- HCL AppScan;
- AppSweep.

Xulosa

Mazkur tadqiqot ishida mobil operatsion tizimlardagi xavfsizlik muammolarini o‘rganish hamda mobil ilovalardagi zaifliklarni aniqlash usul va vositalari tahlili amalga oshirildi. Va tadqiqot ishi doirasida quyidagilarga erishildi: mobil qurilmalardagi xavfsizlik tahdidlari va ularning ta’siri ko‘rib o‘tildi, mobil ilovalardagi zaifliklar va ularning xavfsizligini baholash jarayoni amalga oshirildi, mobil ilovalar zaifligini aniqlash usul va vositalari qiyosiy tahlil qilindi.

Olingan natijalar asosida esa mobil ilovalar xavfsizligi haqida bilimlarimiz kengaytirildi. Bugungi kunda korxonalar o‘z ilovalarini potensial kiberhujumlar va ma’lumotlar sizib chiqishidan himoya qilish uchun mustahkam mobil ilovalar xavfsizligini sinovdan o‘tkazish vositalariga muhtojdir. Yuqoridagi natijalar korxonalardagi mavjud kamchiliklarni bartaraf etishga yordam beradi.

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CREATION AND USE OF ELECTRONIC EDUCATIONAL RESOURCES IN A VIRTUAL ENVIRONMENT: AN INNOVATIVE APPROACH

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Annotation.

This article proposes an innovative methodology for creating and utilizing electronic educational resources in a virtual environment. It explores the possibilities of personalizing and enhancing interactivity in the educational process by integrating virtual reality (VR), augmented reality (AR), artificial intelligence (AI), haptic technologies, and emotional intelligence systems.

Approaches based on mathematical models and concrete proposals demonstrate the effectiveness of the platform.

Keywords: *Artificial intelligence (AI), Augmented reality (AR), Collaborative virtual environments, Electronic educational resources, Emotional intelligence systems, Haptic technologies, Interactive learning, Mathematical models, Personalized learning, Virtual reality (VR).*

In the 21st century, technological advancement has impacted nearly every area of our lives, and the education system is no exception. Traditional teaching methods have become insufficient in meeting the needs of learners, as they are limited in providing interactivity, personalization, and motivation. As a result, the integration of modern technologies into the educational process has become a pressing issue [6].

Virtual reality (VR), augmented reality (AR), artificial intelligence (AI), haptic technologies, and emotional intelligence systems are innovative approaches that can fundamentally improve the quality of education. These technologies provide learners with interactive and immersive educational environments, making the learning process more engaging and effective [1].

AI-based educational systems analyze learners' knowledge levels and learning styles to offer personalized learning materials. For example, in mathematics, the AI system analyzes the problems solved by the learner, identifies the areas of difficulty, and suggests additional exercises on that topic. This individualized approach enhances the effectiveness of learning [2].

Emotional intelligence systems detect learners' emotional states through facial expressions and voice tone, adjusting the learning process accordingly. For instance, if a learner is tired or feeling down, the system may suggest a short break or offer engaging interactive exercises. This reduces stress and increases learners' motivation.

Haptic technologies allow learners to physically interact with virtual environments. For instance, medical students can perform virtual surgical procedures using haptic devices, improving their practical skills. Similarly, in chemistry, learners can conduct experiments in a virtual lab, safely working with reagents [9].

Collaborative virtual environments enable learners to work on projects together, sharing knowledge and experience. For example, students from different countries can gather in a virtual classroom to collaborate on scientific projects, fostering teamwork skills and promoting global collaboration. Mathematical models and AI algorithms play a crucial role in optimizing the learning process. For instance, using Markov Decision Processes (MDP), it is possible to determine an optimal learning strategy based on the learner's knowledge level and needs. This model analyzes the learner's state at each step to determine which learning material should be presented next.

$$\pi^* = \arg max_{\pi} E\left[\sum_{t=0}^{T} \gamma^t R(s_t,\ a_t)\right]$$

$\boldsymbol{\pi}^*$ – is the optimal policy, which determines the best sequence of actions for the agent;

$\mathbf{arg}\,\boldsymbol{max_\pi}$ – is the operator that finds the policy (π) yielding the maximum value;

$\boldsymbol{E}$ represents the expected value, which denotes the average reward that the agent can receive across all possible states and actions;

$\boldsymbol{\sum_{t=0}^{T}} -$ is the operator for summing over each time step (t);

$\boldsymbol{\gamma^t}$ – is *the discount factor,* usually within the range [0, 1]. It is used to discount the value of future rewards. For instance, the smaller the γ, the less the agent values rewards in the distant future;

$\boldsymbol{R(s_t,\ a_t)}$ – is the reward function given for the agent's state (s_t) and action (a_t) which reflects the reward based on the state and action the agent has taken.

The following diagram illustrates the key components of the integrated virtual educational platform and their interactions. The diagram shows how various components, including artificial intelligence, VR/AR, haptic technologies, and emotional intelligence systems, work together to present an interactive and personalized educational process [3].

Technological innovations play a significant role in modern educational processes. Virtual environments serve as effective tools for enhancing the quality of education, increasing learner engagement, and addressing individual needs.

1. Virtual and Augmented Reality (VR/AR) Technologies: By integrating VR and AR technologies into the educational process, learners are provided with interactive and immersive learning experiences. The student enters the virtual environment through a VR device. The virtual environment is a 3D space enriched with educational content. The interface enables interaction through VR headsets, controllers, and sensors [4].

In the VR environment, the student's movements and interactions with the environment are modeled using physical laws and computer graphics. The motion equations used to represent the student's position and direction are as follows: $p_{t+1} = p_t + v_t \Delta t$, where p_t – t is the position at time t and v_t is the velocity.

2. AI and Emotional Intelligence Systems: AI and emotional intelligence systems provide personalized learning tailored to the emotional state of the learner. The IRT (Item Response Theory) Model for knowledge assessment is as follows:

$$P(\theta) = \frac{1}{1 + e^{-a(\theta - b)}}$$

$P(\theta)$ represents the probability of giving a correct answer, θ is the learner's ability, and a and b are the parameters of the question. Emotion detection algorithms are implemented using convolutional and recurrent neural networks (CNN and RNN).

3. Haptic Technologies: Developing practical skills in virtual environments using haptic devices. The physical interaction model is defined by $F = k \cdot x$, where F is force, k is the stiffness coefficient, and x is the deformation.

4. Collaborative Virtual Environments: Creating virtual environments that allow learners to work together. The model is based on graph theory: $G = (V, E)$, where V is the set of learners, and E represents their interactions.

Methodology for Creating an Integrated Virtual Learning Platform

The integrated virtual learning platform combines modern technologies to make the educational process more effective and interactive [4].

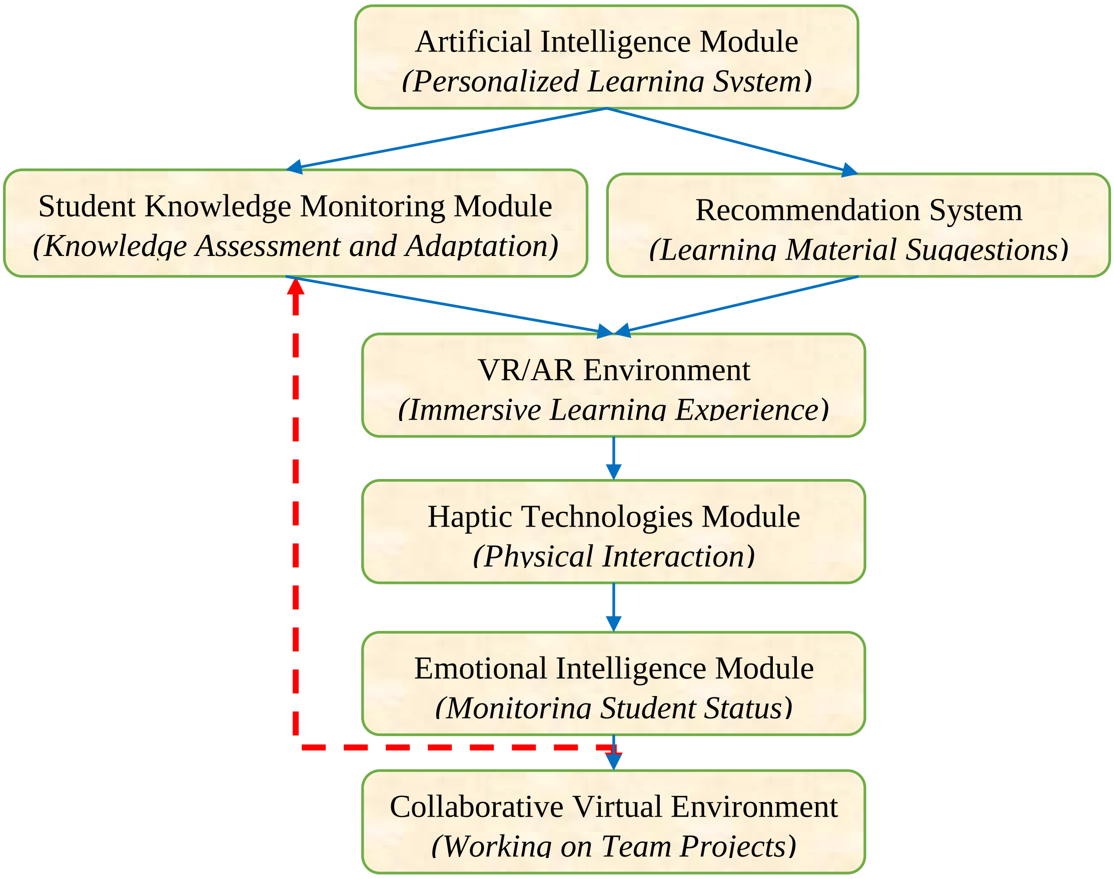
Main Components of the Platform: Artificial intelligence, VR/AR, haptic technologies, and emotional intelligence systems are integrated to create a personalized and interactive learning platform.

1. Artificial Intelligence Module (AI Module): Analyzes students' knowledge levels and learning styles to provide personalized learning materials. Bayesian networks or machine learning algorithms are used to predict the student's knowledge level.

$$P(New\ Knowledge \mid Prior\ Knowledge) = \\ = \frac{P(Prior\ Knowledge \mid New\ Knowledge) \cdot P(New\ Knowledge)}{P(Prior\ Knowledge)}$$

This formula represents Bayes' theorem, which is used to calculate conditional probabilities. The theorem allows us to compute the probability of an event, given that another event has occurred:

- *P(New Knowledge | Prior Knowledge)*: The probability that the student will acquire new knowledge, given their prior knowledge.
- *P(Prior Knowledge | New Knowledge):* The probability of having prior knowledge if the student has acquired new knowledge.
- *P(New Knowledge):* The overall probability of acquiring new knowledge.
- *P(Prior Knowledge):* The overall probability of having prior knowledge.



Integrated Conceptual Model of the Virtual Learning Platform

2. VR/AR Environment: Provides students with immersive and interactive learning experiences. In the conceptual model, 3D models, or virtual objects, serve as educational content, and the user interface plays a key role in enabling interaction with the virtual environment [5].

3. Haptic Technologies Module: Enables students to physically interact with virtual objects. To calculate haptic forces, the following physical equation is used: $F = m \cdot a$, where F is force, m is mass, and a is acceleration.

4. Emotional Intelligence Module: Detects students' emotional states and adapts the learning process accordingly. Machine learning and signal analysis methods are used to identify emotional states.

- **Facial expression analysis:** $Emotion = f_{CNN}(facial\ image)$
- **Voice analysis:** $Emotion\ = f_{RNN}(voice\ signal)$

5. Collaborative Environment Module: Allows students to collaborate and communicate with each other. The proposed modular architecture ensures the integration of components within the platform [7]. The following technologies and algorithms are suggested for implementing the platform [8]:

1. For Artificial Intelligence:
- Algorithms: Machine Learning, Deep Learning.
- Software: Python, TensorFlow, PyTorch.

2. For Emotional Intelligence:
- Algorithms: Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN).
- Software: OpenCV, Keras.

3. **For VR/AR and Haptic Technologies:**
- Platforms: Unity 3D, Unreal Engine.
- Programming Languages: C#, C++.

To demonstrate the effectiveness of the integrated virtual learning platform, consider the following practical applications [10]:

In Medical Education: By using VR and haptic technologies, medical students can perform virtual surgical procedures. The virtual surgery environment consists of 3D models of organs and anatomical structures. Haptic devices, such as haptic gloves, provide the physical sensations of the procedure. The Artificial Intelligence module analyzes the student's movements and provides real-time feedback. Movements are tracked by processing sensor data:

$$H(t) = f_{sensor}(D(t))$$

$H(t)$ represents the student's movements, and $D(t)$ represents the sensor data. Error assessment is carried out by calculating the deviation from the procedural standards:

$$E = \sum_{i=1}^{n} \left(H_i - H_i^{standart}\right)^2$$

In the language learning process: Personalization of language learning is achieved through virtual tutors based on emotional intelligence systems and AI. The virtual tutor analyzes the student's pronunciation and grammar. Using voice intonation and facial expressions, the emotional state is identified. Learning materials are adjusted according to the student's difficulty level. Pronunciation is analyzed through spectral analysis of the voice signal: $S(f) = F\{s(t)\}$, where $S(f)$ is the frequency spectrum, and $s(t)$ is the signal over time. The emotional state is determined by classifying emotions based on voice parameters.

In Engineering, Science, and Education: By integrating virtual reality (VR), augmented reality (AR), and haptic technologies into engineering and science education, students are provided with opportunities to interactively work on practical experiments and projects.

Using VR and AR technologies, virtual laboratories can be created in engineering and science disciplines, where students can conduct complex experiments in a safe and interactive environment. For engineering students, collaborative VR environments allow for joint design and modeling projects. Haptic devices enable students to experience and control physical processes in a virtual environment. This allows students to learn complex physical processes interactively in the VR environment [12].

According to research results, the statistical indicators are as follows:

- Personalized learning approaches can increase students' success rates by 20%.
- Interactive learning methods can increase class attendance rates by 30%.
- Students with practical experience have a 25% higher chance of employment.
- Students with developed teamwork skills show a 15% improvement in workplace productivity.
- Emotional support systems can improve students' academic results by 12%.
- Data-driven approaches increase the efficiency of the educational process by 18%.
- Access to education through online and virtual learning platforms expands by 40%.
- Using virtual laboratories can reduce costs by 50%.

The integrated virtual learning platform has great potential for improving the quality of education, enhancing student motivation and engagement, developing practical skills, and optimizing the educational process. This approach, based on concrete proposals and mathematical models, lays the foundation for innovative changes in the field of education.

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TINNITUS SOOTHESPHERE- PERSONALIZED SOUND RELIEF SYSTEM

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Annotation.

This paper describes different treatment and controlling methodologies used for tinnitus management. In the 21st century, the prevalence of tinnitus is increasing, impacting approximately one in five people. It is a very complicated condition that significantly affects quality of life. Despite the availability of hundreds of tinnitus treatment options, none are very successful. In light of this, there has been a steady increase in studies on tinnitus treatments in the recent past. In this paper, we describe and compare many techniques used for tinnitus management

Keywords: Sound frequency masking, Bluetooth connectivity, Sound therapy, Customizable treatment, Dual modes

I. Introduction

Tinnitus is the perception of sound in the absence of external auditory stimulation. Numerous tinnitus patients describe symptoms such as frustration, annoyance, irritability, anxiety, sadness, hearing issues, Hyperacusis, insomnia, and concentration difficulties. It is anticipated that tinnitus will continue to rise in the 21st century due to the fast-paced lifestyle, demographic shifts, and increased occupational and recreational noise exposure. Numerous attempts have been made to treat or even cure tinnitus, yet no treatment or intervention provides a completely satisfactory solution. There are specific treatment options for certain subtypes of tinnitus. CBT alone or in