Department: Software Engineering

Programme: Software Engineering

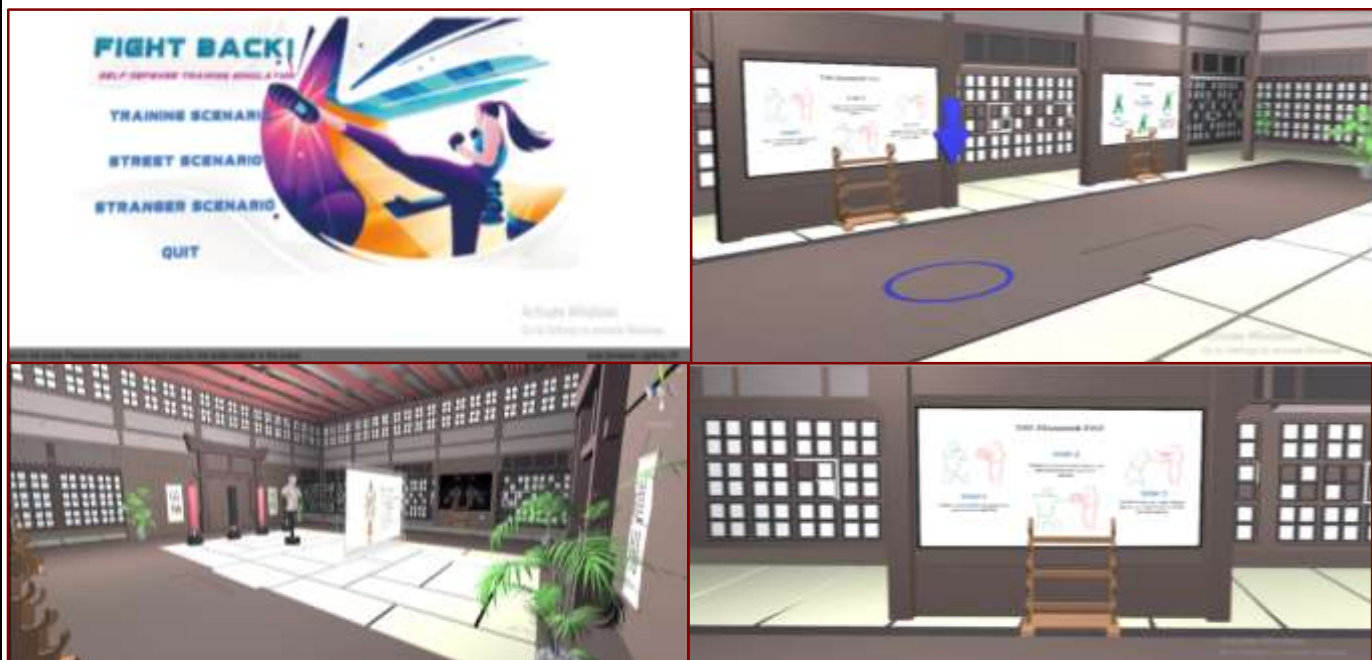| 1	Project Idea	**Self Defense Simulation for Personal Safety using Virtual Reality (Fight Back)** The self-defense simulation using virtual reality was conceived after the identification of major problems within the national and international society: lawlessness regarding harassment and molestation cases amongst people, and the rapid increase of rape cases in our society. The major objectives of this application are to apply virtual reality in a practical scenario, and to teach self-defense techniques. There are countless reports of people being verbally and physically assaulted every day. Our idea provides a solution to reduce the number of these occurrences by offering a self-defense virtual reality simulation to the people. This is to be achieved by first teaching basic self- defense techniques to the user, then a real-world scenario, in virtual reality and finally performance feedback to the user of how they performed. Our solution provides a systematic approach to initially learn the necessary self-defense moves to protect them in any given scenario. The application implements the instruction mechanisms for the users by providing interactive interfaces on the front-end, i.e., training through tutorial, virtual environment exploration, instructions regarding self-defense move and training them on a dummy mannequin.
2	Process	The Self-Defense Simulation for Personal Safety Using Virtual Reality (Fight Back) consists of a simulation, in which the user is prompted to first attempt the tutorial to learn the moves and techniques regarding self-defense. The user is first prompted to get a visual understanding of the moves. After completing the tutorial, the user can move to the real-life scenario where he/she can apply the learned techniques. **Training Scenario**: In this scenario, the user is firstly informed with the multiple moves and techniques that he can perform and after that, he is asked to go towards the training area to practice the moves on a dummy mannequin. Once the user reaches the specific area, different hit points are identified on the dummy mannequin which once gets hit properly changes its position to another specific part of the mannequin. Every hit gives the feedback on whether the hit was a good strong hit or it was a weak inaccurate hit, which would be displayed in front of the user, looking at which, the user can change its techniques and try to either be more accurate or land a stronger punch.

		Street Scenario: A real-world scenario is given as a test to check the user's grasp on self-defense moves and techniques. On basis of the user's performance, they are given a score and a performance review. The output is displayed on a panel which contains the total no. of hits correctly performed out of correct moves. At the moment of performing the moves feedbacks are continuously given, for better understanding for the user. Once the user is approached by an assailant or an attacker the user will maneuver himself to safety by performing the previously learned moves correctly. **Free Roam:** The user can freely explore the whole training room without any hesitation. In this mode, the user is not bound to a particular area. This mode is designed to simulate a training doji open world, where there are no restrictions nor any consequences of one's actions. It is there to be explored.
3	**Outcome**	The outcome to this project is to provide awareness in our society as well as to give education regarding basic self-defense techniques that any person can apply at the time of unfortunate condition. This will not only provide people confidence as well as it will give them the ability to save themselves.
4	**Evidence (Theoretical Basis)**	We have studied and researched theoretically as well as practically by referring to different journals , that was part of the literature review along with a industrial visit and onboarding of certified trainer from " The Forge". Following are some of the research papers that we took guidance from: [1] Suwichai Phunsa, Nawuttagorn Potisarn and Suwich Tirakoat, "Edutainment - Thai Art of Self-Defense and Boxing by Motion Capture Technique", *Research Paper*, IEEE, Mahasarakham, Thailand, 22nd February 2009. [2] Sylvain Chagué and Caecilia Charbonnier, "Real Virtuality: A Multi-User Immersive Platform Connecting Real and Virtual Worlds", ACM, Meyrin, Switzerland, 23rd March 2016. [3] Dora Lapkova and Milan Adamek, "Using Information Technologies in Self-defense Education", IEEE, Zlín Czech Republic, 18th June 2016. [4] Tuukka M. Takala, Yutaro Hirao, Hiroyuki Morikawa and Takashi Kawai, "Martial Arts Training in Virtual Reality with Full-body Tracking and Physically Simulated Opponents", 2020 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW), Atlanta, 26th March 2020.

		[5] Wen-Chun Hsu, Hao-Chiang Koong Lin and Yu-Hsuan Lin, "The Research of Applying Mobile Virtual Reality to Martial Arts Learning System with Flipped Classroom", Proceedings of the 2017 IEEE International Conference on Applied System Innovation IEEE-ICASI 2017 - Meen, Prior & Lam (Eds), Sapporro Japan, 17TH May 2017.
5		**Competitive Advantage or Unique Selling Proposition** (Cost Reduction, Process improvement, Attainment of any SDG (Sustainable Development Goal), increase of market share or capturing new market or having superior performance over a competitor. In summary, any striking aspect of the project that compels the industry to invest in FYP or purchase it. Some detailed description is required in terms of how, why when what. You can select one or more from the following dropdown and delete the rest of them). Please keep relevant options, delete the rest of them, and correct the sequence
a	**Process Improvement which Leads to Superior Product or Cost Reduction, Efficiency Improvement of the Whole Process** (e.g. What is the issue is current process and what improvement you suggests)	We have learned from experience that the availability of a VR HMD such as Oculus Rift and Oculus Quest is very important for a smooth development process.Therefore it is highly recommended, that one should not be depenedent only on the resources of a particular lab, and if possible setup the development kit at your personal workspace. Another important aspect of process improvement was the prior knowledge of Virtual Reality and Unity 3D . This helped us alot in many ways possible. Furthermore in the development phase one should always start with integrating VR in the project instead of , first developing the system and then transferring it to Virtual Reality.
c	**Attainment of any SDG** (e.g. How it is achieved and why it is necessary for the region)	Folowing are the list of SDG's that we have attained along with their descriptions: **SDG-3 – Good health and well being** – With the implementation of our project, we ensure that all members of our society have a good health and mental peace . **SDG 4 -Quality Education** – With the help of our project we will be implanting and spreading knowledge about human rights and regulations throughout **SDG 9 – Industry , Innovation, & Infrastucture** – The project we came up with is full of innovation and ideas using latest available technologies to grow and build upon the underlying infrastructure **SDG 16 – Peace, Justice and Strong Institutions** – The sole purpose of this project is to create a peaceful and strong environment where everyone can protect themselves.
d	**Expanding of Market share** (e.g. how it expand and what is the problem with the current market	Since , VR is a relatively new technology in the third world countries , it will take time for the general society to adapt to it. However , our project can be utilized in many different industry sectors such as hospitals, schools, institutes , training centers and many more
e	**Capture New Market** (e.g. Niche market or unaddressed segment)	Curerntly , there are no major competitors in the national market as well as in the international market , however , the technology is relatively new in the national market. So it should be adequate to say that market dominance nationally is achievable

6	**Target Market** (Industries, Groups, Individuals, Families, Students, etc) Please provide some detail about the end-user of the product, process, or service	Target Market for this project are described as: For the conduction of self-defense training in different institutions such as school, colleges, offices and training centers, this simulation can be used to give a real-world perspective and event driven training which can help in providing eager learners to attain the knowledge of self-defense moves and techniques. • For the conduction of self-defense training by the training institutes. Currently, our project is only designed to take physical maneuvers, as with few modifications it can be operated to conduct psychological training. These tests can incorporate objective as well as psychological questions regarding self-protection in a suitable manner in various scenarios.
7	**Team Members** (Names & Roll No.)	Asjad Salahuddin – SE-17066 Sana Hassan – SE-17072
8	**Supervisor Name**	**Internal Supervisor:** Engr.Dr. Raheela Asif Associate Professor, Department of Software Engineering NEDUET. **External Supervisor:** Engr.Dr. Farrukh Arif Director, NED VR Center, Associate Professor, Department of Civil Engineering NEDUET.
9	**Supervisor Email Address**	Engr. Dr.Raheela Asif : engr_raheela@yahoo.com Engr.Dr. Farrukh Arif : farrukh@neduet.edu.pk

Pictures

11	**Video (If any)**	https://drive.google.com/file/d/1sJDPecaa6de3uOCbtoaEozUNuPV6s_Q6/view?usp=sharing https://drive.google.com/file/d/1ZepMh-YsS-dXNfqUjjBBVxs6cayPr0xr/view?usp=sharing