Take-A-Break Notification

An Ergonomic Application

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Abstract*—Take-A-Break Notification is a software which runs on Windows operating system designed for office workers who have the highest tendency on prolonged computer screens use, in order to reduce Computer Vision Syndrome (CVS). The purpose of this study is to prevent computer users from looking in front of a computer screen for a long period of time. Rapid Application Development (RAD) methodology has been used for the project development phase. The software will dim the computer, disabling the mouse and keyboard functions which will force the employees to take a 5 minutes break after 2 hours working in front of the computer screens. This software will encourage office workers to apply the ergonomic practices and to be able to reduce the increasing rate of Computer Vision Syndrome (CVS).

Keywords—Computer Vision Syndrome (CVS), Ergonomics Practices, Take a Break.

I. INTRODUCTION

It is common for office workers to sit in front of a computer all day long. According to Bauers and Oppenheimer [1], most office workers do not realize that they have sat in front of the computer screen for 8 hours straight at a time. This leads to a number of health related problems including Repetitive Strain Injury (RSI), Computer Vision Syndrome (CVS), Work Related Musculoskeletal Disorders (WMSDs) and others. Porter [2] mentioned that workers who use computer for their work increasingly suffering from eyestrain, musculoskeletal disorders which include mental and physical fatigue and poor physical fitness levels. Previous work stated that nearly 150 million of computer users nowadays, sitting in front of computer screen for hours each day without even realizing how it may affect their vision [1]. Apparently, this situation may cause higher risk with computer usage related health problem such as CVS. This symptom occurs when an individual overtaxes his/her eye by spending prolonged amounts of time staring at images that can overwork and affect its capabilities [1].

Without proper ergonomic guideline and awareness, the unhealthy practice among office workers will continue and it will affect their health which will reduce their productivity at work in the future. Hence, most of the multinational companies throughout the world have implemented ergonomics practices such as ExxonMobil [3]. This was done to protect employees' health. These multinational companies also developed system and application that can help and guide their employees in practicing ergonomic practices. The purpose of this study is to prevent computer users from sitting in front of a computer screen for a long period of time. Prevention can be done in many ways; however this study focuses on developing an application that allows users to take a 5 minutes break for every 2 hours. The scope of this study will focus on office workers who work for long duration of time in front of the computer screen. This paper contains four sections which includes literature reviews, methodology, results and discussions; and conclusion.

II. LITERATURE REVIEW

A. General Problems related to Sittitng in front of Computer Screen

Sitting for a long period of time in front of the computer screens linked with a number of health related problems including computer vision syndrome (CVS), repetitive strain injury (RSI) and as well as eye strain or fatigue. Without proper care, eye strain may increase the risk of myopia (nearsightedness), leading to general fatigue and also decrease in overall performance efficiency. Normally, eye strain results in a combination of various symptoms such as dry eyes, eye fatigue, headache, blurred vision and also changes in the perception of color. While computer users are attempting to interact with images clearly, they tend to hold their heads off in bad postures which leads to neck, back and shoulder pain [4].

Recent study made by Occupational Health and Safety Administration (OSHA) found that computer workers increasingly suffer from eyestrain, musculoskeletal disorders including mental and physical fatigue, poor physical fitness levels, static work and home offices, and longer working hours [2].

B. Maximum Hours to Sit in front of Computer Screen

The Occupational Health and Safety Administration (OSHA) have set minimal standards that all employers should follow to decrease the risk of injury to workers [5]. According

to the study that has been conducted by Academy of Family Physicians of Malaysia in 2008, working nonstop with computer for more than 4 hours has been associated with eye strain, which leads to CVS [6]. Majority of the people are spending the whole day in front of computer without a break.

New study conducted in 2011 suggested that spending more than 4 hours each day in front of a television or computer screens may double the risk of dying from heart disease or being hospitalized [7]. Emmanuel Stamatakis, a researcher from the Department of Epidemiology and Public Health at the University College London believed that people who exercise cannot even overcome the detrimental effects of too much screen time [7].

According to Australian and American guidelines, they have suggested that children and adults should spend no more than 2 hours in front of computer or television screen [8]. American Academy of Pediatrics supports that the maximum screen time or "critical cutoff" for children and adults is 2 hours [9]. An ergonomic expert, Deborah Quilter says that computer users have to blink and stretch their eyes for every 15 minutes and must follow the rule of 20s; stand up for every 20 minutes, walk and look 20 feet away from the screen for at least 20 seconds [10]. Taking 5 minutes break from intensive computer operation in each hour is encouraged as a good practice and a reasonable precaution to protect the health and safety of workers [11].

C. *Computer Vision Syndrome (CVS)*

According to the American Optometric Association (AOA), it is believed that a complex of eye vision problems related to the activities that stress the near vision and which are experienced in relation or during the use of the computer clearly define CVS [6]. CVS can be also caused by a number of different factors including computer screen glare, improper positioning of the monitor, spending more than three hours a day on computer and wrong prescription for corrective lenses [10]. Based on the study conducted in Academy of Family Physicians of Malaysia, the main symptoms of CVS reported are blurred vision, eye strain, double vision, irritation, redness and burning sensation [6].

The symptoms of CVS are headaches and eyestrain which forces the employees to shut down. Computer-related works are yet proven to cause permanent damage to eyes, but temporary discomfort that may occur can reduce performance and productivity [12]. Latest online journal published in February 2013 stated that adults are not the only ones who vulnerable to the symptoms of CVS [13]. The prolonged use of computer may stress child's eyes and affect their development of normal vision too [13]. There are millions of children at home or even at school who uses computer every day.

Social networks such as Facebook, Twitter, Blogs and many other social networks nor websites have influence people to just sit in front of the computer all day long. An expert believes that CVS caused by the different reaction between eyes and brain towards characters on the computer screen. James E. Sheedy, a clinical professor at University of Berkeley School of Optometry says there are about 40% of computer users having dry eyes problems which lead to CVS [1]. Based on the online journal, CVS refers to visual and ophthalmic symptoms which are normally occur among the computer users [14].

D. *Existing Software*

Informer Technologies Incorporation official website has developed various types of software to combat the eyes related health problem [15][16]. Below in TABLE 1 are the comparisons between the top five rated software from their website:-

TABLE 1 COMPARISON OF SIMILAR SOFTWARE

Software Name	Description
EyeDefender [16]	• Eyedefender software allows the user to set periods of time between breaks and duration of the breaks. After the software triggers the time set by the user, the program will activate a default screen saver, display some pictures from its own library or from the folder that the user choose. This will give them a reminder by visual display showing to stop working and take a break.
Off4Fit [15]	• The program will remind the user to take rest and do some exercises in front of the computer. The computer will then generate an image of a girl that demonstrate a set of various exercises for eyes, hands and body, each one repeated several times. It allows the user to choose intervals between training from 10 to 180 minutes, but the program advised the interval between exercises is set to 60 minutes.
Scirocco Take A Break [16]	• The features includes complete customization of work, break times and snooze, audio or visual notifications, type of timer display, screen saver, locking mechanism of workstation on break, tray icons, and time spent statistics, average of break time per hour and also motivational

	pie chart.
Smart Break [15]	• SmartBreak actually monitors the time spent on a computer and prompts that the user need to rest at the specific duration. This means that user can spend more time in front of a computer in more efficient way by utilizing the break time.
TakeABreak [15]	• The program will pop up a message after a specific duration (default: 20 minutes). "Take a break" message will be appeared and it will repeatedly to appear until the break time is over. Once break time is over, sound will be played and turn the screen on to allow the users notify that the break time was ended and the computer can be used again.

III. METHODOLOGY

There are two type of methodology use for the project: (1) development and (2) research methodology.

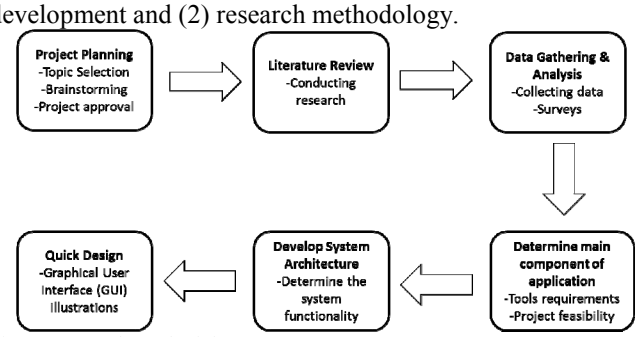


Fig. 1: Research Methodology

Fig. 1 shows the steps taken during research phases. Project planning involves selecting topic, brainstorming and getting a project approval. Literature review step is done by conducting and analyzing past studies/research papers. Data gathering and analysis is done to obtain the maximum number of hours user needs to spend in front of computer and also made a comparison with existing software. Tools required and project feasibility is determined before developing the system architecture. Quick design is a final step to come out with mock or illustration of the project Graphical User Interface (GUI).

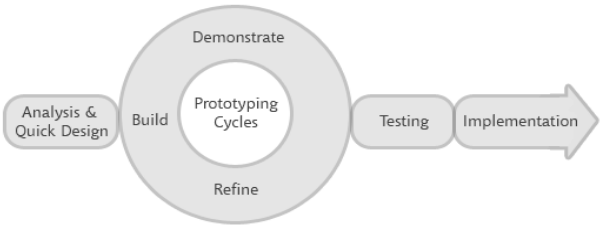


Fig. 2: Development Methodology

There are four (4) main activities in the project development as illustrated in Fig. 2 above which are:-

- Analysis and Quick Design Phase
- Prototyping Cycles (Building, Refining, and Demonstrating process)
- Testing Phase
- Implementation Phase

The first steps in the project development develops the system architecture and quick design by sketching the mock Graphical User Interface (GUI). It is then followed by software development which includes coding, demonstrating and refining using Visual Studio 2012. Testing phase is done by demonstrating the beta version to 10 real users to obtain the usability ratings and their feedbacks.

IV. RESULTS AND DISCUSSIONS

A. Basic System Architecture

As shown on Fig. 3 below, the system timer will firstly check during the 105th minutes on time spent by the user. If the calculated current time equivalent to 105th minutes, the system will pop up the first reminder. The system timer will continuously checking and pop up a second and final reminder at 110th minutes and 115th minutes consecutively. During the 120th minutes, the Dim Screen function will be activated in 5 minutes duration.

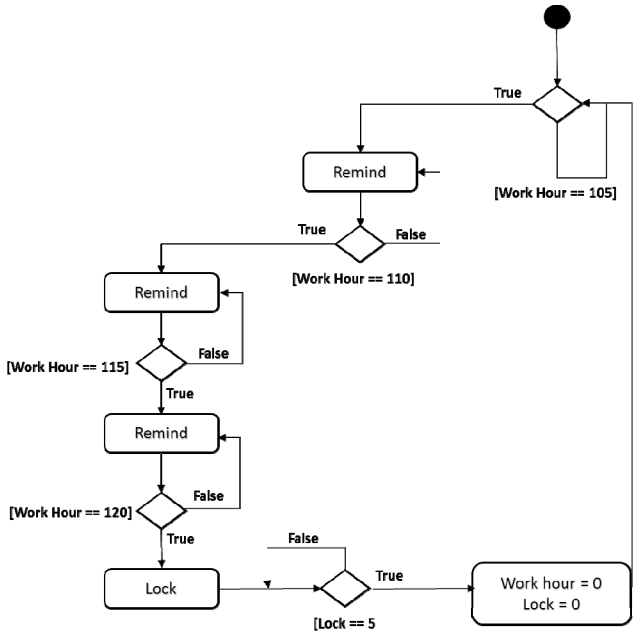
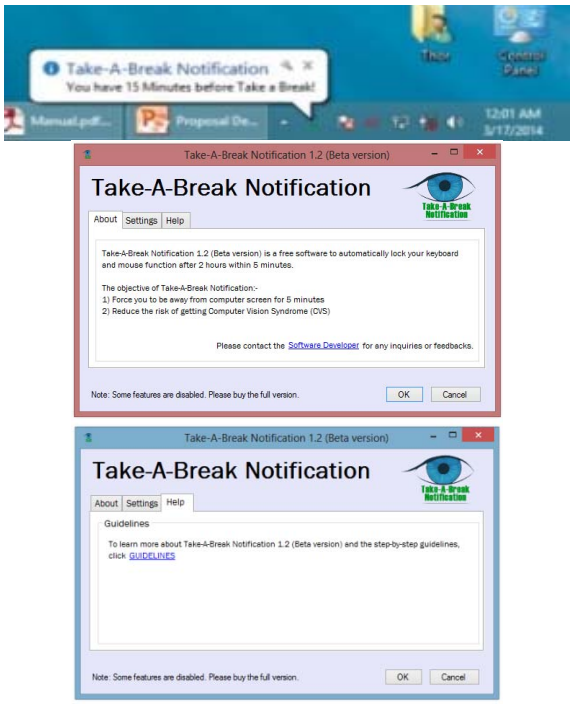


Fig. 3: Basic System Architecture

Once the break duration reach the end, the system timer will loop and initiate to zero values (System Timer = 0 min, SystemLock = 0 min). The program will restart from the beginning.

B. *Prototype*

The software works and runs on Windows operating system. The beta release of the software contains the main components; (1) dim screen (locking functions), (2) system timer and (3) system tray notification. Fig. 4 below illustrates the screenshots of the software:-



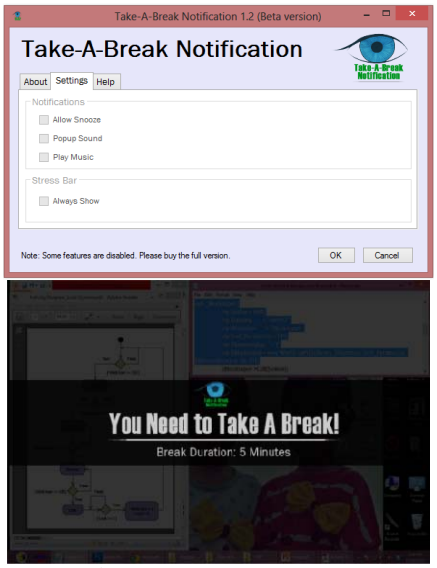


Fig. 4: Prototype Screenshots

C. *Unit Testing*

Main Components	Actual Duration	Duration in Beta testing)
Timer	120 minutes : (7200 secs)	35 secs
Dim Screen	5 minutes : (300 secs)	10 secs

Fig. 5: Test Case of Main Components

Typically, Timer will be set at 7200 seconds. Therefore, for the purpose of beta testing, the Timer duration is set to 35 seconds before Dim Screen is activated to show whether the timer looping and calling the dim screen functions are working properly.

Popup Reminder	Actual Duration	Duration in Beta testing)
1st	105th minutes : (6300 secs)	10 secs
2nd	110th minutes : (6600 secs)	20 secs
3rd	115th minutes : (6900 secs)	30 secs

Fig. 6: Test Case of Popup Reminder

Technique used in Unit Testing:

Simulate the real duration of system timer and dim screen functions. Duration of each component/function has been reduced to increase the efficiency of unit testing by ensuring the effectiveness of each component in the software.

D. *Usability Testing*

The usability aspects of the software were measured based on the System Usability Scale (SUS) standard [17]. 10 users are selected randomly which required to fill up a questionnaire after using the system (software) and to answer each question by selecting based on point scale 1-5. The result obtained is shown below:-

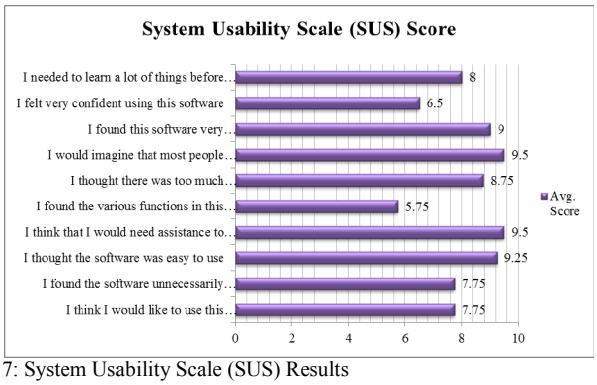


Fig. 7: System Usability Scale (SUS) Results

Fig. 7 shows the average score for each of the question, from a total of ten users. The calculation to obtain average scores for odd-numbered (1, 3, 5, 7, and 9) questions differ from the average scores for the even-numbered (2, 4, 6, 8, and 10) questions. This is because question 1, 3, 5, 7 and 9 expect users to rate more towards the higher side of the scale (3 – 5) to achieve better usability rating, while question 2, 4, 6, 8 and 10 expect the opposite [17].

Below are the formulas to obtain average scores based on the questionnaire outcome:-

Odd-numbered questions

Average score = [No. of Users * (Scale Position – 1)] * 2.5 / Total No. of Users

Even-numbered questions

Average score = [No. of Users * (5 – scale position)] * 2.5 / Total No. of Users

Therefore, the total score for System Usability Scale (SUS) of Take-A-Break Notification obtained from the ten users is shown below:

Sum of Average Score;
= 7.75 + 7.75 + 9.25 + 9.50 + 5.75 + 8.75 + 9.50 + 9.00 + 6.50 + 8.00
= 81.75, SUS Score obtained > 80 (Grade A)

Based on the SUS score, Take-A-Break Notification obtained score above 80 which is considered as attaining grade A in the usability standard. This has shown that development process have been done according to the usability aspects. The high usability quality of this software has proven that it is applicable for non-technical users which may find difficulties in using and configuring new implemented software or system.

V. CONCLUSION

A. *Recommendations*

More detailed research and findings materials are needed such as coding efficiency or reduction, more APIs required in order to obtain the best interactive user interfaces. The recognition and awareness on CVS related software among computer users are very low. Hence, future researchers should look into doing a comprehensive research and ways to implement this kind of software especially among office workers as an alternative way to enforce ergonomics practices in the workplace.

This project only covers the scope of Windows OS users. In the future, it is possible to create a similar application for other operating system such as Apple and Linux users.

B. *Conclusion*

Based on the final prototype of Take-A-Break Notification, it had undergone two tests; (1) unit testing and (2) usability testing. The software has been proven to be accepted by users as shown in the SUS result obtaining grade 'A' software. Beta testing among 10 UTP lecturers have also shown their interest towards the software and supported that it is applicable to implement in their office. The additional features of the software will be included in order to increase its commercial value. Based on all these criteria considered, it is hoped that the project will achieve its main objectives and help to reduce the possibility on getting CVS.

REFERENCES

[1] Bauers, D., and Oppenheimer, A. (2008). How Staring at a Computer All Day Can Affect Your Eyes. (As retrieved on 30th October 2013 from:http://www.livinghealthy360.com/index.php/how-staring-at-a-computer-all-day-can-affect-your-eyes-9-41339/)

[2] Porter, R. (2008). Back School of Atlanta. Ergonomics: Practical Applications

[3] ExxonMobil Intranet: Laptop Ergonomics.(As retrieved on 10th November 2013 from: http://emgs.na.xom.com/sfsafety/newsletters/may2001.html#ergolaptop)

[4] Myers, C.B. (2012). Cranky with a Headache? Check Out 10 Tips to Avoid Computer Vision Syndrome (CVS). (As retrieved on 30th October 2013 from: http://thenextweb.com/lifehacks/2012/03/31/cranky-with-a-headache-check-out-10-tips-to-avoid-computer-vision-syndrome/)

[5] Erin, M (2011). SPRING 2011: Workplace Ergonomics, Journal of the Spinal Research Foundation, Vol. 6(1), pp. 36-39.

[6] Loh, K.Y (2013). Understanding and Preventing Computer Vision Syndrome, Malaysian Family Physician 2008, Vol. 3(3), pp. 128-130.

[7] Chan, A. (2011). Exercise Can't Undo the Damage of Too Much Screen Time. (As retrieved on 30th October 2013 from: http://www.livescience.com/9257-exercise-undo-damage-screen-time.html)

[8] Beckford, M. (2011). Every Hour of TV Watching Shortened Life by 22 Minutes. (As retrieved on 25th October 2013 from: http://www.telegraph.co.uk/health/healthnews/8702101/Every-hour-of-TV-watching-shortens-life-by-22-minutes.html)

[9] Seaman, A.M. (2013). TV Watching Linked to Young Adults' Heart Risk. (As retrieved on 28th October 2013 from: http://groundreport.com/tips-for-avoiding-computer-eye-strain/)

[10] Quilter, D. (2012). Is Your Computer Killing Your Eyes? (As retrieved on 19th October 2013 from: http://www.nextavenue.org/article/2012-01/your-computer-killing-your-eyes)

[11] Ontario Ministry of Labour, (2004). Computer Ergonomics: Workstation Layout and Lighting. (As retrieved on 11th November 2013 from: http://www.labour.gov.on.ca/english/hs/pdf/gl_comp_erg.pdf)

[12] Charpe, N.A., Kaushik, V (2009). Computer Vision Syndrome (CVS): Recognition and Control in Software Professionals, J Hum Ecol, Vol. 28(1), pp. 67-69.

[13] Heiting, G., and Wan, L.K. (2013). Computer Vision Syndrome and Computer Glasses: FAQ. (As retrieved on 25th October 2013 from: http://www.allaboutvision.com/cvs/faqs.html)

[14] Kokkinakis, J. (2012). Factors that Contribute to Computer Related Vision Syndrome. (As retrieved on 26th October 2013 from: http://www.eyestrain.com.au/factors-that-contribute-to-computer-related-vision-syndrome/)

[15] Bjerke, N. (2011). Time to Take a Break. (As retrieved on 29th October 2013 from: http://articles.software.informer.com/time_to_take_a_break.html)

[16] Vozrak, N. (2013). Software Informers: How to Prevent Eye Strain. (As retrieved on 11th November 2013 from: http://articles.software.informer.com/how-to-prevent-eye-strain.html)

[17] Sauro, J. (2011). Measuring Usability with The System Usability Scale (SUS). (As retrieved on 10th March 2014 from http://www.measuringusability.com/sus)