



SOLENT UNIVERSITY
FACULTY OF BUSINESS, LAW AND DIGITAL
TECHNOLOGIES

Research Project Handbook

MSc RESEARCH PROJECT

FOR FULLTIME AND PART-TIME STUDENTS

SOLENT UNIVERSITY
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Implementation of Virtual Reality in Nursing Education

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Abstract

To improve nursing students' learning strategies, this study shows how virtual reality may be used in nursing education. By providing the students with practice scenarios in virtual reality that are analogous to the events they would encounter in the real world, the goal is to increase student confidence.

Theoretical knowledge is applied in nursing education. Patient safety is essential to the nursing curriculum. Nursing students struggle during clinical practice to communicate with patients or other healthcare professionals, make medication mistakes, and decide what actions to undertake in novel scenarios. Patient safety is at danger as a result of all these issues.

However, nurses should always keep in mind the ethical precept of "First, do no harm" when carrying out treatments because it is a fundamental human right. Through experiences that align with their knowledge, skills, and emotional objectives, nursing students can contribute to the development of a culture of patient safety.

Clinical environments may be equipped with mannequins, actual laboratories, etc. Virtual reality simulations assist nursing students strengthen their abilities, boost their confidence, and get ready for clinical practise by demonstrating what it's like to be in a real-world clinical setting and any hazards they could face there. The impact of virtual reality simulations on skill acquisition and patient safety in nursing education has been covered in this section.

Table of content

Acknowledgement.....	iii
Abstract.....	iv
Table of content.....	v
List of Figures.....	8
List of Abbreviations.....	9
CHAPTER 1: INTRODUCTION.....	10
1.0 Psychomotor Skills and Simulations.....	10
1.1 Types of Simulations	11
1.2 Virtual Reality	11
1.3 What is Virtual Reality and It's use	12
1.4 The use of VR Simulation	12
1.5 Nursing Education.....	12
1.6 Pros and Cons of VR.....	12
1.7 Impact of VR Simulation on Patient Safety	13
CHAPTER 2: LITERATURE REVIEW	14
CHAPTER 3: METHODOLOGY	16
3.1 Aims and Objective	16
3.2 Proposed Artefact.....	16
3.3 Method.....	16
3.4 Procedures.....	18
3.5 Project Workflow	21
CHAPTER 4: RESULTS AND DISCUSSION.....	22
CHAPTER 5: LIMITATIONS	24
CHAPTER 6: CONCLUSION AND FUTURE WORKS.....	25
Conclusion	25
Future Works.....	25
Reference.....	25

List of Figures

Figure 1 : Workflow of Project

Figure 2: API Machine Learning

Figure 3 Responses

Figure 4 Responses

List of Abbreviations

VR	Virtual Reality
AR	Augmented Reality
AI	Artificial Intelligence
ML	Machine Learning
USB	Universal Serial Bus
ADB	Android Debug Bridge
ODB	Oculus Developer Hub
SDK	Software Development Kit
DLL	Dynamic Link Library
API	Application Programming Interface

CHAPTER 1: INTRODUCTION

In order to help students develop their cognitive, intellectual, emotional (attitudes and beliefs), and psychomotor abilities and prepare for the workforce, theory and practise are employed in nursing education. The patients' safety is at risk when mistakes are made in real healthcare settings. Therefore, nursing students should regularly practise basic nursing procedures in labs and develop their fundamental psychomotor skills prior to entering clinical practise. Nursing students may gain hands-on experience through virtual reality without risking patients. Without putting patients in risk, nursing students may practise and enhance their teamwork, management, critical thinking, communication, clinical decision-making, and problem-solving skills in virtual reality, which boosts their confidence and gets them ready for real-world clinical practise.

Virtual reality, which is gaining popularity in the healthcare sector, is a cutting-edge method of increasing medical education. Every day on the work, all medical staff members acquire new skills. These experts must keep up to date with developments since medical technology is undergoing revolutionary changes more swiftly than before. That growing knowledge gap limits their ability to provide their patients with high-quality care if it is not closed. Medical AR/VR technology presents businesses with the ideal commercial opportunity. For instance, according to Zion Market Research, the AR/VR market for healthcare would grow to \$5,115 million by 2025. This technology seems to have a promising future.

It is necessary to alter nursing education in order to better educate nursing students for the complex and rapidly changing health care environments due to the fast growth of information technology and nurse workforce shortages. 75,029 competent applicants for bachelor's degrees and nursing postgraduate courses in US nursing schools were turned down in 2018 as a result of a lack of faculty, clinical locations, classroom space, clinical preceptors, and financial restrictions.

Psychomotor Skills and Simulations

To carry out certain activities, people use psychomotor abilities, which are coordinated muscle movements controlled by conscious brain processes. Students put theory into practise in lab settings as they strengthen their psychomotor abilities. Instructors first demonstrate the skills and then let students to put them into practise by themselves and offer them feedback on their performance until they become competent. In lab settings, students develop their critical thinking and problem-solving abilities, assess theoretical information, learn to make observations, and establish a connection between theory and practise. They also gain confidence. They learn how to carry out interventions prior to clinical practise without endangering patient safety through this training.

Nursing students without psychomotor skills are more prone than those with psychomotor skills to feel uneasy and inadequate and to commit medical errors in clinical practice. Helping nursing students learn, grow, and apply their theoretical knowledge of safe care into practice is vital to address these issues. It is advised to use educational tools to do that. Generation Z students have a keen interest in technology and have easy access to knowledge via their mobile devices. Simulators that appeal to the new generation of students are therefore becoming common. Students can safely carry out tasks in surroundings that mimic real-world or hypothetical situations by using simulations. It is efficient and interesting because it teaches

students how to use tools and how to solve problems and make decisions before they enter actual clinical settings where training is challenging, risky, and expensive. Medical education (with cadavers, for example) and pilot and astronaut training both use simulations. Through simulations, nursing students can practise whenever they want without endangering the safety of their patients.

Types of Simulations

High-fidelity and low-fidelity simulations are both employed in nursing education. Three-dimensional organ models, human cadavers, animal models, and standardized and simulated patients are examples of low-fidelity simulations. Three-dimensional organ models are anatomical models used to instruct students in spinal anesthesia, first aid for wounds, and breast inspection procedures, as well as cardiac functions and how to place a peripheral IV catheter. Virtual reality (VR), haptic devices, and image-based, interactive, realistic patient simulations are examples of high-fidelity simulations.

Computerized image- and video-based simulations known as "image-based simulations" aid in the independent learning and development of students' critical thinking and decision-making abilities. In order to teach pupils specific abilities, realistic and interventional simulations—also called partial task trainers—imitate bodily parts. Three-dimensional simulations that feel authentic and interact with users via computers are known as virtual reality (VR) and haptic systems. Haptic systems are used to assess surgical abilities and teach students about laparoscopic and endoscopic treatments. Partially task trainers, also known as realistic and interventional simulations, simulate body components to instruct pupils in certain tasks. Models for intravascular and foley catheterization, stitching, eye and ear surgery, clinical cardiology (auscultation), and invasive cardiology (catheterization) simulations are a few examples of the realistic and interventional simulations. High-tech interactive simulations are virtual patients that use computers to simulate human anatomy and function. These simulations include breathing, talking, eye movement, a pulse, and a heart rate. Virtual reality (VR) and haptic systems are three-dimensional simulations that interact with users via computers and feel real. Laparoscopic and endoscopic interventions are taught to trainees using haptic systems, which are also used to assess surgical abilities.

Virtual reality

A computer-generated 3-D simulation called virtual reality gives the user access to a variety of sensory data so they can interact with items in the environment and feel as though they are physically there. Nursing students can utilise VR to practise their skills in simulated hospital settings. Virtual reality (VR) is more powerful than video display since it emphasises interactivity. Users engage in haptic or keyboard and mouse interactions with one another while wearing data suits and 3-D glasses in VR simulations.

Immersive refers to "plunging into something, and disassociating from reality and entering a virtual world," as well as "the state of being encircled, immersed, and absorbed, the state of being three-dimensional." When using immersive VR, the user

dons a headset and motion-sensing gloves and loses all sense of reality in an environment no larger than a room. Non-immersive virtual reality (VR) is a computer-generated, partially interactive 3D environment that the user controls and navigates using a keyboard, mouse, joystick, and haptic display.

What is VR, and it's use?

Video games were the first industry to embrace virtual reality, and then came industries like manufacturing, the military, aviation, culture, and the arts. Three-dimensional virtual environments in the classroom increase students' motivation to obtain material, use it for learning, and adopt a lifelong learning mindset while also fostering their growth as collaborators. Students can engage with the materials in these virtual worlds and immerse themselves in them through the use of virtual reality. It encourages effective learning and learning retention while appealing to all the senses. VR was initially utilised in the realm of education for astronaut, flying, and military training.

The use of virtual reality simulations in nursing education

In the context of medical education, virtual reality is referred to as a sort of computer-based 3D simulation that gives users the impression that they are in clinical settings where they can hone their abilities without endangering patients. Students can practise as frequently as they like and observe their own mistakes in secure lab environments thanks to VR technology utilised in physical therapy, medical, and nursing education. Therefore, such simulations that encourage active participation enhance learning retention and give participants the opportunity to engage in interactive learning and problem-solving. In nursing education, VR acts as a link between theory and practise. According to research, virtual reality (VR) learning is engaging, allows for active participation through feedback, aids nursing students in learning and skill development, and boosts their confidence and motivation.

Pros and Cons of VR

Students' focus, engagement, motivation, inventiveness, and ability to put theory into practise while learning at their own speed are all increased by virtual reality simulations. Additionally, it gives them the freedom to practise whenever and as frequently they choose in secure and accurate settings without worrying about making mistakes or endangering patients. Because they study in an applied manner, students who take part in VR simulations are more likely to feel at ease, confident, and effective in actual clinical situations. Additionally, they can rehearse risky, expensive, and sophisticated therapies that they are less likely to face in actual clinics. However, designing scenarios and hiring teachers for VR simulations take time and money as well as interdisciplinary cooperation. In addition, extended VR use results in headaches, dizziness, and eye pain.

Impact of virtual reality simulations on patient safety

Patient safety is preventing medical mistakes that could hurt patients. Patient safety requires high-quality nursing education as a prerequisite. The quality of nursing education is improved by simulations in general and VR in particular. This allows students to apply theory, develop skills, and adopt a positive attitude. When carrying out therapeutic interventions, such students are more likely to take patient safety into account. According to research, students who have refined their essential nursing skills in virtual settings are more likely to feel at ease, competent, and less likely to cause harm as a result of their interventions in actual clinical settings.

“Immersive learning and virtual reality experiences offer unique opportunities for learners,” says McMahon. “Cloud-based delivery allows for ‘anywhere, anytime’ access. The availability to practice is nearly unlimited.”

According to a National Institutes of Health research, scientists believe that COVID-19's effects on education, particularly the rising use of virtual reality simulations, will likely remain forever. To teach students how to deliver safe treatment in clinics, VR simulation scenarios should include patient safety standards. The Joint Commission International lists six patient safety guiding principles.

According to research, virtual reality simulations aid students in learning, teamwork, and critical thinking, as well as in identifying uncommon clinical scenarios and communicating successfully with patients. With those abilities, nursing students may treat patients safely, give prescriptions correctly, and identify changes in their patients. Students that take part in VR simulations can ensure patient safety in actual clinics.

CHAPTER 2: LITERATURE REVIEW

Nurse Education Today 110, pp. N.PAG conducted a study on impact of virtual simulation on the recognition and response to the rapidly deteriorating patient among undergraduate nursing students. The purpose of this study was to determine how a virtual simulation intervention affected how undergraduate nursing students identified and handled a patient who was fast deteriorating. focus groups and a quasi-experimental pre/post design were used in this mixed-methods study. There were 88 participants of third- or fourth-year nursing students from five academic institutions located in four different countries (Australia, Canada, England, and Scotland). Students were divided into treatment and control groups at random. The treatment group received a virtual simulation intervention and participated in a focus group. The virtual simulation intervention significantly increased nursing students' clinical self-efficacy and knowledge in identifying and responding to patients who were fast deteriorating. The virtual simulations, according to the students, reduced anxiety, helped them prioritize, filled in any learning gaps, and promoted independent learning in a secure, "low risk" setting. This study demonstrates the beneficial impact of virtual simulation on knowledge and confidence of undergraduate nursing students from four different countries. Virtual simulation is an effective strategy for increasing knowledge and confidence in recognising and responding to the rapidly deteriorating patient among undergraduate nursing students. Virtual simulation, according to nursing students, improved learning, boosted confidence, and sharpened critical thinking skills. Both knowledge and clinical self-efficacy were significantly different between the control and simulation groups following the six-case virtual simulation intervention.

Another study conducted by Nurse Educator pp. E57-E61 said that In nursing, immersive virtual reality (VR) technology is used in digital education. It is crucial to have proof of its efficacy. the usefulness of and obstacles to employing immersive VR in nursing education were examined in this review. The Cumulative Index to Nursing and Allied Health Literature, PsycINFO, Web of Science, and ProQuest Nursing & Allied Health Database were searched in an organised manner. The quality of the studies was evaluated using the Medical Education Research Study Quality Instrument. Results: Nine papers of moderate to high quality that were published between 2018 and 2020 made up the final review. Immersive VR improved learning, cognitive, and psychomotor performance, according to the review. The majority of study participants favored utilizing immersive VR in learning situations with a range of experience elements. The use of technological hardware and software was a barrier (eg, simulation sickness, lack of visual comfort). The analysis validates the use of immersive VR technology in nursing education.

In 2012, FundamentalVR was established in London. It won an Interactive Innovation Award at SXSW 2019 and was named one of Time Magazine's top inventions of 2018. The Royal College of Surgeons of England has approved all of Fundamental VR's simulator-based training programmes for surgeons. The simulations provide a

secure, regulated virtual environment for surgeons in training to practise and enhance their procedures and talents. A tactile feedback feature is also included.

In 2017, Health Scholars was established in Westminster, Colorado. Health Scholars closed its \$17 million Series B financing in January 2020 to support the growth and expansion of its VR content library. Through VR simulations backed by artificial intelligence, their VR training solutions aim to scale life-saving experiences (AI). Emergency care training for adult and paediatric scenarios in diverse contexts is covered by Health Scholars' VR simulations (e.g., pre-hospital or perioperative). By providing focused virtual reality medical training, realistic and accurate visualisations assist in the development of abilities that could save lives.

CHAPTER 3: METHODOLOGY

1) Aims and Objective

Building a clinical virtual simulation ward with VR technology and Machine Learning is the goal of this project, which also seeks to assess the project's effects on nursing students' information retention, clinical reasoning, self-efficacy, and satisfaction with the learning process. This study aims to assess the viability of using virtual reality to teach nursing students in terms of knowledge, skills, satisfaction, confidence, and performance time.

2) Proposed Artefact and Social Impact

Wireless VR headsets are used for completely realistic virtual reality nursing simulations. It provides a link between classroom learning and practical medical training. For judgment calls and successful actions on the job, nurses need the intensive training they acquire during their study. Traditional education has several drawbacks, such as high fees and constrained opportunities. Nurses can benefit from a much more adaptable and immersive option with VR training. Before ever encountering a real patient, students using VR gain clinical experience.

General Skills

- 3.D. modelling.
- Knowledge of DSLR 2D photos and films, as well as VR operating tools.
- Proficiency in using the resources at hand to produce VR content.
- Understanding of hardware and specifications for numerous devices.
- Having practical experience with wearables like the HTC VIVE, Oculus, and HoloLens.

3) Methods:

Let's talk about a scenario where in a person suffers from a chest pain and the EMS services are called, Nurse examines the patient and asks a few questions like How severe is the pain in your chest?, Did you had any such pain before? What did you eat today? Health History, etc these are assessment questions that a nurse will be asking, the next step would be the monitoring phase, the nurse will monitor heart rate, blood pressure, blood sugar level, pulse, temperature, etc

The third step would be the treatment given.

The system should suggest diseases/ ailment based on the assessment and monitoring.

a) Improving effective communication

To guarantee patient safety, all healthcare personnel need have strong

communication abilities. According to research, patient safety is put at risk when there is a breakdown in communication between patients, nurses, and other healthcare providers. Poor planning and missing patient data are caused by a lack of communication, and these issues can lead to incorrect diagnoses and unsuitable treatments. Communication skills are developed by healthcare professionals through high-fidelity simulations. While high-fidelity Simman and virtual patients can communicate, low-fidelity partial body manikins are unable to provide input. Students can collaborate and make precise clinical judgments more quickly and accurately thanks to VR simulations that can talk. Students' communication skills are also improved by interacting with computer-generated patients. Students can learn how to gather patient histories, welcome patients to the clinic, follow discharge protocol and procedure, and interact with other healthcare professionals through the use of virtual reality (VR).

b) Improving the safety of high-alert medications

The six rights—the appropriate drug, the right patient, the right dose, the right route, the right time, and the right documentation—are frequently followed when nurses deliver medications. Patient safety is more likely to be compromised by nurses who do not follow these guidelines, do not know how to give medications, or have never practised on a model. Virtual reality simulations enable students learn by doing interactively while providing feedback. Students can safely give pharmaceuticals by using VR simulations of intravenous drug infusion and delivery

c) Ensuring correct-site, correct-procedure, correct-patient surgery

One of the most frequent mistakes that endanger patient safety is surgery. Students can learn about patient safety using virtual patients and the Surgical Safety Checklist. Students can practise filling out forms for informed consent prior to surgery and the name and location of the surgery. They are able to assess patient results, recognise their limitations, and gain more knowledge through experience in this way. On virtual patients that mimic human anatomy, medical students can treat patients, perform procedures, and deal with consequences. Colonoscopy and obstetric nursing procedures performed on virtual patients are likely to be performed by nurses with superior competence and fewer mistakes. In a virtual reality colonoscopy simulation, nurses conducted the procedure more precisely, safely, and swiftly, according to Kruglikova et al. Students' skills were claimed to have improved by practising obstetrics on a virtual patient, according to Weideman and Culleiton. This outcome demonstrates how nursing students can use virtual patients to see their weaknesses, patient outcomes, and skill development.

d) Reducing the risk of health care-associated infections

Hospital deaths are most frequently caused by infections. Before each intervention, practise good hand and skin cleanliness to stop the spread of illness. The

rate of infections can be decreased by using VR simulations to assist nurses in adopting healthy hygiene habits. The best way to stop the transmission of illnesses is by frequent hand washing. Using simulations to teach students about hand cleanliness and cut down on catheter infections. It is uncommon for students to be required to execute certain procedures in clinics. Nevertheless, students should rehearse them in VR simulations so that they won't feel nervous or have trouble if they have to use them in clinics. This makes it possible for doctors to apply their knowledge and abilities more quickly, which leads to higher-quality care and lower incidence of infections and consequences.

e) Reducing the risk of patient harm resulting from falls

Safe care is something that nurses must deliver because it reflects on the standard of care. To avoid unintentional falls, check that the bed brakes are secured and raise the bed railings. Therefore, they are taught through VR simulators. In their tracheostomy care scenario, Biyik Bayram and Caliskan instructed the student to lower the bed rails prior to the intervention and raise them again following the intervention. If the student omitted this step, she was judged to have failed the task. These role-playing exercises show pupils the many fall prevention precautions that should be used. According to Bursiek et al., clinics with nurses engaged in virtual environments saw a reduction in patient falls. Teamwork's effectiveness in avoiding patient falls was also stressed. According to DeBourg et al., simulation studies helped 285 students develop a patient safety culture and prevent falls. Students can continue to practise fall prevention techniques using VR simulations. In this way, they are prepared for circumstances like these in actual clinics.

4) Procedure:

1. Planning:

The planning and analysis were conducted to implement Virtual Reality in Nursing and various approach to execute.

2. Data Collection: Domain knowledge was an important aspect in the project, what Nursing students have in their curriculum, and how this approach could be implemented in a virtual environment to bridge the gap between academics and practise.

3. Implementation in Unity: Scenarios were created to give a real time experience to the student. The conversation that is needed to be carried between the patient and the nurse. When you construct an app in Unity, it generates an Android executable file called .apk. You may manually install the apk on your Oculus device for testing and debugging by using ADB instructions.

4. Tools and Technologies:

- Development Software: Unity Editor, Visual Studio 2022.

- Operating System: Windows 10(64 bit version only), macOS Sierra 10.10 or higher (x86 only) (supported with limited features)
- Programming Language: - .NET
- Hardware used: - Oculus Quest All in one VR headset (128 GB) and controller.
- Other Technologies: Machine learning.

5. Machine Learning:

To make creating custom ML Models incredibly simple, ML.NET provides Model Builder (a straightforward UI tool) and ML.NET CLI.

These tools make use of Automated ML (AutoML), a state-of-the-art innovation that streamlines the creation of the top-performing models for machine learning scenarios. The data must be imported before AutoML can proceed with constructing the model.

- .Net latest version uses Automation ML for selection of best accuracy algorithm and model building and prediction.
- Data classification, value prediction, image classification, recommendation, object identification, and forecasting are all incorporated in the scenario that is chosen at the beginning. Additionally, there are only a few Anomaly detection and Clustering scenarios available.
- In this case, Data Classification in Local environment is selected.
- After selection of Local Training environment, Input data whether a file or from database is given as input. After selection of data, a Label Column to predict output is selected.
- Now the next steps need to enter time in seconds for training of data, more number of seconds improve accuracy of model, in Training results, the model chosen by Automated ML with Best accuracy and other information is shown.
- After training and finalization of model it will evaluate the model by giving inputs and then predict the output.
- After this process it will generate the code and give options for deployment.

6. Coding:

- Create ModelInput and ModelOutput dataset models in Consumption class
- Consumption class path variable name as MLNetModelPath which is path of MLModel
- When initialization of an object for whatever reason is expensive, It is best to typically instantiate it once and only when it's required. There is an API introduced in .NET Framework called Lazy<T> for this purpose. In this case Lazy<> instance is used to create variable name as PredictEngine as well as method name CreatePredictEngine()

- Consumption class include Predict method which predict value using PredictEngine Lazy instance. It returns Predicted value to calling function.
- It also includes CreatePredictEngine() method which is used to load ML model using MLContext
- Training file includes RetrainPipeline which is used to build pipeline and prepare model by using train data
- Training file also includes BuildPipeline which create actual pipeline based to features and label from dataset
- LibraryCR library will return predicted value to calling function.

7. Development and Testing:

- An essential stage in the software development lifecycle is testing the programme on a real headset before making it available to consumers. This subject explains how to configure the Oculus headset for using a real headset to test and debug the programme.
- The most common method for testing the app on the actual Oculus headset is by plugging in the USB cord. Additionally, Oculus headset can be connected via the Oculus Developer Hub or carry out sophisticated testing and debugging tasks for Android apps using the Android Debug Bridge (ADB) (ODH).
- Oculus Developer Hub (ODH) is a stand-alone companion development tool that integrates the Oculus Quest 2 headset into the programming process.
- The Android Debug Bridge (ADB) is a command-line programme that allows you to install and debug apps, transfer files, and run shell commands on the Oculus headset. It is installed with the Android SDK tools and is stored in the /Android/SDK/platform-tools/ folder.
- ADB is a handy tool that allows you to execute a variety of debugging tasks. Depending on your needs, you may execute a number of ADB commands on your Oculus device.

8. Connecting over a USB:

- The Oculus Headset must be set in developer mode and connect the headset with USB cable to the computer.
- Wear the Oculus headset, then log into the developer account that is intended to use for programming.
- To test the connection, launch the Unity project and then, from the menu, select go to File > Build Settings.
- Select Android from the Platform list, then click Switch Platform. Skip to the following step if the target platform is already set to Android.
- Select the Oculus headset from the Run Device list. If the Oculus headset isn't shown, click Refresh.

5) Project Workflow:

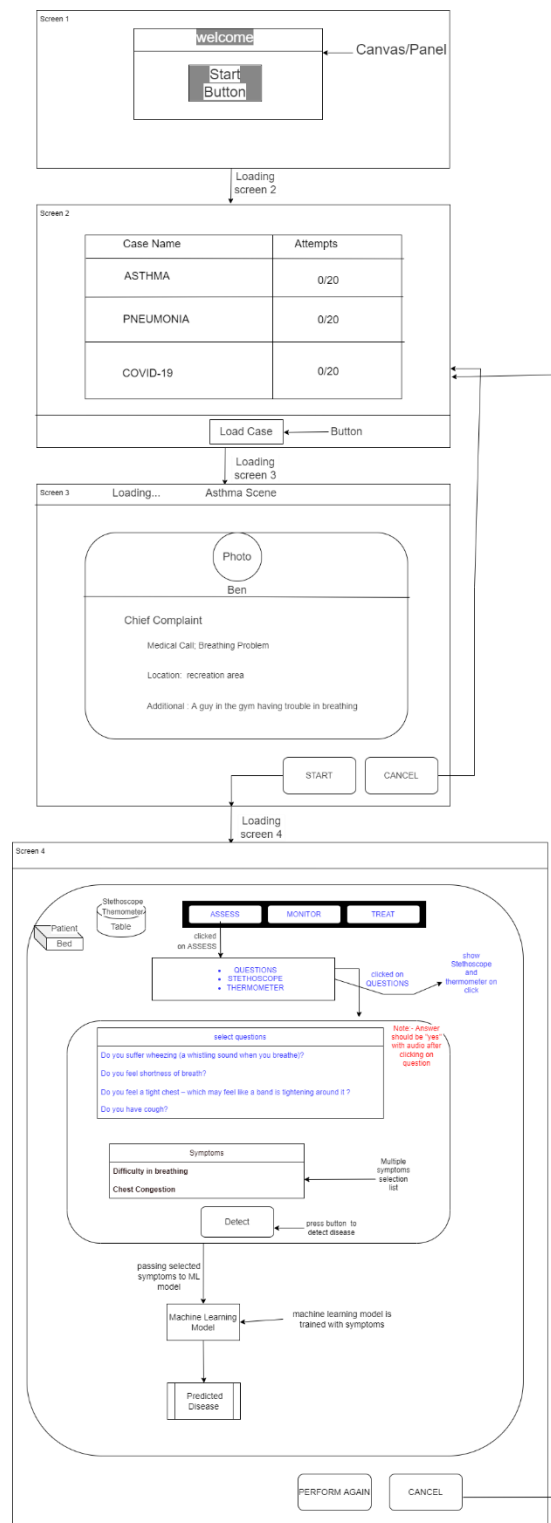


Figure 1

CHAPTER 4: RESULTS AND DISCUSSION

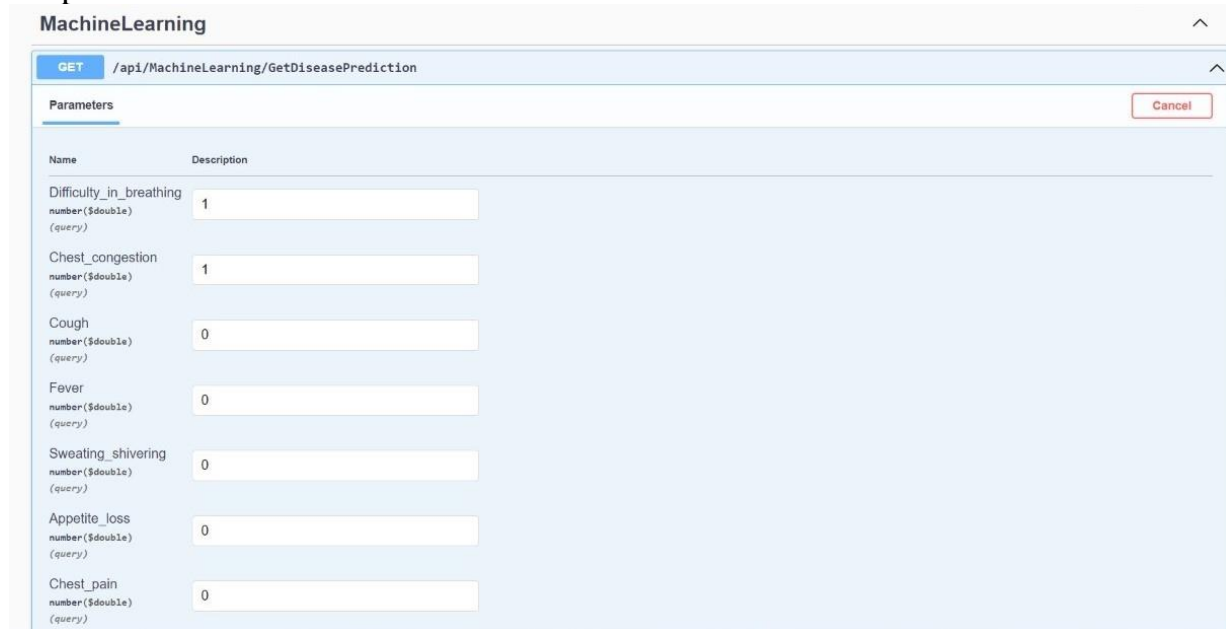
Virtual reality (VR) and augmented reality (AR) are sweeping the healthcare business. Adapting real-world patient scenarios for virtual use may be creative, successful, and enlightening. Utilizing immersive VR resources is now easier than ever before, thanks to the widespread availability of improved VR headset technology.

When medical education is suspended due to distance, pandemics, or expense, professional teaching may be freely available as if it were a video game, thanks to industry-leading VR technology.

This research will highlight the importance of virtual reality in the future of healthcare innovation.

Think about the following virtual reality (VR) scenario: the virtual patient is shown as frightened and recovering from the shock of an accident. While relaxing the patient, the student must concurrently check vital functions. To complete the activity, student must utter certain terms, which the leader can programme. The student will learn the appropriate phrases to speak in a circumstance when empathy and awareness are required, just like a video game quest or typical evaluation.

Output:



The screenshot shows a web application interface for a machine learning model. The title is "MachineLearning". The URL bar shows a GET request to "/api/MachineLearning/GetDiseasePrediction". Below the URL bar is a "Parameters" section with a "Cancel" button. The parameters are listed in a table with columns "Name" and "Description".

Name	Description
Difficulty_in_breathing number(\$double) (query)	1
Chest_congestion number(\$double) (query)	1
Cough number(\$double) (query)	0
Fever number(\$double) (query)	0
Sweating_shivering number(\$double) (query)	0
Appetite_loss number(\$double) (query)	0
Chest_pain number(\$double) (query)	0

Figure 2

number(\$double)

(query)

0

Sore_throat

number(\$double)

(query)

0

Running_nose

number(\$double)

(query)

0

Diarrhoea

number(\$double)

(query)

0

Execute

Clear

Responses

Curl

```
curl -X 'GET' \
  'https://localhost:7066/api/MachineLearning/GetDiseasePrediction?Difficulty_in_breathing=1&Chest_congestion=1&Cough=0&Fever=0&Sweating_shivering=0&Appetite_loss=0&Chest_pain=0&Taste_loss=0&Smell_loss=0&Breath_shortness=0&Sore_throat=0&Running_nose=0&Diarrhoea=0' \
  -H 'accept: text/plain'
```

Request URL

```
https://localhost:7066/api/MachineLearning/GetDiseasePrediction?Difficulty_in_breathing=1&Chest_congestion=1&Cough=0&Fever=0&Sweating_shivering=0&Appetite_loss=0&Chest_pain=0&Taste_loss=0&Smell_loss=0&Breath_shortness=0&Sore_throat=0&Running_nose=0&Diarrhoea=0
```

Server response

Code	Details
200	Response body

Figure 3

```
curl -X 'GET' \
  'https://localhost:7066/api/MachineLearning/GetDiseasePrediction?Difficulty_in_breathing=1&Chest_congestion=1&Cough=0&Fever=0&Sweating_shivering=0&Appetite_loss=0&Chest_pain=0&Taste_loss=0&Smell_loss=0&Breath_shortness=0&Sore_throat=0&Running_nose=0&Diarrhoea=0' \
  -H 'accept: text/plain'
```

Request URL

```
https://localhost:7066/api/MachineLearning/GetDiseasePrediction?Difficulty_in_breathing=1&Chest_congestion=1&Cough=0&Fever=0&Sweating_shivering=0&Appetite_loss=0&Chest_pain=0&Taste_loss=0&Smell_loss=0&Breath_shortness=0&Sore_throat=0&Running_nose=0&Diarrhoea=0
```

Server response

Code	Details
200	<div>Response body</div> <div>asthma</div> <div>Response headers</div> <div> <pre>content-type: text/plain; charset=utf-8 date: Fri, 09 Sep 2022 10:15:03 GMT server: Kestrel</pre> </div>

Responses

Code	Description	Links
200	<div>Success</div> <div>Media type</div> <div>text/plain</div> <div>Controls Accept header</div> <div>Example Value Schema</div> <div>string</div>	No links

Figure 4

CHAPTER 5: LIMITATIONS

- The system is unsuitable for training practical evaluation abilities like palpation.
- Facilitates various aspects of skill development, yet it might not be enough for all talents.
- Limited capacity to aid in communication skill development.
- Simulators used in situ are rarely used.
- Use in communicating with patients is limited. However, just rehearsing explanations and providing assistance gives the student a chance to express their thoughts out loud and assess their own performance.
- Senior instructors might not take virtual reality seriously because they see it as a game.
- There were certain Limitations encountered in the project. The Machine Learning File that created a DLL Library could not be integrated in the Unity editor due to some version issues.

CHAPTER 6: CONCLUSION AND FUTURE WORK

An applied sort of education is nursing education. Students must therefore complete both lab and clinical practise. However, due to their inexperience, students could endanger patients. Patients' protection and the development of a culture of patient safety are the responsibility of nurses. To learn about patient safety, nursing students should take part in exercises and lab interventions. VR simulations can be made available to nursing students who don't get much of an opportunity to participate in lab activities. According to above studied research, virtual reality simulations aid students in learning, teamwork, and critical thinking, as well as in identifying uncommon clinical scenarios and communicating successfully with patients. With those abilities, nursing students may treat patients safely, give prescriptions correctly, and identify changes in their patients. Students that take part in VR simulations can ensure patient safety in actual clinics, in conclusion.

Future Work

- In .NET DLL library was created, while using ML.NET, the file was not integrated in Unity due to issues, which are expected to be removed in future works.
- Additional diseases will be included.
- Project should be more realistic using 3d technologies.
- Use of deep learning to make it more real time learning process.
- Inclusion of previous Medical history to make it more powerful predictive system.
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