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| Student Name: Deirdre CorrMobile Number: 087 253 4180 | Student Number: C11720431 |
| Project Title:Development of a Mobile Application to Monitor the Effects of Sleep Apnoea at Home Through Interaction with Non-Intrusive Sensor Technology | |
| Summary (approx 200 words):  * A proof of concept project in which an application will receive data from the Beddit sleep monitor and a wrist worn pulse oximeter for monitoring the vital and non-vital signs of the user (blood oxygenation levels, respiratory rate, heart rate, movement). * Interpretation of raw data to determine the severity of the condition over one night or a long period of time using the data from two sensors. * Transmission of data via Bluetooth 2.0. * Use of raw data to create statistical and graphical representation which can be easily understood by the user. * Functionality for determining the impact of weight change, sleeping patterns, caffeine or alcohol consumption on frequency/severity of apnoeas over a long period.   **Optional Functionality I would also like to implement:**   * User data can be viewed online by the patients physician. * The application will interact with a wearable three-axial accelerometer to detect when a user is lying on their back and alert them to change position. * Provide daily suggestions to the user based on their data from the previous night (eg. avoid consuming alcohol before bedtime, go to sleep at xx o'clock, etc.) * A feature to alert the patient/an emergency contact if heart rate has elevated to an alarming level or blood oxygenation is too low. * Consideration of external factors (eg. time of year (room temperature, room light), excessive use of mobile before bed, caffeine and alcohol intake). | |
| **Background (and References):**  Apart from audio detection of snoring and breathing noises, there is no mobile application which allows sleep apnoea sufferers to monitor their condition at home and over long periods of time. Partial monitoring, such as respiratory rate and movement, can be achieved through use of a CPAP breathing machine (if this is the chosen treatment - not usually for mild apnoea or hypopnoea) but the machine must be brought to a sleep specialist/sleep company (such as Baywater) for data analysis. Currently, there is no existing technology on the market which allows users to monitor their own condition using non-intrusive sensors which will not disturb their normal sleeping pattern in a home environment. Commercial use of an application like this could significantly reduce patient monitoring and treatment costs.  **References:**   * Interview with Dr. Edward Moloney of the sleep clinic in Tallaght Hospital. * Questionnaire completed by Mr. Dan Smith of the Irish Sleep Apnoea Trust. * http://www.helpguide.org/life/sleep\_apnea.htm * http://www.mayoclinic.org/tests-procedures/polysomnography/basics/definition/prc-20013229 * http://www.daveburrows.com/cpap/sleepstudy/sleepstudy.pdf * http://www.baywater.ie/healthcare-professionals/our-therapies/sleep/how-can-we-help * http://www.tutorialspoint.com/android/android\_environment\_setup.htm * Sensors:   + http://www.beddit.com/   + http://www.amazon.com/Bluetooth-enabled-Oximeter-Acc-SnugFit/dp/B00LKUF5CM/ref=lh\_ni\_t\_dup?ie=UTF8&psc=1&smid=A2JC26QA0XFPHT | |
| Proposed Approach Firstly, I will continue to research the area of sleep apnoea, collecting information from the internet, the library and interviews/questionnaires from specialists in the industry. I would also like to conduct a small survey targeting sleep apnoea suffers. I will also analyse the existing applications with similar functionalities, particularly the way in which raw patient data is stored and interpreted.  Next, I will focus on the data analysis aspect of the project, determining the factors that are the biggest indicators of sleep apnoea (respiratory rate, blood oxygenation, ..) which sensors are available to me and what values or combination of values indicate a breathing pause.  Data transmission between the sensors and the application will be conducted via Bluetooth 2.0 and I will attempt to emulate synchronous connectivity between devices (this may be difficult). I have not yet decided what tools and languages I will use with regards to data storage and upload.  I will code my application using Java and Eclipse IDE, ensuring full documentation and versioning. I will concentrate on the existing formulas such as the Apnea Hypopnea index(AHI) and the Respiratory disturbance index(RDI) for use in my algorithm design.  After Christmas, when I have received feedback from my interim report, I will reassess my planning, task schedule and goals for this project so that my work load is manageable and expectations of completed work are reasonable for the April due date.  I will concentrate on the GUI design last to ensure I have all planned features implemented. Then, I will conduct full user tests on the software with the assistance of two to three sleep apnoea sufferers. Any bugs/aesthetic issues will be addressed and readdressed until they are functioning successfully.  I will be continuing to work on my thesis and make note of all my research/issues encountered/findings throughout the 6 months to ensure I am not left with a huge workload at the end and will have not forgotten anything. | |
| Deliverables  * An Android application with the functionality stated in the summary. * (Optional) A web application allowing physicians to view patient data online. | |
| Technical Requirements **Hardware:**   * An Android smartphone with at least Bluetooth 2.0 functionality (Andriod Eclair and up) * A Beddit Sensor * A wrist pulse oximeter   **Software:**   * Beddit API * Android SDK * Eclipse IDE * ADT Eclipse Plug In * Smart Bluetooth Widget (to emulate synchronous data transmission from multiple sensors)   **Languages:**   * Java * PHP? * XML? * SQL | |

## Project Reviews – Please include reviews of two of LAST years projects from your programme.

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| **Project 1**  **Title:** Snore and Apnoea Detector  **Student:** Berik Aubakirov  **Description (brief):**An application which uses audio to detect the presence of snoring or/and sleep apnoea in an individual.  **What is complex in this project:** Elimination of background noise in an audio file and isolate and detect characteristics to correctly identify human snoring.  **What technical architecture was used:**   * Visual C++ * Interpretation of MatLab code into C# * Windows Media Format 0 Series SDK * Dotfuscator (encryption software) * Visual Studio 2010   **Explain key strengths and weaknesses of this project, as you see it:**  **Strengths:**   * The idea - snoring is a key indicator of sleep apnoea and pauses in breathing can be detected through (a lack of) sound followed by a gasp (the patient catching their breath). * This application only requires an audio recorder + computer or a smartphone which the user is likely to have - no additional equipment required.   **Weaknesses:**   * Sleep apnoea cannot be identified solely on audio - vital signs data required (respiratory rate, blood oxygenation levels). * Student only interpreted a pre-existing algorithm for snore and apnoea detection into another language, rather than designing their own or an optimised or improved version of the existing algorithm. * Little critical analysis or user testing. | |
| **Project 2**  **Title:** Development of an iOS Application to Query and Display Nutritional Data to a User  **Student:** Rachel Callan  **Description (brief):** a mobile application providing nutritional and fitness related functionality (caloric and RDA calculations, generation of food suggestions, food searching, GPS mapping)  **What is complex in this project:**   * Application development in Objective C. * Extraction of food data from Tesco.ie * Creation of server side pages   **What technical architecture was used:**   * Xcode 5 using iOS7 SDK * Apple Development Account * Apple Provisioning Certificate * Nutritional database API, Nutritionix, for querying data * Scandit SDK and API for barcode scanning * Google Places API * Barcode SDK and API for querying data * JSON for parsing data in a device readable format   **Explain key strengths and weaknesses of this project, as you see it:**  **Strengths:**   * Good analysis of existing technology in the area of mobile nutrition applications. * Good understanding of client and server technologies involved in the transmission, storing and retrieving of data. * In depth user testing * Recognition of the importance of use cases, usability surveys and prototyping.   **Weaknesses:**   * The application is extremely similar to existing apps available with little originality or extra functionality apart from price comparison (but does have a lot of features overall). * No advanced AI complexity in algorithm design for the generation of food suggestions based on existing user data (maybe the student could have focussed on making one or two features more complex than including a lot of less complicated functionality). | |
| Proposal Sign off:Lecturer Comments | |
| **Student Signature** | **Date** |
| **Lecturer Signature** | **Date** |