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Augmented Reality for Construction Sector in Desktop and Smartphone Application

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Abstract:- Augmented Reality(AR) is a technology which merges real world environments. The emphasized technologies are like Image/Object recognition and Computer vision can be installed with AR to formulate an interactive and proliferated user experience of the real world. I have schemed to use AR to leverage the power of computing with a web based module and android module to build a system that visualize 3D objects using a predetermined images without a usage of any equipments. The purpose of this system is to boost the learning and understanding of notions such as structures and mechanisms. Instead of reading prolonged manuals, the user can watch and interact with a 3D video mechanism through AR. A regular person learns in a enchanced manner by observing and listening something through Augmented Visuals than reading.

Keywords:- *Augmented Reality, Vuforia Engine, Pattern Equalizer, Unity Graphics System, Web Camera, Computer Vision, Images Targets, Augogram.*

I. INTRODUCTION

Augmented Reality(AR) is an interactive experience of real world entities which integrates with virtual world entities. The AR has been used in many sectors with various purposes such as performing a human tasks as an second hand system and also it shows better accuracy and efficiency of the tasks especially in the auto manufacturing , civil engineering sectors and so on. In civil engineering sector, it has been used as an 3D virtual pipeline to render architecture design from raw to digital data that helps the engineers to scope the building in a well planned construction schemea. AR also can be used as a tool in automobile manufacturing to built the structure and functions of the spare modules in an easier way.

The 'Construction sites' are often noisy, dirty environments. It may results in many imcompatibilities and unnecessay process may occurs during construction process that ensures errors and inevitable doubts araises. This notion is to provide more enchanced visualization of layers of materials and complex installations of drawings. By the implementation of this module the 3D plans and Virtual model holograms are used to leverage the understanding of projects and to execute the projects core. The visualization will help the civil engineers and architects to see through walls and understand the path of building process and mitigate the possibility of errors and even geometric errors.

II. RELATED WORKS

[1] Survey on Augmented reality :- The field of Augmented Reality, in which a 3-D virtual objects are composed into a 3-D real environment in real time. It states some several applications such as medical, manufacturing, path planning, visualization and military applications. It explores the trade-off between optical and video blending approaches. The major problem that has been notified in Augmented Reality systems are sensing errors & registration. This application summarizes current efforts & a starting point for those who are interested in researching or using Augmented Reality.

[2] Survey on Augmented Reality challenges and tracking :- This system represents the classification of different challenges and tracking techniques in the field of Augmented Reality. The competitive functionalities in Augmented Reality are categorized into alignment challenges, Interaction challenges, Mobility/Portability challenges, Performance challenges and Visualization challenges. Augmented Reality tracking techniques are divided into the cores of Sensor based tracking, Vision based tracking and hybrid based tracking. The sensor based tracking is further divided into Optical tracking, Magnetic tracking, Acoustic tracking, Inertial tracking or any combination of these forms Hybrid sensor tracking. Each tracking has it's own unique enhancement and constraints.

[3] Augmented Reality meets computer vision :- Computer vision is based on the availability of large annotated dataset. To reduce the needs of hand labeled images, virtually rendered 3D worlds have recently gained maximum number of users. Formulating realistic 3D content in competitive manner on it's own and require significant user efforts. The proposed system has an alternative paradigm which merges real and synthetic data for learning semantic instance segmentation and object detection models. Capturing the real world images at large scale is easy, cheap and proportionally provides real background appearance without any complex 3D models for environment.

III. PROPOSED NOTION

This application system scopes in formulating high quality 3D video manuals using Augmented Reality. Image targets are tracked using a camera and the 3D models are mapped to the tracked points such as keyframes. These 3D models are the representation of a product or a notion that the user can see on his screen. With the observation of the animations the user may interact with the 3D models which makes the user to understand the mechanism, functions and credentials of a certain application or concept.

IV. PROPOSED APPROACH

These following components are composed in formulating an application that can runs on desktop clients & smartphones such pre-requisites are,

i) Unity Graphics Engine
ii) Vuforia Module
iii) Server
iv) Computer / Smartphones

Unity:- Unity engine is a physical and graphics engine that can be used to develop scalable applications and it can be rendered for multiple platforms with the same codebase. Such platforms are windows-X86/X86-64, liniux-X86/X86-64 and mac-X86/X86-64, ios, webGL, Android. Unity also allows the users to choose a graphic API module such as Vulkan, openGL, openGL ES 2.0, Direct X9, Direct X11, Direct 12, webGL 1.0, webGL 2.0, openGL ES 30. This engine uses c#(web script) for functional logic and internal scripts.

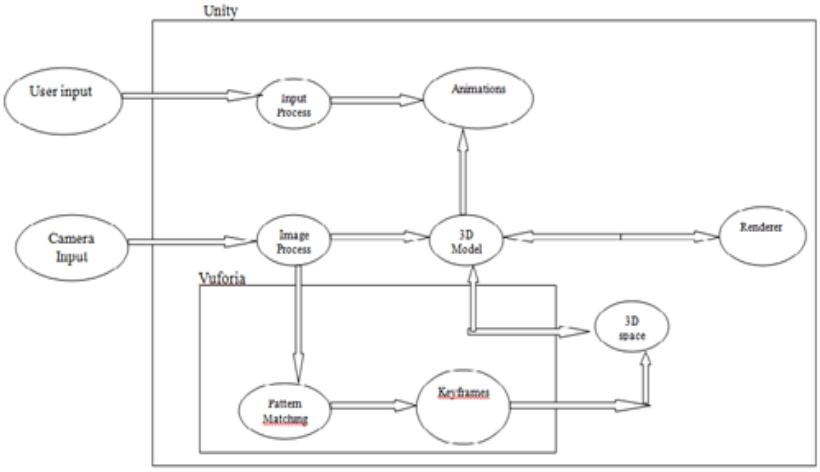

Fig 1:- Module Architecture

Vuforia engine:- Vuforia is a software development kit which has the characteristics of tracking and detection of image targets by using feature detection. This engine which composes the function of coloured cube, it has 4 (four) feature points. In which any point in the image that features the edge of multiple coloured sections. It is available as a plug-in for unity and has been installed already on the engine with the unity engine release version 2017.1, 2017.2 and beta version. By the usage of vuforia engine it is possible to formulate a dynamic object recognition and can leverage images, environments and 3D models to a well development flexibility.

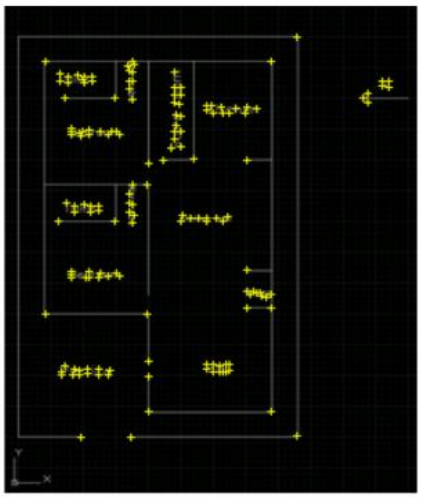

Fig 2:- Tracked Keyframes of Plan1

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Vuforia Server:- The vuforia API which enables the user to manage their own content management systems (CMS) with the vuforia cloud recognition and vumark generation. Vuforia API may provides the user to upload the image target to a cloud recognition database and it enables to add metadata and monitor the database status and targets. This API can be used for developing CMS(Content management system) to make contact with the vuforia cloud recognition service.

Computer / Smartphones:- The unity graphics engine offers a variety of developmental platforms such as windows platform, Android, Ps4, Xbox and so on. For this proposed I have developed an augmented reality application for android and windows. The androids scopes the specifications of 32-bit compression and with the enablement of vuforia license configuration. To the prespective of windows platforms the development build scopes x64 and x86-64 architecture of an execution file. Before the build of this augmented reality application the vuforia and augmented reality core is implemented. Then the enablement of AR core implementation they build may succeed. This application requires camera permission for android and web camera for windows.

Fig 3:- Tracked Keyframes of Plan2

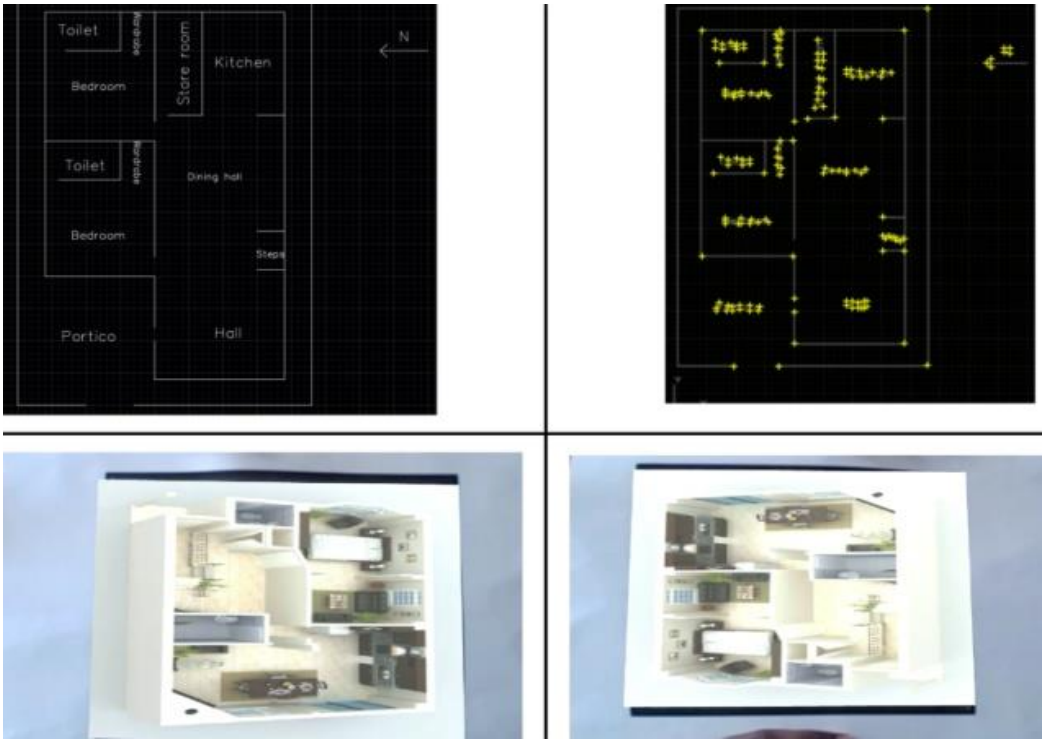

Fig 4:- Raw data to Augmented Reality data of plan1

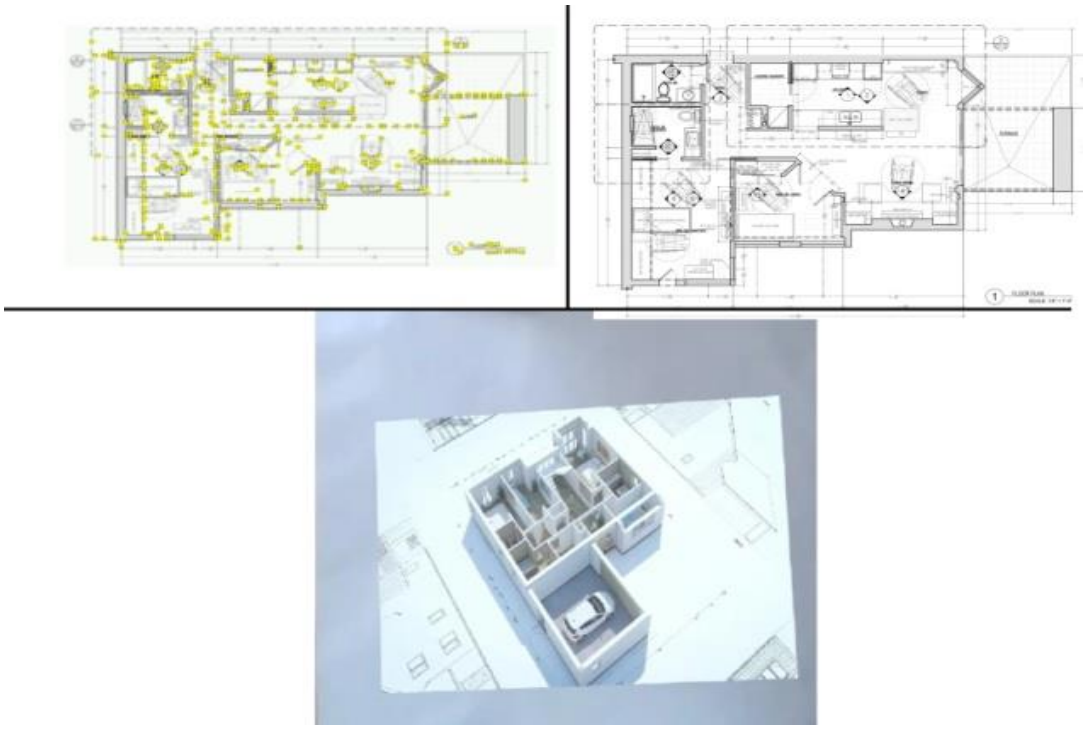

Fig 5:- Augmented Reality Visualization of Plan2

V. MERITS AND DE-MERITS

A. Merits:-

- 3D object tracking in video with Augmented Reality is well suited for ubiquitous learning.
- Augmented Reality are low cost as compared to permanent or special purpose augmented reality technology.
- To experience augmented reality technology many people can own their own necessary hardware.

B. De-Merits:-

- Limited amount of content can be resided in the application memory usage.

VI. CONCLUSION

By the development of this system and the usage of augmented reality with this application which helps to leverage learning and understanding of a product notions for civil engineering sectors. In construction sectors, this system will helps the engineers and architects to understand the raw plan of construction pipelines into digitalized animation models. It makes the engineers to construct the building in a more modernized and proficient schemes. This system aims at formulating and helping better training systems, 3D user manuals and interface user and 3D model interaction materials that will assist upgraded learning and training for the civil engineers and architects.

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