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Application of Online 3D Visualization in Agricultural Management

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Abstract:-Technologies have greatly shaped the activities in farming. In this context, agricultural information technology has brought about significant change in agriculture development, especially the adoption of Information and Communication Technology (ICT) tools in agriculture farming, including the 3D visualization technique in agriculture management applications. The 3D visualization has been a major driving force with replacing human labor and converting the earliest traditional farming methods. Therefore, good plantation management is vital for the development of agrarian technology. Good agricultural management also rests upon the ability to make right decisions. This study aim is to investigate the suitable issues of managing agriculture especially a coconut plantation and to reflect these issues to develop an online 3D visualization technique for coconut plantation management. The research attempts to contribute to a better understanding of how 3D visualization technique can be used to manage coconut farms efficiently. The online 3D visualization technique is specifically constructed to ensure the research objective of the study.

Keywords:- *3D Visualization; ICT; Agriculture; Management.*

I. INTRODUCTION

3D representation is nothing but the capacity to draw in virtual world by using 3D desktop models to stimulate the real world. In the context of agriculture, 3D visualization systems play an important role, making information flow and dissemination better through 3D technologies; 3D visualization system has developed significantly, thus providing us better views and better information [1, 2]. Nowadays, 3D visualization techniques are more used than the 2D techniques in the information visualization area, especially in agriculture. A significant amount of work has been published in this area, but little work has been done to study the visualization discipline [3]. Hence, the inclusion of 3D technology in agriculture is about to change the whole process of farming. So, make 3D visualization work for you [4]. In agriculture, it is understood that the benefits of using a 3D visualization system play an important role, making information flow and dissemination better through 3D technologies.

Moreover, [5] mentioned that 3D visualization is truly a novel idea as it provides analysis capabilities and can help users, especially in agriculture, to analyze and visualize agricultural environment in 3D form with online capabilities, giving farmers new ways to increase yields.

Besides that, the K2V [6] also described about the powerful ability of serving 3D visualization applications, provide platforms for integrated web-based 3D modeling and visualization. In an another study, [7] and [8] concentrated on the improvement of 3D visualization techniques and revealed that 3D visualization models have a high information potential for a variety of application fields. Challenges that arise in leveraging 3D visualization is obvious, particularly in integrating the 3D into the farming management; clearly, these challenges need to be managed to harness the untapped potential of adapting such technologies [9].

Similarly, [10] demonstrated that precision farming such as the use of a web based 3D terrain visualization for remote monitoring and farm management is the key to better crop yields. However [10], therefore, was developed as an application that runs on a local machine. Moreover, agriculture professionals are not typically trained in the use of remote sensing technology for analysis and modeling of land use and resource management such as terrain analysis and soil-landscape modeling.

Likewise, in their research [11] stated that farm management and spatial information systems are great decision support tools to help users especially farmers for their advance planning of crop management. Concisely, [11] examined a web-based information and decision support system with 3D visualization tool to empower community farmers and farm managers to define their own needs especially in planning processes. Thus, the research was restricted to test the suitability of the data model to perform 3D spatial analysis.

Additionally, [12] developed the “Uganda Rural Agricultural Information System (URAIS) Model" as a central hub/utility or framework to guide agricultural

information processes to access agrarian information. Similarly, [13] described various modeling approaches and their integration in multiple domains, such as web-based 3D visualization in spatial context to facilitate urban decision process. [14]Proposed a smart low-cost imagery vision system known as the Unmanned Aerial Vehicle (UAV) for oil palm plantation management. However, commercial UAVs are especially costly for oil palm plantation management.

Further,[15]proposed an online 3D visualization technique using game engine technology to facilitate fertilizer and irrigation management in oil palm plantations. Terrain information could also be visualized in a 3D environment. They suggested that future studies to develop a complete system by utilizing the game engine technology for online applications that are not completed yet.

In a similar way,[16]introduced a web-based virtual globe system to allow Web-scale access big climate simulation data. The proposed server-client architecture platform did not require the installation of plug-ins. This platform provided strong support for scientists to test models and make hypotheses validations, as well as for the public to better understand different components of the system and its interactions. It can also be extended to enable data visualization in various domains, such as oceanography, weather, and geology.

There are many incredible tools available for visualizing data which can output both images.The online 3D visualization framework is fundamentally associated with the monitoring of information to support decision-making processes. Reliable data and information are important in management decisions; therefore, it is fundamental to equip farmers with the tools necessary to make the right farming decisions, online 3D visualization in particular. In such situation, this has motivated the present study. Hence, this study attempts to develop an online 3D visualization technique to address the issue of managing coconut plantation.

II. RESEARCH METHODS

The main purpose of this study is to develop an application of online 3D visualization system based on unity3D game engine technology to provide alternative to current free and commercialize 3D based visualization applications. The most widely used Unity 3D with game engine can be utilized for developing the system. The center development apparatus is Unity 3D which can undoubtedly convey the 3D landscape visualization into the web server, in which unity 3D give alternatives to send to different platforms, for example, portable mobile and online based. By utilizing the game engine capability to create this kind of system, the information gathers from actual coconut palm plantation data such as area of the plantation will be view virtually and accessible on the internet,the information of plants in 3D form to farmers (like the name, distribution of water, solar radiation and soil type or soil pH of the area or soil materials on the field, air pressure etc.), the information gathers from actual coconut plantation data such as tree location, number of trees,ripe fruits status,weed control and pests and satellite images and selection of unproductive and old coconut palm with area of plantation, and management practice data could be used. As the real field data could be used for real world simulation in the future system, it is vital for decision makers to understand what information that they can gather for decision making process.

The game engine is utilized to simulate the management of a coconut palm plantation, as using 3D will allow a lot more information to be conveyed. Generally, 3D outlines are dependably appeared and reach in x, y and z measurement which can pivot and move in such a way people will feel like a genuine world. The plants are in 3D view, so it can be seen as genuine plants. 3D based plant viewing system was favored in view of its interactive capacity to disperse information to agriculturists and other individuals. This is also true for the game engine as game engine emulate the environment, thus using 3D model inside the game engine would allow more data manipulation to be done. This kind of technology could be utilized for managing of coconut palm plantation. Game engines allow so much customization as able to construct an online 3D coconut palm plantation. This idea would be beneficial to everyone especially future developers who might expand this idea. As a game engine provides a more alternative function that can be included as plug-in, thus making a lot more choice for researcher to study data. Additionally, using game engine, a lot more user interaction with the terrain can be done and able to experience the terrain in different perspectives also showing the terrain visualization.

The system development could be deployed on using recent advances in core web technologies (HTML5) enabled web browser with the help of Web GL API. From this point, the users especially the manager of coconut palm plantation can make use of his applications for managing their coconut palm plantation effectively. The advantages of this type of applications are that because of online availability, the system can be accessed anytime, anywhere and at any place. This application of the prototype model is a proof of the idea that shows that the 3D Visualization system can be created in the game engine using the Unity 3D. The HTML5 allows it to be a user-friendly application. It is one of only handful applications of utilizations that make 3D models that would detect real field large information and show it in a more significant manner to apply farm management practices. Here is below in Fig 1 shown some of the screenshots of developed online 3D visualization system.

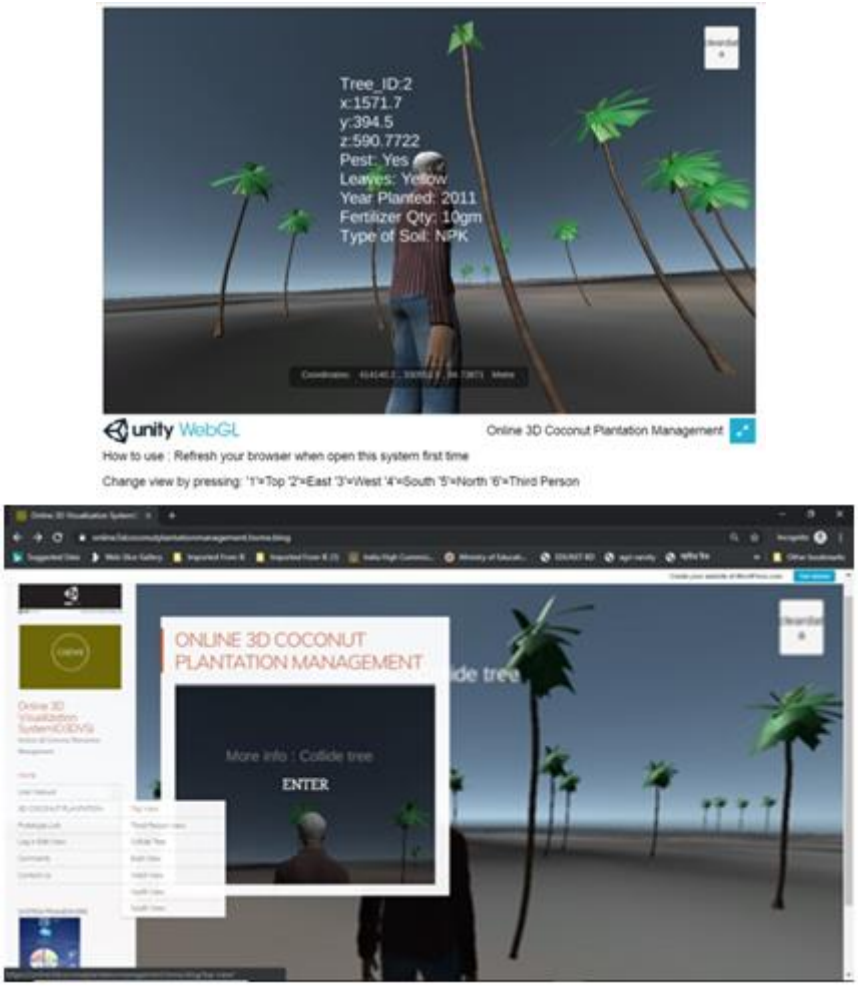

Fig 1:- Screenshots of developed online 3D visualization system

III. RESULT AND DISCUSSION

After that, the successful development of the visualization technique it then applied for coconut plantation management to help coconut plantation managers to manage their plantation more effectively. The application was successfully carried out by launching it into the web server. It consists of different menus to aid the manager of coconut plantation or users to use the system. The menus are login, home, update, prototype view, credit view, how to use view, comment view, credit view, and link. The managers can visualize coconut trees in 3D environments. They can interact with the system by walkthrough, top, east, west, north, and third person controller. The collision detection is available in the system where the managers cannot pass through the coconut tree itself. Other than that, the managers also can update the database of the system as necessary by accessing the database menu. By updating the database, the managers can always have accurate information about their tree. This can help the managers decide on the spot or when they are away from the office and have access to the system. This is because the system is online. With this ability, the duty of the managers becomes more effective to monitor their plantation, and the productivity of the plantation also being increased.

Finally, user evaluation was successful; therefore, the application was well-accepted by all users. Thus, they were satisfied with the developed application. Therefore, the results of the evaluation indicated that the online 3D visualization technique achieves its satisfaction or efficient in ease of use by allowing coconut plantation managers to solve management issues. This means the system is highly efficient in helping the coconut plantation management through online and enables them to make the decision easily. Overall, this implies that in the case whereby most users are satisfied with using the developed visualization application. This implies that the developed visualization technique is effective.

IV. CONCLUSION AND SUGGESTIONS

There are many applications and related research problems in this area to be solved by researchers as the online application nowadays is the main platform for all the applications. The future of developing online applications of 3D visualization of agricultural management is still open and becomes brighter as more researchers are migrating into this area. While the context is extremely different than any other contexts as it determined how plantation area can be viewed through the developed 3D visualization technique to allow coconut farmers to make right farm use decisions. Hence, this study attempts to introduce a better

understanding of how 3D visualization technique can be used to manage coconut plantation more efficiently. In order to achieve the research objective, this study presents an online visualization technique for managing and visualizing data with various resolutions. In coconut plantation region, interactive 3D visualization of vast volume datasets is a challenging task. The study endeavored to defeat this limitation by introducing an online visualization technique for showing pictures at the limit of the resolution of the human eye. Hence, this study explored how to develop a visualization technique thereby allowing it to boost the performance of the system by visualizing more management related information. The technique is also capable of dragging, grabbing, throwing, rotations, navigation, zooming, and collisions, which all worked as according to the plans. The application does support collision detection, which seemed necessary so that objects in different size and shape don't encapsulate other objects. It is possible to disable collision detection entirely or on particular objects if appropriate.

Contrary, this application suffers a limitation of using 10 trees that need addressing for future research. Besides, this developed application is only accessed from the latest browser of windows operating system, and hence it does not support yet android based mobile platform. Once these have been resolved, the future study should be in considerations to fix all of these arising issues for better performance. Once the technique is fully developed as a complete application, it would be of great value to agricultural plantation management in the future.

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