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**Smart Health Care Monitoring System using RaspberryPi2**

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**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**

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**SOFTWARE REQUIREMENT SPECIFICATION**

#### CONTENTS

1. **PRODUCT OVERVIEW**
2. **EXTERNAL INTERFACE REQUIREMENTS** 
   1. User Interfaces
   2. Hardware Interfaces
   3. Software Interfaces
   4. Communication Interfaces
3. **FUNCTIONAL REQUIREMENTS** 
   1. Functional Requirement 1.1
   2. Functional Requirement 1.2
   3. Functional Requirement 1.3
   4. Functional Requirement 1.4
   5. Functional Requirement 1.5
   6. Functional Requirement 1.6
   7. Functional Requirement 1.7
   8. Functional Requirement 1.8
4. **SOFTWARE SYSTEM ATTRIBUTES** 
   1. Reliability
   2. Availability
   3. Security
   4. Portability
   5. Maintainability
   6. Performance
5. **PERFORMANCE REQUIREMENTS**
6. **DATABASE REQUIREMENTS**
7. **DESIGN CONSTRAINTS**
8. **OTHER REQUIREMENTS**
9. **PRODUCT OVERVIEW**

Software development which can be delivered fast, quick adaptation to requirements and collecting feedback on required information. The agile software methods and development is practices based approach empowered with values, principles and practices which make the software development process easier and in faster time. Agile methods which encompass individual methods like Extreme programming, Feature Driven Development, Scrum, etc are more coming into the commercial and academic worlds.

Agility refers to the quality of being agile. Internet software industry and Mobile and wireless application development industry are looking for a very good approach of software development. Conventional software development methods have completely closed the requirements process before analysis and design process. As this approach is not always feasible and compatible with all other projects. In contrast to the conventional approaches, agile methods allow developers to make late changes in the requirement specification document.

The focus of the agile software development as given by “Agile Software Development Manifesto” is presented in the following:

* Individuals and interactions over processes and tools
* Working software over comprehensive documentation.
* Customer collaboration over contract negotiation
* Responding to change over following a plan

1. There is vital importance of communication between the individual who are in development team, since development centers are located at different places. The necessity of interaction between Individuals over different tools and different versions and processes is very vital.
2. The only objective of software development team is to continuously deliver the working software for the customers. New releases must be produced for frequent intervals. The developers try to keep the code simple, straight forward and technically as advanced as possible and will try to lessen the documentation.
3. The relationship between developers and the stakeholders is most important as the pace and the size of the project grows. The cooperation and negotiation between clients and the developers is the key for the relationship. Agile methods are using in maintaining good relationship with clients.
4. The development team should be well-informed and authorized to consider the possible adjustments and enhancements emerging during the development process.

RFID Tag

GPS /GPRS

Raspberry PI 2

Wearable device

Heart Monitor

Temperature Monitor

*Amazon Web* Services

Data Base

Monitor \Laptop



Heart rate and temperature data can be analyzed



Figure 1. Block Diagram

**2. EXTERNAL INTERFACE REQUIREMENTS**

**2.1 User Interfaces:**

The user interface includes an Android Application. The android application will be highly interactive, efficient, and attractive but would yet be simple and possess a sleek look. Also this interface will be highly user friendly and will perform two important tasks. One task is keeping track of real-time medical related data. Another task is that it would enable the user to keep a location and this would be helpful for analysis and speedy recovery. The remote system displays the voltage value that is produced as the output by the Raspberry pi 2 for the corresponding sensor inputs .The user interface shall be implemented using Java and a framework like Android Studio. A web application to can be implemented where alerts are triggered to keep the relatives informed in case of emergency events.

**2.2Hardware Interfaces:**

The hardware interfaces will include the need of wireless internet connectivity to send Gmail Alerts in case of unforeseen emergency events and also to update the Web Application. Raspberry pi 2 is the hardware device which is responsible for co-coordinating various activities with respect to the project and is the core component. Further heart rate sensors are used to measure the change in heart rate and its output is fed to the input of the Raspberry pi 2. A wireless module must also be interfaced.

**2.3 Software Interfaces:**

The values are sensed from the heart rate sensors which are then fed to the Raspberry pi 2. An assembly language or python program is written and embedded into it to covert the sensor value to a corresponding voltage value as its output. Further Java and a framework like Android Studio will be used to develop the Android Application and also to send the intended Gmail Alerts to the doctor. Further CSS, HTML5 etc. can be used to develop the Web Application which runs on an Apache Tomcat Server.

**2.4 Communication Interfaces:**

SMTP is the communication protocol used to send Email Alerts to the doctor which uses port number 25. Further for the Web Application HTTP protocol is used which runs on port number 80. Also a Wi-Fi signal is used as the communication interface between the wearable computing kit and the Android Application running on the mobile device of the user and monitoring system.

**3. FUNCTIONAL REQUIREMENTS**

**3.1 Functional Requirement 1.1: Tracking of the Real time location**

The GPSR module will help to keep track of the real time location of the person who is under the monitoring.

**3.2 Functional Requirement 1.2: Email Alert**

In case if emergency condition, The Gmail Alert is sent to the doctor and the concerned guardian.

**3.3 Functional Requirement 1.3: Online Monitoring**

The values sensed by the heart rate sensors can also be monitored online with the help of a web application. This is particularly helpful when the user is alone and others want to monitor his/her status.

**3.4 Functional Requirement 1.4: Android notification**

The user is provided with an Android application interface to keep the alerts and also to be updated.

**3.6 Functional Requirement 1.6: Maintaining History**

The Web Application also maintains a log/history of the sensed values which be accessed at any time.

**3.7 Functional Requirement 1.7: Analysis of Data**

The Analysis of data will give the prediction over the health status , Also Android application can also be used to view the complete analysis of data that has been collected.

**4. SOFTWARE SYSTEM ATTRIBUTES**

**4.1 Reliability:**

The reliability of the product depends on the lifetime of the heart rate sensors and the accuracy of the measurement. As lifetime and accuracy is high the system is reliable. Further the android application would be rigorously tested to ensure that the application does its intended tasks in real time and doesn’t generate fake alerts due to some bugs.

**4.2Availability:**

The basic functionality of the system except the Gmail Alerts and Web Application is always available as long as the device is worn by the user. For Gmail Alerts and Web Application updates internet connectivity is needed.

**4.3Security:**

The scope for security in this product is more over concerned with privacy. Only the authorized phone of the user must be capable of receiving the alerts and more over the data readings stored in the web application must be kept safe and thus authentication and authorization can be added. The system shall not leave any cookies on the customer’s computer containing the user’s password. The web browser shall never display a user’s password. It shall always be echoed with special characters representing the typed characters.

**4.4 Portability:**

One of the features of Java is that it is architecturally neutral i.e. the code is machine/platform independent. Thus the same application can run on different Android phones and its backward compatible with respect to a specific Android phone version. Also the Web application can be accessed from a variety of browsers.

**4.5 Maintainability:**

The Android application needs to maintained and updated in case of any bugs. Updated applications will be free from bugs and also some design oriented changes can be incorporated to make the interface more user-friendly and attractive.

**4.6 Performance:**

The product’s performance is measured in terms of responsiveness, efficiency and user experience. A product with high performance will be delivered. Performance is high if the throughput is high, latency is low, response time is less and system dependability exists. The changes in the angle of the knee joint must be measured with accuracy and also in real time. Performance is also affected by the speed of internet connectivity for updating the web application and also for sending Email Alerts.

**5. PERFORMANCE REQUIREMENTS**

The only way in which systems will meet their performance targets is for them to be specified clearly and unambiguously. It is a simple fact that if performance is not a stated criterion of the system requirements then the system designers will generally not consider performance issues. In order to assess the performance of the product the following are clearly specified:

* **Response Time**- It depends on the Raspberry pi 2 used as it needs to execute the embedded program to convert the sensor value into a voltage signal and then needs to transmit the Bluetooth signal. The response time needs to be low.
* **Workload**- Even if the workload on the system is increased the performance doesn’t degrade as Raspberry pi 2 has 16bit CISC architecture. Raspberry pi 2 is designed specifically for ultra-low power applications enabling customers to build low cost system.
* **Scalability**- The product is highly scalable as it can be worn by various users and all that they need to do is to install the Android application on their phone.
* **Platform-** The Raspberry pi 2 is that uses 16bit CISC architecture and the Android application is built using Java and a framework like Android Studio.

**6. DATABASE REQUUIREMENTS**

A database is used to provide persistent offline storage as it keeps a log of the values sensed by the heart rate sensors along with the date and time. The database used needs to be a relational database, for example MySQL can be used or we can make use of Amazon web services for persistent storage.

**7. DESIGN CONSTRAINTS**

1. **Space**: The amount of space occupied by the embedded program must be less as it needs to be incorporated into the Raspberry pi 2. Further the android application must be of size less than 100MB.
2. **Application memory Usage**: The amount of memory that is cache as well as main memory used must be low while executing the embedded program. This is to meet the requirements of the Raspberry pi 2.
3. **Budget**: The amount of money that can be spent on the hardware must be less than Rs6000/- so that the price of the overall is quite reasonable.
4. **Application Quality:** The quality of the product must be good and also it must be comfortable to wear it.

**8. OTHER REQUIREMENTS**

1. **Help:** A detailed user manual which is easy to follow must be developed and also an online demonstration of how to use the product must be available.
2. **Android version:** The application developed must be simulated on the latest Android version and also it needs to be backward compatible.