

**Masters Project Interim Report**

**11th July 2015**

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| **Project Title** |  | | | |
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| **Please Circle the appropriate** | **Masters Program** | | **Type** | |
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**This should be your Project Title**

**M. Mayura Prakash Wijeyaratne**

**2015**

List of Tables

List of Abbreviations

Chapter 1: Introduction

Deadline! This is the one word every employee is afraid of. In the modern day where deadlines are in quite abundance, it has made employees work harder for a longer time

In the modern life, where life is moving fast with deadlines and being more demanding many people do suffer from a lot of stress. “Stress isn’t always bad, though. Stress within your comfort zone can help you perform under pressure, motivate you to do your best, even keep you safe when danger looms. But when stress becomes overwhelming, it can damage your health, mood, relationships, and quality of life” [1].

What is stress? Why do we need stress at a certain level and why is it harmful if it allow you to overwhelm you?

Stress is body’s way of responding to any threat by releasing stress hormones, including adrenaline to arouse to make an emergency reaction. This is also called “fight or flight”, this helps you to stay focused energetic and alert. In emergency situations stress can save your life, however having stress all the time and more than your comfort zone will actually be detrimental to your mind and body [1]. Heart disease, sleep problems, depression, weight problems are some harmful effects of having stress for a long period of time at a level than a person can handle. "Over time, if you're constantly in fight-or-flight, if your heart muscles and valves are awash in the epinephrine, it causes changes in the arteries and in the way that cells are able to regenerate,” [2].

When a person is overwhelmed with stress for a long time, there are several different symptoms that shows.

* **Cognitive Symptoms**
  + Memory problems
  + Inability to concentrate
  + Poor Judgement
* **Emotional Symptoms**
  + Moodiness
  + Agitation, inability to relax
  + Sense of loneliness
* **Physical Symptoms**
  + Aches and pains
  + Nausea and dizziness
  + Chest pain, rapid heartbeat
* **Behavioural Symptoms**
  + Change of sleeping patterns
  + Change of eating patterns
  + Isolating oneself from others [1]

Everyone could have many reasons for having stress and these reasons are getting more frequent every passing day. Some of them are

* **External Causes of Stress**
  + Major life changes
  + School or work
  + Relationship difficulties
  + Financial problems
* **Internal Causes of Stress**
  + Chronic worry
  + Pessimism
  + Negative self-talk
  + Rigid-thinking, lack of flexibility [1]

Therefore because of the reasons mentioned above it is very important for people to keep their stress level in check and not be stressful for long periods of time. The work that people do is the main source of one’s stress, and here people interact with computers in many of the professions. Hence if the computer can detect stress of the employee while they work on the computer it’ll be very helpful to them.

What if we could measure the physiological features through the computer and monitor it over time, we could find the stress level of the computer user. Using the physiological features, if the stress level of the user could be measured it will be possible to indicate to the user if it is going too much.

In the field of medical science there are numerous devices that could be used to detect human stress levels. A few of them are Heart Rate Variability (HRV), Blood Volume Pulse (BVP), Variations of Pupil Diameter (PD), Galvanic Skin Response (GSR), Fingertip skin temperature. These equipment need to be hooked on to the human body in order to find out the stress level. However, using these devices in day-to-day life isn’t practical, therefore it’s best to use more non-invasive methods of gathering human physiological data.

With help of computer peripherals, we could gather some of the human physiological data in an non-invasive manner. Keyboard typing patterns, web cam footage of user/employee, variable pupil diameter using webcam are some of the better non-invasive techniques to measure stress.

With these non-invasive physiological data gathering techniques the author aims to collect data from employees who are working in front of the computer for an extended period of time. With the collected data, quantify the stress level of each participant and indicate to the user if the stress level is rising with time.

Author is expecting to contribute to the field of computer science researching to quantify stress with webcam footage.

Chapter 2: Background

Researches on stress detection using computers with the help of other devices have been done from the early 2000s. In 2006 a research with the title “Stress recognition using non-invasive technology” by Jing Zhai and Armando Barreto [3] has been done using invasive technologies like Blood Volume Pulse (BVP), Galvanic Skin Response (GSR), Pupil Diameter (PD) and Skin Temperature (ST). The above mentioned technologies are could be categorised as minimal invasive ways of stress recognition. This is because the technology today has developed so much that we could have much more non-invasive methods of recognising stress. Some of those non-invasive techniques in the modern day are key stroke dynamics and pattern variations [2], mouse track movements, web cam footage.

In a research to measure stress on e-learning students [4], the information acquired from key strokes and mouse clicks. Some of the sources of information gathered in this research comprise of click accuracy, click duration, mouse movement and also key strokes. In this research they have made an observation that if the student is stressed backspace key and right shift key will pressed more often.

The above researches are minimal invasive and non-invasive methods of detecting stress. There have been researches done to find out if players of a particular game develop stress. One such research is “PokerMetrics: Stress and Lie Detection through Non-Invasive Physiological Sensing”[5]. In this research too, they have used minimal invasive stress recognition methods such as skin conductance peaks and HRV and non-invasive method of voice pitch variation in their research to find if poker players develop stress.

The author’s research is to recognise stress in a working environment with webcam footage. There have been researches done to recognise the emotions of people through the video footage. In the research “Unsupervised Emotional Scene Detection for Lifelog Video Retrieval Based on Gaussian Mixture Model (2013)” [5]

Chapter 3: Analysis and Design

Functional Requirements (FR)

FR1 - Create an application to capture data from colleagues to be used in the research.

FR2 - The webcam footage is displayed on the screen, the system should be able to recognise the face of the person.

FR3 - Recognise the features of the person’s face.

FR4 - Feed the raw data into the system

FR5 - Calculate the base value of a players stress level at the beginning of the record.

FR6 - Measure the stress level periodically

FR7 - Calculate the value of the stress level periodically, and if it is rising then indicate it to the user.

Non-functional requirements (NFR)

NFR1 - System should have good performance, as it calculates the stress values as the video is streaming.

NFR2 - Easy to use with a simple user interface

Chapter 4: Implementation

Implementation of the functional requirements is the first and foremost objective in this project. In order to achieve these objects the author deliberated on a few technologies to use for implementation.

1. The author is comfortable in implementing systems using Java as the coding language, therefore it was used for any UI based implementation
2. In order to get facial features of the users, the author looked through several face recognition API’s however most of them were proprietary and could not be used for research purposes. The only SDK (Software Development Kit) that gave a evaluation key to work with for research purposes was Luxand FaceSDK [7]. Therefore this was used for recognising facial features from the collected user videos.
3. Python is considered as one of the best languages for number crunching. The best being ‘R’ [8]. Moreover, python is an easier language to learn than R. Therefore author chose python for the facial feature calculations and machine learning section of the project. Modules such as numpy, scipy and scikit-learn were selected to be used for implement the machine learning section of the project.

FR1

It is common to see datasets available in the web to work on data mining projects [9] [10]. The area that the author is working on is a niche area, therefore there doesn’t seem to be a dataset to work on off the web. The one database that is quite close to what the author is working on, Lifelog videos [6] has been shutdown now. Therefore an application had to be written in order to gather the necessary data to work on the project. [1]

A java application was built using a generic webcam Java API called ‘Webcam capture’ [1] [11]. While the application is running it records the users’ face and actions. The author was able to gather videos of colleagues doing their daily work at office, thereby creating some data to work with for the project.

FR2

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