Development of Mobile Application Incorporating Augmented Reality for E-education and Training Systems

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Madhankumar S[1], Prawin Sankar T A[2*], Shibin Thomas S[2], Brundhavani G[2], Prince Paul[2], Vishnu Girishkumar[2]

[1]Assistant Professor, Department of Mechatronics Engineering, Sri Krishna College of Engineering and Technology, Coimbatore, Tamil Nadu, India - 641008.
[2]UG Scholar, Department of Mechatronics Engineering, Sri Krishna College of Engineering and Technology, Coimbatore, Tamil Nadu, India - 641008.

[*]Corresponding author, Email Id: 18eumt071@skcet.ac.in

Abstract.A visual platform to help the learners to enhance their knowledge of understanding. The learners can use the application as an aiding source to increase their visual understanding of knowledge through immersive 3D objects (images) in the real-world. The 3D objects are displayed in a rendered perspective aided by multimedia to be shown to the user in the real-world environment. The end-user uses an application to view the Augmented images in the real-world. The 3D visuals give the users apparently an immersive experience through user interactive environments. Complex concepts in STEM education can be apparently be displayed in 3D visuals with ease, which can improve the understanding perspective of the individual concept displayed in Augmented Reality. In the education system, this style of learning can be drastically improvised using this source of modern technology. The product is a mobile application which can be accessed offline or online according to the need and requirements of the user. The existing educational system can be complemented with this solution to enhance the knowledge and understanding of the users with technical expertise.

1 Introduction

Augmented Reality is an innovative development built over the last three decades that serves a key part in diverse use cases and implementations in all science classifications. Objects that are viewed throughout the physical world become persistent computer-generated data sources. In an AR scenario, the physical reality is not directly affected: it is an interface among the physical environment and simulated entities [1].This information can be displayed and controlled as visual, olfactory, auditory, or haptic. AR requires the integration of virtual and physical knowledge in real time across a multitude of electronic platforms, like mobile phones or tablets, to build this virtual world, which has an effect on the amount of innovations produced for AR[2].Qualitative approach assessment is employed to analyse the basic features of AR technologies in Educational leadership, the teaching methods and procedures used in the research studied, as well as the assessment approaches adopted in the strategies[3].Multiple reports have revealed patterns, benefits, prospects, threats and impacts of this innovation on learning. Consequently, almost all of the earlier research have neglected to examine pedagogies, in any way missing the fact that the effectiveness of the solution relies not just on the technological features of the systems, but rather on the instructional methods to incorporate them[4].Virtual objects are displayed in real world with user interactive positions and control of the object. The object can be controlled by general 3D object control. The primary goal of using Augmented Reality is to display digital objects which are virtual in the real-world perspective. This immersive experience can be interlinked with actual universe in such a

manner that provides an interactive element to the natural setting. As AR emerges, more learners can participate interactively and share knowledge in an improved manner. Augmented reality is being used in several fields of research and conceptual practices. This has been utilized, within and between many, through: navigating (in vehicles, aircraft), defence (image monitoring, making plans), geophysical and geographical research (isometrical charts, landscape assessment), architectural (rehabilitation including its presence of destroyed structures, modelling of ventures), healthcare (visualisation of treatments), Amusement (animated exhibits, meetings) as well as cultural programmes. The thought to be asked now is whether AR technology could be utilized effectively in the teaching of library and knowledge science professionals [5]. Computer Generated Simulations of science concepts and historical content can help learners with better understanding. The visual images can be self-explanatory or user interactive.AR are being defined like an enhancement of actuality by virtual environment like Three dimensional and details. In the manufacturing setting, such material also contains development measures involved, job worksheets and repair orders.The basic elements of the AR environment entail: simulation emerging technologies, sensor system, monitoring unit and host controller[6].The best part of this AR technology is that it kindles curiosity in the minds of the leaners. With the evolution of AR, learners may engage collaboratively as well as construct quite genuinely through information. Instead of being inactive users, learners will become active participants who can engage through the educational environments. Throughout order to enrich students ' learning contexts, it is important to enhance ones sensory and intelligent participation via the use of technology, in particular until trying to understand esoteric and complicated techniques. Augmented reality modules can provide contextualised, merely-in-time guidance; self directed compilation of physical environment visuals and illustrations; as well as responses on learner behaviours [7].Knowing education processes, learning goals, performance requirements and the expertise, abilities and competencies needed in the area of AR can assist to identify patterns, insights and possibilities for more advancement of creative AR initiatives[8].Through AR innovation, the creation of successful and fascinating technology based instructional resources has become feasible. In another side, retaining overlaid details and recognising AR as an invasive technique are few of the key drawbacks of AR applications [9]. Experts and scholars often tried to extend AR to classroom-based learning in topics such as physics, arithmetic, engineering, materials science, astrophysics, and some K-12 or higher education, as well as to incorporate AR through expanded textbooks and learning manuals.In AR based interactive modelling framework which allows users to envision and change simulated premium products via elegant environments.

As previous research about the use of AR in teaching science have always concentrated on studying/educational outcomes, encouragement, and attitude, it's also assumed that perhaps the analysis of such factors may still approach the stage of exhaustion. Focusing on memory problems, experiences and social tasks outside these factors could be more useful in the long run[1]. In today's College, students are open to a range of educational stimuli, and often it is hard to identify and return the favor several principles at the same moment. This framework would both fulfill the intent and allow each student to develop in a specific teaching ability.An AR-based CAD framework allows participants to walk about in a specific 3D space to simulate digital items via HMDs and communicate with others and change digital items utilizing system that alerts. In addition, users may experience the physical country and make maximum usage of actual objects with interaction / methodological approaches[10, 11].Mobile Application-based technology through e-learning can be much more centered throughout the coming years on scientific literacy funded by AR, as this is one of the cutting-edge innovations that are trend-setting. Instituting virtual reality throughout the curriculum will turn a daily learning activity into an interactive virtual activity.AR method gives simulated models in the real-life context and incorporates game features to reinforce textbook content. Mostly as result, students are becoming more engaged with learning interest. AR lets learners to comprehend the knowledge or ideas they have mastered. As AR can indeed be implemented and accompanied by the existing school system, an effective instructional framework can be created.The core ideas behind its study, its guiding criteria, operational processes and the operating method can be clarified step by step together with the safety procedures that really need to be taken can be clearly illustrated utilizing AR. Teaching approach could be further improved by AR quizzes and exams[12].

AR has a tremendous scope for many areas of technology. While it have been widely seen in clinical or defense environments for several years, industrial technologies are mostly viewed as discrete technologies which are only available in a given and fixed workplace[13].New businesses are built

with modern technology and ecosystems. In the high-tech industrial climate, authorized people are designed to attend challenging service and repair operational activities. Various learning strategies assisted by e-learning networks were intended to enhance the abilities of staff.To this end, new innovations such as AR, are changing the way in which learning materials are delivered to qualified professionals[14].

2 Materials and methods

The potential of AR systems can be divided into 3 categories: entity, model and person. Entity are all nonhuman physical environment artefacts (workpiece, equipment, climate, etc.). The model comprises certain digital resources (framework, documents, concept renderings). The person being the learner to really be assisted by its AR device. The AR improves the overall functionality among virtual and personal data leading to enhanced visual representation and regulate. The objects will be actual 3D models viewed by the student made of model with lighting and animation Its simply the model with Animation, Lighting and User Interface. The model will be a CAD model of a specific BASE TARGET, documentation, design drawing. Human will be eliminated in this context as the entire process can be automated. The AR model can be further used to train human workers by creating virtual models of different objects and adding the technical specifications and various functionals. SOLIDWORKS is used to design a 3D model and then the model is exported in FBX format. FBX format of the model is then imported in MAYA and the required animation in given the model and again the model is exported in FBX format with the animation and the model is kept imported in UNITY 3D. By using VUFORIA, an AR Tool Kit the base target (using image) or Ground Target (using ground) or User Defined Target (using any base target) for devices that does not support Ground detection. The programming for the application is done using VISUAL STUDIO the program used is C# developed by Microsoft. All of these is imported separately in same project in Unity 3D is developed using Android SDK and Android Studio.

As AR is being used as a platform for gamification, it would have the ability to serve as a motivating weapon, vast usage in studies so it can be implemented in school and college students text -books and on ground plane. Augmented Reality can be customized according to the need of the learning requirement from elementary schooling level and can be extended up to Engineering domain level. By using Vuforia the target is set as the text book or even as Ground Plain and the 3D models are uploaded for each target and when the student views the base target in the textbook using his AR camera the 3D model of the image can be viewed. And by giving animation to 3D model the exact working of the 3D model can be added and the student can view the working of it in all directing unlike a video all directions can be viewed in every frame.

By implementing Multimedia based animation, it seems like a video which can be viewed in multi directional positions and in high quality. Languages and other content can be kept constant so that the size of the application is reduced to great extent. Learners might well interpret by the AR System book through displaying visuals over the actual sections augmented with sound as well as an expressed storytelling mostly by book's author.Figure 1 shoes the overall Workflow diagram.

Implementations involving object monitoring are mainly focused on the lesser method of the label, that is focused on the identification of pixel values throughout the context of attributes and the designation of adjectives. Such obtained features are being used to apply computer graphics to the physical world[15].Google AR Core is an open source APK provided by Google. AR Core APK (Application Package) can be used to develop Baseless target Detection using which the Augmented Image can be visualized in any surface without any base or reference objects .AR Core can be used to develop cross platform Applications. Using AR Core Baseless Target Detection, the application can be made more interactive by visualizing AR in any plane surface (Plane surface can be complemented with a spatial plane which has features for detection). Before Augmented Reality image (3D visuals) is projected and can be viewed, the surface is intensively scanned for distinct features which acts as a partial reference for the AR image in the Real-World view. These features are captured are

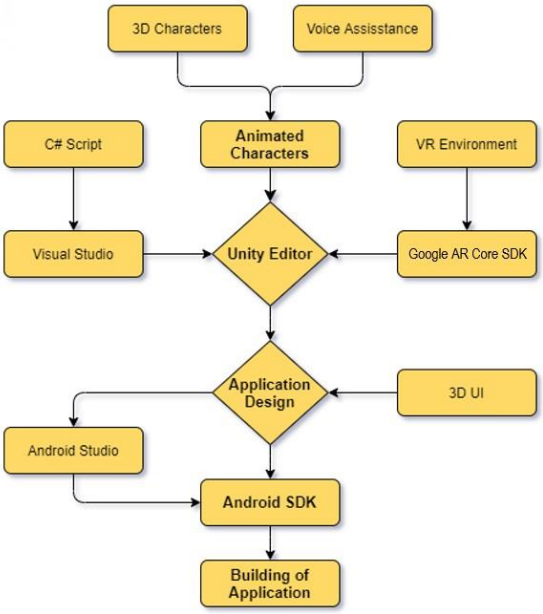

Figure 1. Overall Workflow diagram

2.1 Training Systems with implementation of Virtual Laboratory, Maintenance and Inspection

Over recent times, production firms increasingly encountered a variety of obstacles connected to the still-changing demands of buyers and producers. The goal of the interactive media plans as well as the planned initiatives is to leverage the employment opportunities arising from ongoing effect of fast-moving ICT[16].Sector is fast shifting towards digitalised 'modern manufacturing' using the IoT to develop sophisticated core technology such as condition monitoring or robust computer interaction. AR is the central platform that helps user incorporation into such a structure , providing users via an experience to communicate with the artificial world[17].Augmented Reality Laboratories can be used to train new beginners who have no previous experience in the field. When beginners are recruited, they have less knowledge about the advancements and technicality of unique(special) machines. In few cases they wouldn't have experienced this technology aided platform which can be used to learn about a particular concept i.e. a machine in detail and its various parts of the machine in an augmented environment and self-train with less dependency on external resources. In the Augmented environment they can disassemble every part of the machine, assemble them, and learn each part in detail.By way of AR tools, enables people to discover stimuli and to discover classroom opportunities that which, in certain instances, surpass that provided by conventional laboratory courses[18]. Figure 2 shows the augmented model of some concepts (Crocodile, dinosaur, ant and motor) in STEM Education. Item detection and simulation should be done in real-time so as to enable for further conversational exchange with the programme and lower the impact of failure or blurry vision.Real time technology is established to include constant guidance throughout trainings[13]. Figure 3 and 4 shows the Augmented model assisted by multi-media visuals and Multidimensional simulation of lathe machine in spatial plane

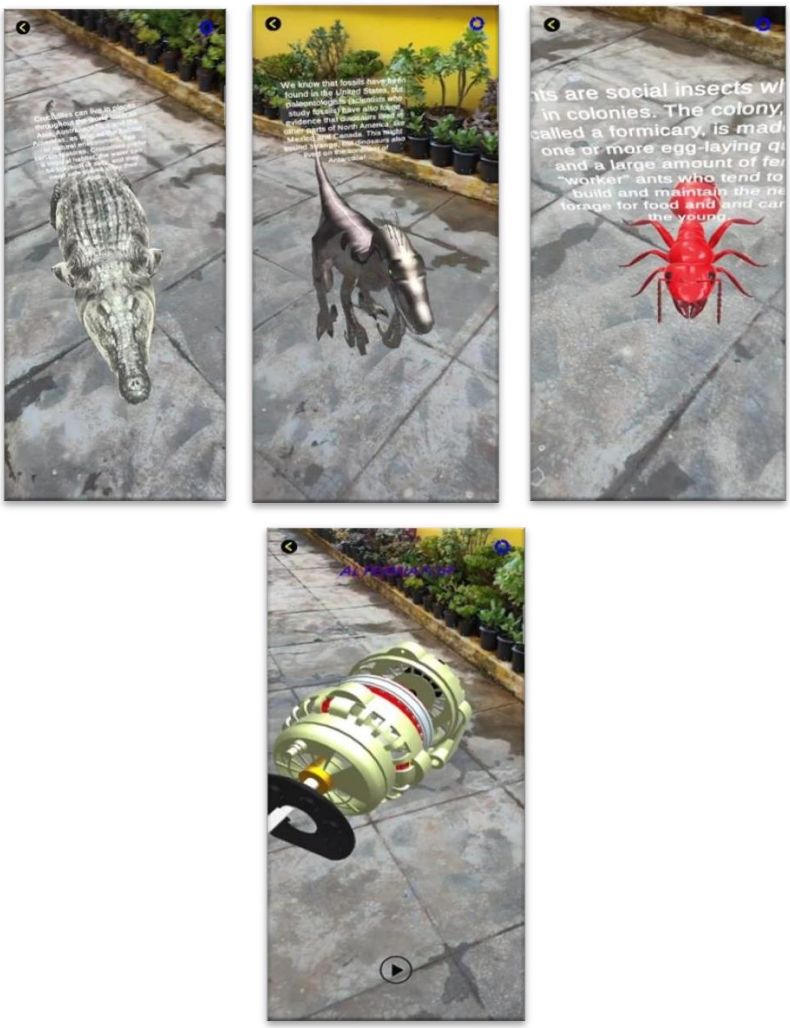

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Figure 2. Augmented model of some concepts in STEM Education

Figure 3. Augmented model assisted by multi-media visuals

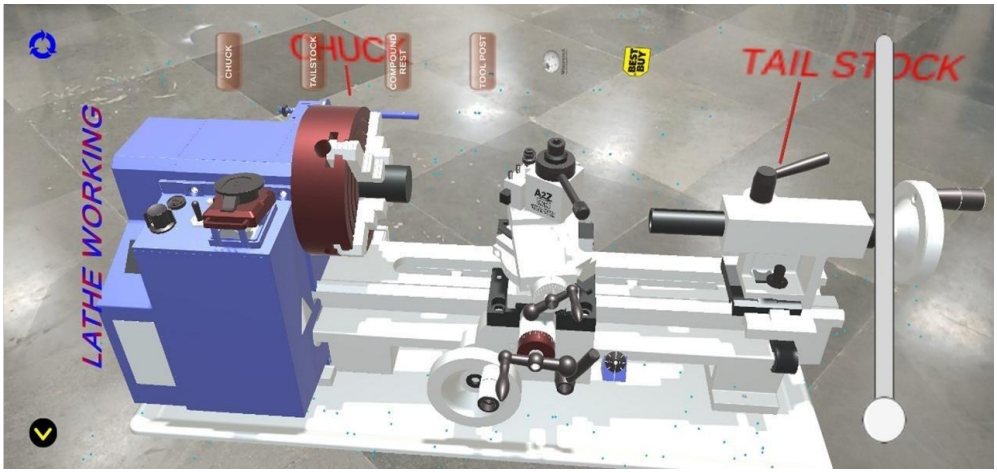

Figure 4. Multidimensional Simulation of Lathe Machine in Spatial Plane (Marker-less detection)

The Augmented environment offers the user an interactive mode of control of the machine or component by performing replica functions of the machine and simulations. They can train themselves even at comfort of their home by just using a mobile device (i.e. smartphone). This can be done with just a mobile but when the hardware is further developed the following use cases can be achieved. This type of application can equip the beginners with required amount of pre-knowledge before stepping into the real environment. AR seems to be able to achieve these goals of crumbling technical equipment, as well as IOT is used to perform studies in such a comfortable world. AR thus splits the boundaries between time and space as well as enables the topic of analysis to still be reimagined.AR adapted to various teaching situations throughout the present study offering adequate framework for evaluating knowledge and skills from components shown in this field, however in addition to cross-cutting responsibilities like: integrative skill sets (assessment and formulation skills , planning and organizational skills, problem-solving, metadata management and decision-making) are established[19]. Figure 5 shows the 3D model of Centrifugal pump with Assembly simulation. Viewing interior components in detail using virtual buttons, Depicting the solution for the ideal functioning of an Electric drive and Simulation Analysis of a system Assembly are shown in figures 6, 7 and 8 respectively.

Figure 5.3D model of Centrifugal pump with Assembly simulation

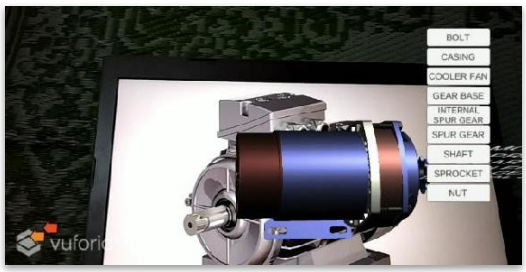

Figure 6. Viewing interior components in detail using virtual buttons

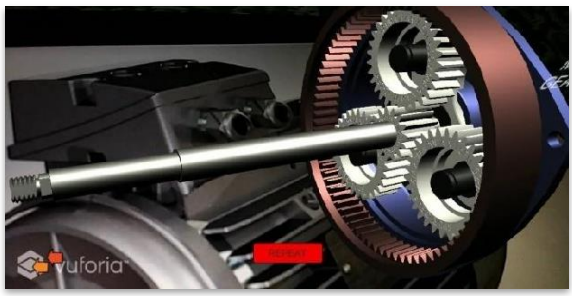

Figure 7. Depicting the solution for the ideal functioning of an Electric drive

Figure 8. Simulation Analysis of a system Assembly

2.2Assembly process guidance

The requirement to incorporate improved realism in industrial learning methods has resulted from the desire to improve the standard of comprehension in order to eliminate mistakes and misunderstandings relevant to modern protection teaching [14]. Inside the sector, production line workers face significant complicated packaging systems and complicated control processes. The ambiguity, combined with demand to finish the assembly inside a small-time frame but with the highest efficiency, makes it impossible for technicians to behave optimal way. Amazing learning instruction is used to help and enable technicians to perform assembly activities in the most effective manner[20].Maintenance and assembly line operations are distinguished by a large number of skilled labor stages.These can time consuming when done manually. Using the effective development of advancement of Industrial environment with IoT (Internet of Things) systems Infrastructure with required Sensor Instrumentation this can be achieved. Details like optimum processing methods, or controlling devices or system variables, may be shown around the operator by AR throughout these operations.

Throughout this situation, there is a significant two - way volume of contact between its single workforce as well as the hardware server on the Company production line, leading to a high degree of interaction or the digital entity, whereby technicians physically attempt to assemble the physical machine and get relevant information via controlling it and getting input via the controlled system.In order to solve the problems of complicated tasks and to create personalized statistical validity, the findings argue the use of intelligent machines. The aim is to get a professional method through understanding of basic intelligence to systematically assess the qualitative characteristics of a AR approach[21].Inspection and renewal activities are a fascinating and ability-filled trouble spot for the implementation of AR. Many operations in this area are undertaken by qualified maintenance team adapting defined techniques to recorded models in largely constant and repetitive settings[22]. Such protocols are usually structured into series of provable activities that address a specific entity at a particular place. In the recent past, attempts to achieve quality safety training in the power industry required extensive and expensive equipment for the recreation of such an environment, which in reality varied widely, given the Technical area of industries and job sites to which technicians or workers are deployed. Marked or Marker-less based systems. On either hand, in the area of automotive framework

management, in specific maintenance, inspection or caregiving responsibilities, real-time process information is quite often needed in order to monitor the nation of a physical model or even of specific equipment, to identify random errors, or to protect the rights of employees. Consequently, AR devices need to be able to incorporate data collected[23].

The virtual interactive tool is composed of virtual buttons, which have meaningful assembly information of the machine in an Assembly-line where a worker is deployed. These virtual buttons along with few interactive features would be the primary control methodology to operate the machine virtually.

3 Results and discussion

Dynamically produced shortcomings of observed defects are compared to points data in the cloud defining the present position of a real-time item. The outcome of the measurement is recorded for each flaw in the virtual representation. The whole method is model-based and there is no living thing-object communication.installation procedures are distinguished by a large proportion of physical work phases and limited lead times. Details like optimal cutting strategy or control variables may be shown to the employee by AR mostly during the procedure. In this scenario, intense bi-directional contact takes place between the human worker and the physical device resulting in a high degree of communication between the person and the entity: the worker physically composes the physical model and obtains knowledge about its mechanism via controlling it and obtaining input by process variables. In the past, attempts to achieve quality safety training in the power industry required extensive and expensive equipment to recreate a work environment, which in reality varied widely, given the breadth of industries and job sites to which technicians are deployed.

AR is perceived to be one among the best technological solutions with the highest opportunity to reshape and complement the existing industrial environment.Of course, to recreate these simulated sites effectively, the same dangers and risks of injury must exist in the virtual depiction and events created.

Augmented reality training solves many of those safety issues inherent in traditional training because the simulated training environment is 100 percent safe. The exercise allows people to practice the routine hazardous activities they are expected to perform safely without any real-life consequences should they make a mistake. And service center managers have a clearer understanding of crew capabilities before dispatching a team to a customer's workplace.

4 Conclusions

Augmented Reality brings Fun (by enabling the learner to enjoy the content), Challenges (setting a task/objective allowing learners to self-understand their level of understanding), curiosity (stimulating learners to explore new concepts). Augmented reality is facilitated through mobile phone. Not just very cutting- edge but Augmented Reality can also be made extremely affordable and accessible as an open-source learning resource. It works on just mobile phone and an app, both of which are available with common people and learners. The goal is to impact as many learners through this powerful learning experience and reach out to every learner. The current education system is a passive and non-interactive learning environment where many of the learners are disengaged. Training by Virtual Reality tends to be elevated rates of interaction, due to increased educational experience and, as a result, strengthened effective training. Technology based knowledge impartment and providing Skill-based training to learners to enable their product towards a longer life. Trying to emulate learners to gain further attention by practicing game elements (able to integrate game features in educational systems. This can be asserted that AR innovations are an innovative educational tool that facilitates agile education on systematic review mostly on work place. Developers can sometimes claim that AR blends reality with insightful elements put in technical devices to construct a modern reality.Digital laboratories are immersive facilities for designing and performing type of approach based on real-world phenomena. It solves the issue of availability and the absence of personal technologies for laboratory-based learning, particularly in science and mathematics. AR, on the opposite side, allows teachers and coaches to accomplish things that they will have never or could not traditionally accomplish in a stable simulated world. Together, all of these engage learners with a curiosity driven and thus are expected to become even quite prevalent in their use and influence throughout the long term.

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