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Designing Stress Relieving Game Associated to Virtual and Augmented Reality for Bus Drivers

Esnehara P. Bagundang[1]
[1]College of Computer Studies, Sultan Kudarat State University, Philippines
[1] esneharabagundang@sksu.edu.ph
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Abstract— Stress is a phenomenal problem that affects a large number of worker, regardless of the financial or social status, age and profession, a person exposed to stress may develop health problems that can interfere with work and his quality of life. Problems about stress should not be taken for granted as it may lead to health problems that causes sickness absenteeism. In this scenario it is important to have strategies that helps to deal with such problem.
Nowadays technology has been used in different areas not only to help our day to day transactions easy but also provide assistance in coping with psychological problems like stress thru computer games, mainly those based upon Virtual and Augmented Reality (VR/AR) techniques because it offers players some experiences like: relaxation, sense of control, challenges, learning opportunities and immersion and so these characteristics can contribute to the control process of stress. In this paper, it aimed to describe a design intervention though virtual reality game controlled by breathing and simple body movements to relieve stress.
Keywords— Stress, Virtual and Augmented Reality, Breathing exercise, Relaxation

I. INTRODUCTION

Public Utility Buses (PUBs) is one of the main public transportations in the Philippines especially in metropolitan cities. Among the road-based transport such as taxis, public utility jeepneys (PUJs), Asian Utility Vehicles (AUVs), Tricycles (TC) and pedicabs (bicycles with sidecar), buses offer more in terms of affordability and efficiency as they carry more people using less road space[3].

Most reason why they become a bus driver is that they cannot find other job due to low educational attainment. Bus drivers are typically high school graduate or have taken vocational courses in driving. Basically, there are two types of bus, non-air and air-conditioned. Drivers who have more years of experience in driving is typically assigned in air-conditioned bus.

In a daily life of a bus driver, there is a need to drive safely according to traffic regulations and condition. Often, they work on timetables and shift schedules. They maintain good contact with passengers, for instance to travelers by providing information about timetables, routes, stops, fares, etc.

Over three decades there are numerous studies conducted from 13 countries on the occupational health of bus drivers. This studies compare bus drivers with other employees: office employees (often, but not always, from the same company), conductors, non-drivers, blue-collar workers, taxi drivers, employees of a brewery, white-collar employees, employees of a printing office or national statistics (e.g. all Dutch civil servants, or the

average male employee). The studies indicate that being a bus driver is a high-risk occupation. All these studies yield comparable results: high demands, low control and low support. This combination spells stress and, consequently, an increased risk of physical and mental occupational ill health, leading to absenteeism and to decreased productivity of employees and enterprises.[4].

In this context, this paper aims to describe a virtual reality game controlled by breathing and simple body movements which is helpful to relieve stress.

II. BUS DRIVERS: OCCUPATIONAL STRESS, SICKNESS ABSENTEEISM, HEALTH PROBLEMS

A bus driver's task can be mentally demanding because of having to cope up with conflicting requests such as demand to provide service to passengers; demand to drive safely; and demand to stick to tight timetables. Often, this demands for efficiency and improvement to customer services form a pressures at work thus a gaining ground with production of high level of stress. In [6], stress is define as an imbalance ratio between environmental demands and personal resources, in which individuals perceive demands that deplete or exceed the resources they judge available to face the situation that is assessing for them as threatening for its balance.

When stress happens in the workplace it is called occupational stress. In[6], occupational stress is defined as a product of the relationship between the individual and the work environment, in which the demands of that environment exceeds the coping skills of the worker, causing excessive wear on the body and interfering with his productivity.

From high demand in job, other factors that causes stress is subjected to work conditions and physical environment like difficulty to keep time schedule because of traffic or road construction. Due to tight schedules, sometimes they cannot take breaks in full length during a workday. In a working environment such that of a driver due to exposure from inhalation of annoying pollution, strong heat in summer, cold in rainy season and the like can cause health problems such as flu or colds. Most drivers also experience symptoms of diseases such as arm, shoulder, neck and low back pain disorders. These symptoms may be subjected to the quality of driver's cabin. As for non-air-conditioned bus, the driver's seat is not comfortable compared to air-conditioned bus but this buses is most likely assign for long distance travel.

Health related problems due to stress, working condition and physical environment should not be taken for granted as it is the main cause of sickness absenteeism among workers. Sickness absenteeism of bus drivers is significantly higher compared to other professional groups. The same holds true for the risk of disability. Bus drivers who have to leave their job for medical reasons do so at a younger age than comparable groups of employees. The main conditions leading to disability relate to the back, tendons and joints, mental disorders and cardiovascular diseases. [4]

With the aforementioned situations, stress has become a serious problem that affects people ei. Bus drivers. Thus, strategies to combat stress should be taken into consideration.

III. RELIEVING STRESS: BREATHING AND STRETCHING EXERCISES FOR RELAXATION

There are many ways to manage stress, first is by prevention which concerns to eliminate or modify the stress-producing situation or remove the individual from it. In [6] it discusses the four basic feature to stress recovery: namely Psychological Detachment, Relaxation, Mastery Experience and Control during Leisure Time.

Psychological Detachment implies not to be occupied by work-related duties, it can also mean to disengage oneself mentally from work. It implies to stop thinking about one's work and job-related problem or opportunities. Relaxation is a process often associated with leisure activities. The potential for relaxation experiences to reduce activation and to increase positive affect are important for recovery in two respects. First, prolonged activation resulting particularly from stressful work is an important mediating mechanism by which job stressors translate into illness. Therefore, processes that reduce this prolonged activation are crucial in order to restore an organism's pre-stressor state. Second, positive emotions can undo the effects of negative emotions. Positive affect resulting from relaxation experiences will be helpful in reducing negative affect resulting from job stress. Mastery Experiences refers to off-job activities that distract from the job by providing challenging experiences and learning opportunities in other domains. These activities offer opportunities for experiencing competence and proficiency. Mastery experiences challenge the individual without overtaxing his or her capabilities. Attaining mastery experiences is not necessarily effortless but requires a certain degree of self-regulation. And last, Control during Leisure Time, it can be described as a person's ability to choose an action

from two or more options. The experience of control during leisure time may satisfy one's desire for control by increasing self-efficacy and feelings of competence, which in turn promote well-being. In this sense, control may act as an external resource that enhances recovery from work during off-job time.

It is clear that relaxation is an effective technique to relieve from stress. Relaxation sometimes vary from each individual however one of the effective ways to relax is through breathing exercises. Deep breathing is not only relaxing, it's been scientifically proven to affect the heart, the brain, digestion, the immune system. Mladen Golobic, a physician in the Cleveland Clinic's Center for Integrative Medicine, says that breathing can have a profound impact on a person's physiology and health. [1]

In modern science, breathing deeply with focus and intention can help clear the mind and help alleviate negative feelings, in fact, this technique is not new. In India, breath work called pranayama is a regular part of yoga practice. Yoga practitioners have used pranayama, which literally means control of the life force, as a tool for affecting both the mind and body for thousands of years. [1]

In ancient Chinese, there is a health care system that integrates physical postures, breathing techniques and focused intention, which is called Qigong. Eastern practitioners have known about the benefits of qigong for centuries, and today Western scientific research is following-suit, confirming that qigong can help prevent and manage many different health problems. The ancient practice is especially beneficial for older adults and people who are chronically stressed out. Today, holistic practitioners promote qigong for its proven stress-reducing benefits, plus its ability to improve flexibility and inner-focus. Qigong involves performing gentle movements that are synchronized with the inhalations and exhalations of the breath, making it similar to yoga in that it's a powerful holistic practice for both the "body and mind." [8]

IV. The application of Virtual Reality and Augmented Reality

Virtual reality can be defined as the creation of a virtual world that users can interact with. It is an advanced interface to computer applications, which allows the user movement (navigation) and real-time interaction in a three dimensional environment. VR technologies is designed mainly to fully immerse and engage the users inside that virtual world [6].

On the other hand Augmented Reality is a combination of virtual reality and real life setup. It allows the users to interact with virtual objects in the real world [6].

In the virtual environment people's sense capabilities can be expanded in intensity, time and space. This is achieved by three-dimensional modeling techniques used to build virtual objects and scenery, where the user can navigate. Thus, VR allows the user to interact with and portray imaginary situations, like the fictional scenarios involving static and moving virtual objects. It also allows to faithfully reproduce real-life environments. In this technology, the possibility to use people's knowledge of real world in the virtual world is an advantage. Thus, skills and intuitive knowledge can be used to deal with virtual objects.

In a virtual reality, the user is required to wear VR glasses and grip joysticks on both hands. The VR glasses will help project the virtual environment that will be loaded to the device. While the joysticks on both hands will serve as an input device necessary to record the hand gestures and actions of the user.

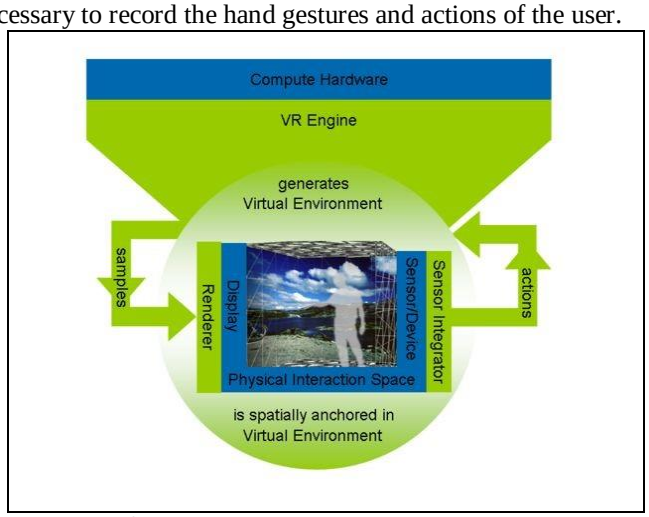

Figure 1: Aspects of the Virtual Environment (EuroVR knowledge base 2008)

The diagram above is used to illustrate the different aspects of the Virtual Environment. The top section is computer hardware which serves as the base of the technology to be used. Below that is the VR Engine, which serves as the platform of the game to be developed. VR Engine, will generate the virtual environment that consists of renderer and sensor indicator which are spatially anchored within the environment. On the inner level are the display, sensory device and physical interaction space. The display is used to output the virtual scene. The sensory device on the other hand, serves as an input device to detect the actions performed by the user. While physical interaction space is where the user interacts with its environment. The arrow on the left going down will generate various sample virtual environments. Whereas the arrow on the right going up, will feed the actions of the user back to its virtual environment.

V. SERIOUS GAME

Serious game is a term used to identify games for a specific purpose i.e. to go beyond the idea of entertainment and offer types of experiences, such as those related to learning and training.

It is designed for a certain purpose other than leisure. Serious games are considered useful and important in trainings and education. It is also a well-known approach in the gaming industry that can make simulations more attractive and even entertaining. It offers activities that highly promote absorption of concepts and psychomotor. Thus, these features are important to do repetitive exercises provide training tools for health professionals, provide environment/tools for treatment at a lower cost or in remote locations.

VI. RELATED WORKS

Augmented Reality (AR), Virtual Reality (VR) and Serious Games (SG) are some of the technologies that has a user interaction characteristics which can be used to assist coping strategies for stress. The main characteristic of AR and VR are immersion, engagement and interaction. Moreover, the solutions using AR combine a 3D visual interface and tracking system for the alignment of real and virtual objects. Recent research also shows the power of gaming technologies to support virtual communities and distributed training groups to explain concepts and to engage and motivate people.

In an effort to teach people how to harness the power of breath, developers Owen Harris and Niki Smit created *Deep*, an immersive virtual reality experience controlled entirely by breathing in and out.

Deep runs on the Oculus Rift, and uses a custom controller that wraps around your diaphragm to analyze its expansion as breath goes in and out of your lungs. The thin strap with sensors that touch your midsection is still a prototype, but it will be able to determine whether or not you're inhaling deeply or taking shallow breaths. [2]

The game is based on yogic breathing, or *pranayama*—an intense focus on your breath and energy as you meditate or take your body through a physical journey. As wearers breathe in and out, the experience in the headset changes. They follow a small white circle around the screen, and as they inhale, it expands, and when they exhale, it shrinks. The environment itself is like an underwater maze, but instead of traditional marine life, different shapes, colors, and beams of light react to breath.

In gaming technology, there are works that study the breath control in game interfaces. The following are some of breath based games [7] :

a) **Serious Sam Aim Control** is a game which makes aiming of the gun be perturbed by breathing, meaning that to shoot straight, you have to time breathing with shots, or hold your breath.

b) **PerPing** is a two player breathing controlled tennis game – breathe in to move the bat up, breathe out to move it down, and hyperventilate to split the ball in two. Miss the ball and your opponent scores a point. PerPing was run for a large audience at Cheltenham Science Festival.

c) **Tunnel Run** is a game for two players. One player's breathing controls the shape of a tunnel shown on the screen. The second player's breathing controls the flying of a plane going through the tunnel. The first player must try and make the tunnel as hard to fly through as possible, whilst the second player tries to fly for as long as they can. Players take turns creating the tunnel and flying through it, and are scored based on how long they can fly safely for.

It is clear therefore that technologies of AR, VR and SG is being used in game which involves breathing as way to control the game.

VII. DESIGN INTERVENTION: HOT AIR BALLOON VR GAME FOR BUS DRIVERS

To simulate the breathing exercise for relaxation, the user is required to wear the VR glasses, electronic belt and hold two joysticks on both hands. The VR glasses will let the user see what's going on inside the virtual environment, the belt will acquire the breathing pattern of the user and the joysticks will get the gestures and movements of the participant. The game is centered in flying a hot air balloon. In order to control the balloon, the user has to properly breathe in and out. The proper breathing will keep the balloon floating in the sky. As the game progresses, the user will encounter moving objects in which he needs to ward off to continue on playing the game. The user is required to do simple gestures to avoid the moving objects. To move the balloon upwards, the user has to jump. If he wants to keep it moving up, he has to continue jumping. If the user wants to move the balloon downwards, he has to squat. If he wants to keep it going down, he has to remain seated. The joysticks will let the user maneuver the balloon from left to right. If he wants to move on the left, he has hold the joysticks together pointing to the left. He has to do the same thing pointing to the right if he wants to go in that direction. As the user reaches higher stages, he will encounter more objects that move faster. Also the virtual environment changes at different stages. The user will only have three chances. Once he gets hit by a moving object the fourth time, the game will be over.

The figures below represent the Virtual Reality Scenarios in the game:

Figure 2: Hot Air Balloon VR Game Stage 1

Figure 3: Hot Air Balloon VR Game Stage 2

Figure 4: Hot Air Balloon VR Game Stage 3

Figure 5: Hot Air Balloon VR Game Stage 4

The Hot Air Balloon VR game will be implemented in the recreational offices. Drivers can play this game for relaxation while waiting for their next destination.

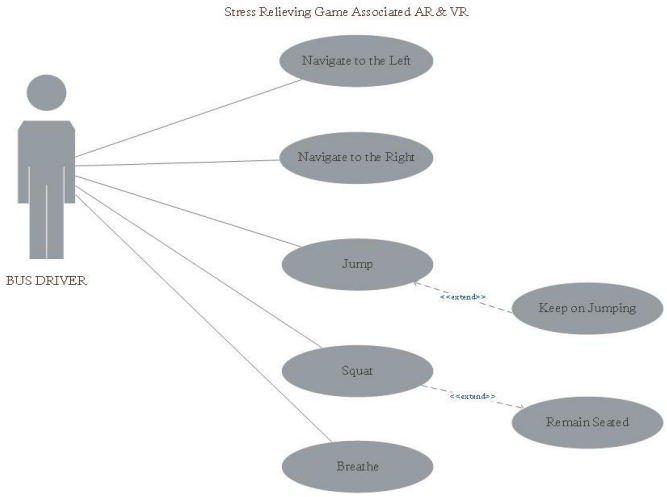

Figure 6: Use Case Diagram

VIII. CONCLUSION

Game Technology with Virtual and Augmented Reality which involve control using breathing is not widely implemented, therefore professionals are encouraged to conduct further research on the application of the benefits of breathing as a form of relaxation to relieve stress through these technologies.

The proposed Hot Air Balloon VR Game to simulate breathing exercise for relaxation, needs to be validated and tested to verify the effectiveness and efficiency. However, based on the information gathered, the study certainly has design opportunities that can be realized into an actual software application and can be utilized by bus drivers to relieve stress. Furthermore, the study is beneficial not only to bus drivers but also to any individual who would like to relieve stress. Hence, the study is transferrable to other context and environments may be customized depending on the user of the game.

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