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Augmented Reality Based Construction Module for Floor Capacity Estimation

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ABSTRACT
Augmented reality is widely used technology to overcome with space and cost problems. Civil engineering stream is looking to use computing applications and software. Proposed system is defined to identify how much weight can be hold by the building floor. It will estimate the capacity of the floor by considering augmented reality data only. In augmented reality, just architecture plan is needed to identify its floor capacity estimation. Proposed approach defines the capacity of floor in terms of weight unit using considered parameters as type of material used in construction, area of the floor and area of the object with respect to the material.

Keywords :— Augmented Reality, Material strength, Floor capacity

I. INTRODUCTION

Augmented Reality (AR) is a enriching technology to the real world with digital information and media, such as 3D models and videos, overlaying in real-time the camera view of your Smartphone, tablet, PC or connected glasses [1]. It is using technology to superimpose information on the world we see. This is rather different from virtual reality. Virtual reality means computer-generated environments for you to interact with, and being immersed in. Augmented reality (also known as AR), adds to the reality you would ordinarily see rather than replacing it [2]. Augmented reality brings out the components of the digital world into a person's perceived real world. Augmented reality is often presented as a kind of futuristic technology, but it's been around in some form for years. Augmented reality has many applications. In real life, Augmented Reality is used for military, industrial, and medical applications. The current world of augmented reality deals with live video imagery which is digitally enhanced with computer generated graphics. The military uses augmented reality to assist men and women making repairs in the field. The Heads-Up Display (HUD) is the typical example of augmented reality when it comes to military applications of the technology [3].

The gaming industry is moving games outside like the old days…equipped with the wearable head gear of course. Navigation applications are possibly the most natural fit of augmented reality with our everyday lives.

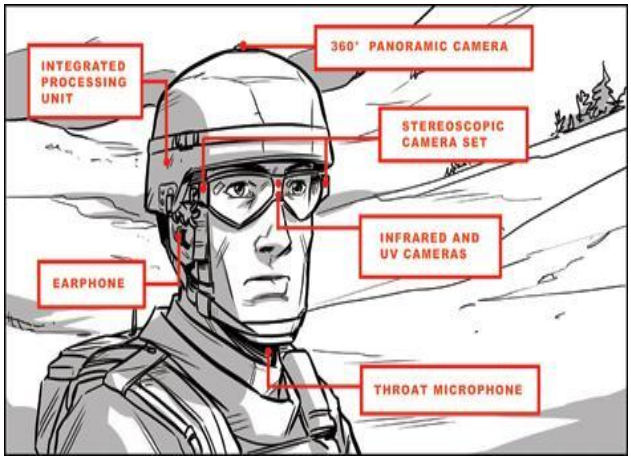

Fig.1. Considered AR components [4]

Moreover, there have been really interesting advances in the medical application of augmented reality. Medical students use the technology to practice surgery in a controlled environment [6].

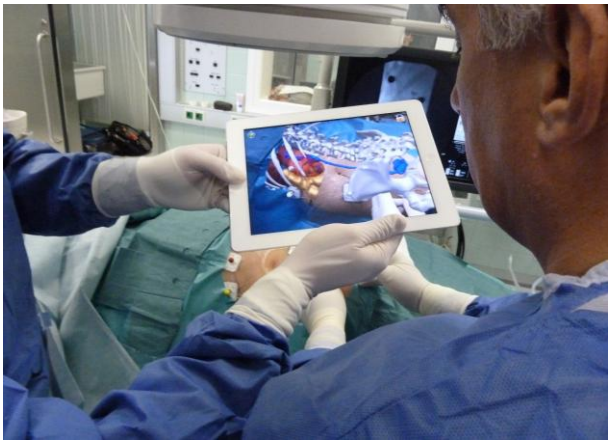

Fig.2. AR in medical field stream [6]

II. EXISTING AUGMENTED REALITY BASED APPROACHES

Some basic augmented reality based approaches lie in the field of navigation, medicine, gaming, education and construction. Examples of some approaches are: Visualizations, which aid in explaining complex medical conditions to patients. Augmented reality can reduce the risk of an operation by giving the surgeon improved sensory perception. Secondly, enhanced GPS systems are using augmented reality to make it easier to get from one point to another. This takes place with the help of phones or goggles. For instance, a user might wear translucent goggles or view the screen of a camera equipped mobile device where they can see the real world as well as strategically placed computer generated images.

When it comes to construction, an oft-cited use of augmented reality came in the aftermath of the 2011 Christchurch earthquake in New Zealand. The University of Canterbury released city view AR which enabled city planners and engineers to visualize buildings that were destroyed in the earthquake. It gave planners a great reference to what used to be there while also letting them gauges the devastation the quake left behind [7].

III. PROPOSED APPROACH

According to our approach, in the technology of augmented reality a user can place a 3D model in context, viewable through an iPad, iPhone or any android device, whether on a 2D set of plans, in front of an image of your project's site. Users focus on a given design or plan file with the camera on their iPad, or phone; the app then recognizes the design, and the screen overlays a virtual model of what the project will look like upon completion. Not only that, but the user will also be able to detect the capacity of the flooring , that is how much weight can the different types of building material bear. According to this the user or customer can detect or place furniture and make changes in the room as per he or she wishes, keeping in mind the capacity of the building material.

A) Augmented reality in construction

With the help of advanced augmented-reality technology such as computer vision and object recognition, the information about the surrounding real world of the user becomes interactive and able to be digitally manipulated. In augmented reality, computer software must derive real-world coordinates, independent from the camera or from camera images.

Augmented reality in construction and architecture projects involves placing a 3D model of a proposed design onto an existing space using mobile devices and 3D models.

Its utilization matured in the AEC industries in the past five years when contractors such as Seattle's BN Builders began using it to show clients proposed designs in the context of existing conditions using iPads and other mobile devices on a construction site.

B) Construction module approach

Some of the basic building material including Granite, Wood, Concrete while making changes the user has to keep in mind the following 3 factors:

1) Floor capacity
2) Materials dependency
3) Defined capacity

Table.1 gives an example of the use of materials for making any kind of changes or adding furniture in the room with the help of virtual images seen on the screen of the device. Suppose capacities for granite, wood and concrete used in the construction are X, Y and Z respectively.

Table.1 Total load with respect to area

Material	Dimension	Total load
Granite	10 by 10 by 10	1000 cubic metre *X
Wood	9 by 8 by 8	576 cubic metre *Y
Concrete	10 by 10 by 10	1000 cubic metre*Z

With the help of this additional feature, the user can not only see the specific room or part of the building but will

also know how much weight can the room bear. In this way, Augmented reality will help user in making changes in the upcoming room structure accordingly.

C) Proposed theory with augmented reality

Three main parameters are considered in proposed approach. In procedure, camera module is used to take snapshot of architecture plan. By reading components of architecture plan, it will automatically generate augmented model based on its applied components. In proposed approach, two things are focused. First is strength of material and another is geometric calculations of considered object. Strength of the material is considered to define the capacity of the floor. For this, user needs to define which material is used like steel, cement, brisk, soil and others. In proposed approach, database includes the table with respect to the material strength.

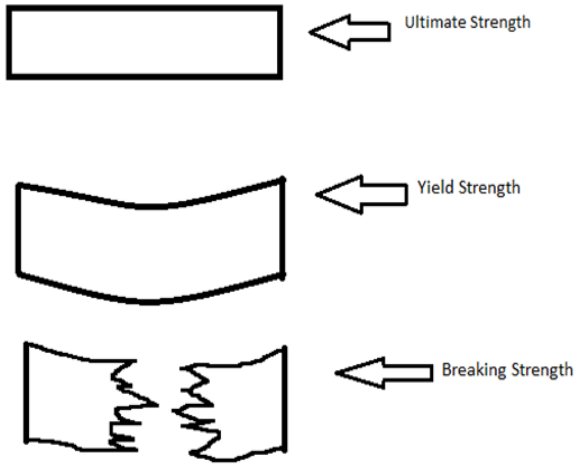

Fig.3 Types of strengths of material

Area of the material is considered which will be kept on the floor. Based on augmented model, its area will be calculated based on which its volume will be calculated to identify its actual weight. Types of strengths are ultimate, yield and breaking strength. Ultimate strength is the strength which is the normal level of the floor at which floors area can remain contestant without affecting physical changes. Yield strength is the strength which can bend the floor to maximum capacity. And Breaking Strength is the maximum capacity of the floor after which it can break down. Architectural plan will be captured by camera. Based on camera components, its augmented reality based model will be generated. Material option will be made available out of which user needs to select the type of material applied in construction with respect to quantity and area. Based on focal length, floor area will be calculated.

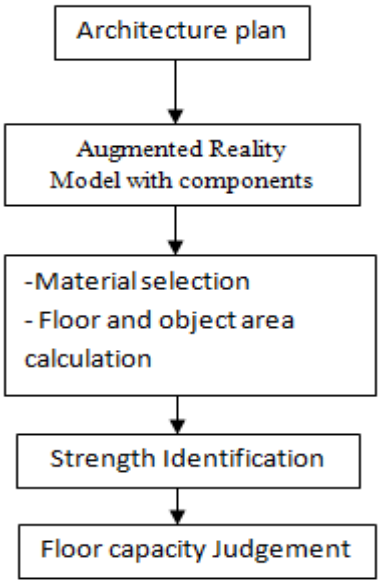

Fig.4. Proposed approach working

Object has to be selected whose area will be calculated based on foal length identified by the camera components. Based on material selected and area of the object considered, strength of the floor will be calculated. It will define what is the capacity of that floor is. Security needs to be checked in case of cloud or using different security techniques [8].

IV. CONCLUSION

To understand actual capacity of floor, cost, efforts and space need to be applied. By proposed approach, all these drawbacks are overcome. Proposed approach with augmented reality improves the existing estimation approaches. Same approach can be applied in different aspects also to calculate the weight estimation on particular area.

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