues. Neither of these is sufficient for my intended purpose. This product will be somewhere in the middle; reading and simplistically analyzing the heartbeat to look for irregularities. Another product idea that will be incorporated in this project is a “Life Alert” type of system. The idea of life alert is for the user to be able to press a button that they wear around there neck that will alert the company and prompt them to take the necessary actions to help. In the event of heart trouble or some kind of accident the heart is undoubtedly going to react, most likely by speeding up.
After meeting with a technician at North Cascade Cardiology’s office, I discovered a few heart rate data acquisition systems in use. The first is a piece roughly the size of a thumb drive that is inserted in under the skin on the chest and takes data for extended periods of time. This is quite invasive and requires visits in order to have the data read. The function of this product is to record the activity of the heart to decipher a person’s problem. Another product we discussed summarily needs to be inserted into the skin, but will send the data to a piece worn on the body which will then send the data to a base piece. The base piece sends the data off to be analyzed. The problem with this product is that it requires a landline phone, which fewer and fewer people have. In addition this product lacks the urgency in that it just takes and sends the data for analysis rather than alerting someone to take immediate action. If features from these forementioned products were combined to make a convenient and affordable solution to living without the fear of something happening, I believe this product would benefit many and sell very well.

**Societal Impacts:**

As we age it becomes more and more of a risk to live in an environment where help is not nearby. Adding to the health hazard for many at old age is the stressful situation of constantly having to worry about the possibility of something happening with no help near. Many of these people have little option but to be relocated to an assisted living type situation; very undesirable to most. What if instead of being forced into an unfamiliar and undesirable retirement facility, you could still live at home and be relieved of the anxiety of worry about who is coming to your rescue in the unfortunate event that something goes wrong? This product will attempt to solve this problem and allow more people to live their lives at home, without this fear.

**Development:**

The first component in the sequence is the plethysmograph, which will be bought off the self according the necessary specifications and compatibility. Currently the best prospect appears to be AD Instruments transducer series plethysmographs. This will give me the most options of places to read the pulse from, either the finger, toe or ear lobe. The main problem with these components may be the compatibility relaying the information to the microcontroller I am using. The wireless communication will be performed by a pair of Zigbee 1321XDSK-BMD boards. These boards include 2.4 GHz RF transceivers, which are within the ISM band and therefore do not need to be licensed. The analysis of the information read by the plethysmograph may be done by the board that is wired to the plethysmograph or the board that wirelessly receives the information. Once the development starts I will be looking at the CPU load of the first board as it gathers and sends the information. If the capabilities of the board can handle the analysis I would prefer to do the majority of the analysis on the person, but since speed is important in this application, the load will be shared between the two boards as much as possible.

The development kit that will be used has far more features than necessary. In further development, the rather large board used would be reduced to merely a small chip; much more convenient for the user. Also, I have opted to avoid dealing with medical and health regulations pertaining to an electric style heart rate monitor. In further development it would not be difficult to swap out the rather bothersome plethysmograph style monitor with a chest heart rate monitor.

I intend to demonstrate my project on myself. I will show the process of programming the device with my target heart rate range. I will do some kind of strenuous activity, like push-ups, to raise my heart rate out of the target range where the board will send out an alert. For the purpose
of this demonstration the board will be programmed to set off a light or some indication that an alert has been set off. I will also briefly remove the monitor to simulate the stopping of the heart and similarly, watch for the alert.