Original Research Paper

Volume - 12 | Issue - 12 | December - 2022 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Engineering

TECHNOLOGY ASSISTED MOBILE APPLICATIONS FOR ONLINE EDUCATION -DIGITAL TWINS FOR VISUAL REPRESENTATION OF PHYSICAL OBJECTS

V. Gopi Swaminathan

Scientist 'F' & Additional State Informatics Officer, National Informatics centre Puducherry UT, India

ABSTRACT This paper discusses the new technologies assisted mobile applications for the online learning in the distance and online education. The paper also identifies the reasons for this paradigm shift. This paper discusses the characteristics, features and the system of Mobile learning in the distance education. The paper explains how the visual representation of physical objects is relevant to explain the concepts and influence the modern way of learning particularly in the distance education.

KEYWORDS : Technology, Distance learning, Digital twins, Mobile Applications, visual, physical objects.

Introduction:

In the recent development, the COVID-19 has brought distance learning forcibly to a much wider world. As a result, educational institutions have had to create distance education plans to get teachers and students on board with the available technology as quickly as possible. There are array of software applications and platforms already in existence to facilitate distance education through online, though further improvement is always within the scope to make these tools easier to learn and use.

Distance learning is often discussed as a synonym with online learning. Though, initially the distance learning started to attract students from all over the world, online learning is now preferred as technology provide a spectrum of activities right from resource materials, online classrooms, instant evaluation, revisioning of topics, identification of student's weaker and stronger areas very effectively. Due to the invasion of mobile technologies, the Mobile application has given lot of advancements which are handy as well as "learn from anywhere" concept. Mobile application is defined as "a software solution compatible to use on small, handy computing devices, such as smartphones and tablets, rather than personal computers environment. With the emergence of smartphones, the subject of mobile application has gained attention in many sectors particularly in Distance Education. The major advantage of ease of use of smartphones with internet connectivity has provided a unique opportunity to all levels to embrace the technology to extend its services on 24x7 "Anytime-Anywhere".

Emerging technologies provide a means of personalized study plans and convenient learning. For example, Chatbots provide interactive learning methodologies depending upon the user responses. For more interactive learning sessions like Artificial Intelligence help students with a with a better learning experience from the comfort of their homes.

In this modernized distance learning era, where the mobile applications take a centre stage, one major feature is becoming much relevance which is visual representation as well as linking with Big data and IoT devices for a real time data integration. This requirement will be bridging the gap in the visual representation for any physical object.

Digital Twins

The "Digital twins" is one of the fastest growing technologies in the industry, a virtual representation of a real-world object that can act as a simulation to test its performance and efficacy. This ability will basically bring revolution to the Mobile application in distance learning. The paper presents some use cases of mobile for leveraging the potential of emerging technologies.

The Digital Twin Technology represents physical and virtual model of any object to get a dynamic digital representation. In the Online learning it can help throughout the development life cycle, right from the design phase of the course material to the deployment phase, the resource management can have a complete digital foot print of the object.. The major advantage is the object which becomes the 'connected digital things' generate data in real time, and this helps education section to explain with better analysis with many real time problems. Such analysis helps the researchers to present the problems and explain every hypothetical scenarios. All these will have a greater impact on delivering a better learning experience in online method. The Digital Twins also incorporates Big Data, Artificial Intelligence (AI), Machine Learning (ML) and Internet of Things. These are the keys in Industry 4.0 and are predominantly used as emerging technologies.. When IoT becomes a wide spread technology, the Digital Twins will become more cost-effective and accessible for the users.

Digital Twins in Learning

In the existing distance learning techniques, there is no scope for analysis on real time data. The real time data requires separate data collection exercise particularly in the field of science. As IoT collects huge amount of data from sensors and devices, they also require massive high-speed data streams that are difficult to process, analyze, store, and secure. Normally, IoT with AI tools help to segregate the desired data for the learning various purposes. The visual representation of this IoT data may create necessary paradigm shift of the learning models.

Digital twin technology has the necessary potential of giving visual representation of real time data as well as transforming the conventional chalk-and-talk classrooms to more interesting, interactive experiential learning process. With the real time data, the digital twin technology helps students to explore and understand dynamic system behaviour. It also helps them to get answers to many interesting queries and understand failure modes and conditions better. The technology can be explored for better teaching-learning outcomes to classrooms engagement.

Digital Twins, the virtual representation of the physical assets

Digital Twins are created as digitalized duplicates of any equipment or objects using sensors. These digital assets can be designed even before a physical asset is built. To create a digital twin of any physical asset, the education resource build object repositories collect and synthesize data from various sources including physical data, properties data, and operational data and functionality insights from analytics software. All this information along with necessary AI algorithms will be integrated into a virtual model and by applying Analytics into these models we get the relevant insights regarding the physical object. The consistent flow of data helps in getting the best possible analysis and insights regarding the asset which helps in optimizing the object outcome. The integration of Mobile application with digital twins helps in bringing plethora of visual representation like 360 degree view, internal representation and applying range of discrete or continuous input values for an empirical study by researchers. Therefore, the digital twin will act as a live model of the physical asset or object.

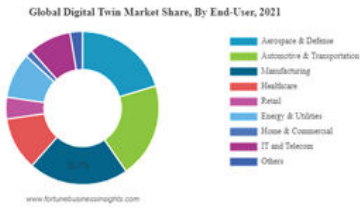
Digital Twin concept is the next big thing in education sector, which helps in accurately predicting the current state and future of physical objects by analyzing their digital counter parts. When implemented, visual representation in experiments can gain better insights on object behaviours, improve conceptual understanding and make better operational and strategic decisions based on these insights. Some of the applications of the Digital Twins in the following sectors.

Mechanical and Automobile Engineering: Digital Twins can be

used in the mechanical engineering sector for creating the virtual model of a connected machine. It captures the behavioral and operational data of the machine and helps in analyzing the overall machine connected features. It also helps in improving the quality of the design of such machines.

Learn Programming: Appealing user interface and sufficient validation checks are some of the key factors for learning the programming. Digital twin implementation can play a key role in augmenting the developer-user experience by creating virtual twins for users during the development of prototypes for them on it. Digital Twins also helps in better planning, security implementation and resource management in an optimized manner.

Medicine: Digital Twins along with data from IoT can play a key role in the field of medicine students from patient monitoring, preventative maintenance and providing personalized health data with necessary comparisons on normal parameters.



Pic 1: Global Digital Twin marked Share by End-user 2021

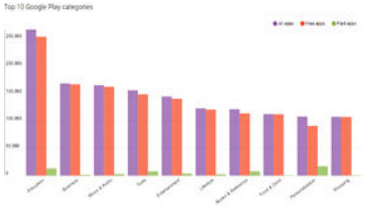
https://www.fortunebusinessinsights.com/digital-twin-market-106246

API integration in Digital Twins

In the Internet of Things world, an application programming interface is an inevitable software intermediary that allows interaction between two systems for sharing information. It makes the IoT devices use the internet for communicating and exchange information and performs the allotted operations efficiently. APIs serve as the logical connectors that allow applications to communicate with each manufacturer's IoT devices. APIs help the devices expose data that enables to transmit data to the mobile applications.

Leveraging API strength in Microservices for building Mobile applications

Mobile applications require to address the on-demand scalability. The integration of microservices help to develop, deploy and test individually. When the application requires to be broken down into smaller groups for, the APIs help to exchange the data among the microservices. IoT uses this strength of API functionalities in microservices for handling big data from various devices. APIs are now integral part of the modern software development, providing the binding tissue that powers all digital products available today. Digital twins heavily rely on this emerging trend of leveraging the API strength for visual representation of real time data from various physical components and databases.



Picture 2 Top Google Playstore categories as on Sep 2022.

Courtesy: https://www.appbrain.com/stats/android-app-downloads

If we look at the graph given in diagram 2, it clearly shows "Education" is the top category among all Apps available in google store as well as Free apps. Therefore, the penetration and usage of mobile technology among the students and in education sector is clear.

Conclusion :

Mobile Applications with Digital Twinning will bring the world new learning environment for the students. The Education 5.0 which embraces automation, data exchange and design technologies will soon occupy the trending space. Digital Twins is at the core of this new educational revolution bringing in unlimited possibilities. It changes the traditional approach of learning and brings in a more virtual system-based design process that brings in the much more efficient role out of any system by understanding its unique features, performance, and potential issues if any. With Digital Twin, a learner can get trained on a virtual machine without spending for a dedicated trainer or simulator. Self-diagnosis and self-analysis with minimal intervention from a manual approach will be one of the major objectives.

In the future, the Distance learning will be a huge data mining where the entire objects referred will have visual component with real time data and the students, and researchers will have ubiquitous system of learning with everything in digital representation.

REFERENCES:

[1] Mobile Learning-A New Type of Distance Education Wang Junfeng Distance Education Research Center of Shaanxi Province Shaanxi Radio & TV University Xi'an City, China e-mail:wangjynfeng@sina.com. 978-1-4244-8035-7/10/$26.00 © 2010 IEEE.

[2] G. Digital Twins Enabled Remote Laboratory Learning Experience for Mechatronics Education Furkan Guc, Jairo Viola and YangQuan Chen* Department of Mechanical Engineering University of California Merced, California 95343 USA {fguc,jviola,ychen53}@ucmerced.edu. 978-1-6654-3337-2/21/$31.00 ©2021 IEEE

[3] Mobile E-Learning: The Choice between Responsive/Mobile Websites and Mobile Applications for Virtual Learning Environments for increasing access to Higher Education in Malawi.