CSED Group 11 Semester 2 Report

Computing as a Science and Engineering Discipline (CM10251)

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Abstract

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1 Introduction

1.1 Overview of Domain

Personal informatics is a term used to refer to devices and software that help people gather information about themselves, so they can reflect upon it and gain motivation to make changes to their lifestyle and habits to improve their overall wellbeing. Personal informatics is used for effectively motivating people to gain self-knowledge, change behaviours.

The area of personal informatics has started to expand in popularity in recent years mainly due to the increased availability and usability of affordable hardware. Consumer products such as the FitBit and Apple Watch allow users to collect data on a wide variety of metrics including heart rate, blood pressure, motion and many others. Products such as the Neuroon, a wearable electroencephalograph (EEG) eye mask, and Zeo Sleep Manager Pro, an EEG headband, allow the user to collect information on brain waves for the purpose of sleep tracking.

Another factor that has contributed to the growth of personal informatics is the ubiquity of smartphones, meaning that users have an ever-present device that allows them to collect and collate data from their personal informatics hardware. Many personal informatics apps also add an element of socially driven competition and gamification, driving users' motivation to continue to use them and push their friends to also begin using this technology. In addition, there is a larger social force pushing people to take steps to improve themselves.

1.2 Challenges

Although personal informatics systems for wellbeing has been on the rise, it inherently presents flaws that need to be taken into account. In a survey conducted by Rapp and Cena (2014) where participants were regular personal informatics users, it was revealed that the most significant shortcomings of personal informatics systems supplied by commercial companies was a lack of understanding for the end user's requirements and an absence of assistance and alerts for users who didn't meet their goals. Apart from users who are familiar with personal informatics systems it is also important to consider the challenges faced by the common user; a user who is new to using a personal informatics device. It was discovered by Rapp and Cena (2014) that the main challenge for personal informatics systems was the lack of motivation faced by the end user to continue to use the system. These challenges need to be taken into account because these hinder the end user from improving themselves which is contradictory to the goal of personal informatics systems.

1.2.1 Privacy and Security of Data

1.2.2 Health Risks

One crucial problem in the realm of health is sleep deprivation. Sleep deprivation is defined by the British Medical Association as "a lack of sufficient sleep resulting from disruption to the natural sleep cycle" (2018). This is important to highlight because as as opposed to fatigue, sleep deprivation isn't subjective. In accordance to Alhola and Polo-Kantola (2007), it was estimated that the main effect of sleep deprivation was the reduction in cognitive performance. This includes: impaired attention; longer delays in making decisions; poor quality of decisions and a reduction in long memory. This is especially important to monitor for individuals who have high risk jobs. In 2010, 158 passengers' lives were lost when an Air India Express plane overshot a runway by 600 metres. A leaked government report was stated to have found that the accident unfolded due to the pilot's severe sleep deprivation (British Broadcasting Corporation, 2010). Even in circumstances where the individual isn't responsible for people's lives, a reduction in cognitive performance is still observed. Hence, the validity of this problem is justified.

Sleep deprivation has the potential to be a dangerous to anyone and even fatal, if it is not identified and managed. Over a third of adults get less than seven hours of sleep during a typical 24-hour period. Lack of sleep affects a person's abilities and health in many ways and can limit their ability to perform in their line of work. This can be seriously, especially for professions that the general public's lives rely on greatly such as doctors and nurses. Each year, 100,000 deaths occur in US hospitals due to medical errors and sleep deprivation in the medical staff has been shown to contribute to this statistic (American Sleep Association, 2019). Driving whilst feeling drowsy has been shown to be similar to driving whilst under the influence of alcohol and can be attributed to a portion of car collisions each year (National Sleep Foundation, 2019). There are few visible indications that an individual is getting less sleep than recommended and it's difficult to know if you are deprived of sleep which often makes it more damaging as it may be challenging to identify and then attempt to curb. Similarly, there's no legal limit for sleep deprivation for situations such as driving a vehicle. Sleep deprivation is difficult to measure without the aid of external equipment.

1.2.3 Solution

Our software system aims to reduce fatigue in individuals due to a lack of sleep. EEG have the ability to detect sleeping problems based on brain wave patterns (Mayfield Certified Health, 2016). Monitoring and recording the individual user's brainwave data during their sleep allows the system to be tailored specifically for that individual. Implementation of a points system would ensure the user regularly uses the headset. If the system were to be used most nights, the headset would be able to measure and record a large quantity of reliable data for the system to process making results recommendations the system provides likely to be accurate and therefore helpful to the user. If the data were to be displayed in a format easily, this would help the user to better understand their recorded sleep data and allow them to make more appropriate decisions as to how to change their actions.

2 References

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