3D LIDAR City Model Application and Marketing Plan Development

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***Abstract*—The main goal of this research is to create a prototype application in Unity3D using 3D City Model generated from LIDAR/Point Cloud data with Virtual Reality feature enabling the use of Google Cardboard accessories. This application has a purpose of showing Yado-VR 3D city model potential/use-case into their new potential customer. Aside from the application development, a marketing plan also constructed in this research to give Yado-VR a business direction to approach their new market.**

Keywords—LIDAR; point cloud data; 3D city model; Unity3D; virtual reality; Google Cardboard.

I. INTRODUCTION

Yado-VR B.V. (Yado Virtual Reality) is a company who produce LIDAR (Light Detection and Ranging) based 3D city models based on real-world point clouds data that gathered from aircraft with automation and with 90-95% accuracy rate. LIDAR is a detection system that works on the principle of radar, but uses light from a laser. A 3D city model is a representation of an urban environment with buildings as the main object, added with other urban structures and objects [1].

3D models served many purposes such as Urban and Infrastructure Planning for the government, Harbor and Coastal Management, and also the LIDAR processing technology can be a great add – on for creating an autonomous driving platform. 3D city modelling really helps in understanding the performance of the city [2]

On the other side, the gaming market is showing a remarkable growth in the past few year, with the appearance of games that use 3D city models similar to the real ones as a game environment such as Grand Theft Auto V, Watchdogs, Need for Speed, and Cities: Skylines. The 3D model is the main essential component for VR and AR oriented applications [3]. Those mentioned games are using real world city models as a reference to create replica city models to be used as a game environment and most of the time the player just revolve around that in-game city maps itself meaning that those city models are important assets to develop the games.

From those points stated before, there is similarity that can be seen as opportunities, where Yado-VR can provide the real city models for the game developer rather than a replica city models because mainly to resemble the original maps they only took the landmark of that city. Using real world city models instead of the fake ones will boost the game value since everything looks the same with the real world. 3D city models are usually used to enhance results which are not necessarily related to GIS (Geographic Information System) [4].

The other point is that Yado-VR can rapidly follow the dynamic urban construction that happens in each city since they produce the city models with automation and in a very short time. The conclusion is that Yado-VR wants to expand their business scope into gaming production industries.

This research mainly to create a marketing plan for the 3D LIDAR based city models in order to help Yado-VR to reach their new markets and goals, also to develop a prototype software to demonstrate 3D LIDAR based city models use case in the form of 3D City Simulation application with the purpose of showing use case example to potential customers. Therefore, there will be some research question written in this report and the answers will be provided. Hopefully by having this research will help Yado-VR to reach their new markets and achieve the desired goals.

Yado-VR 3D city model served a multiple purpose mainly for urban planning since they are joining the market, in order to convince their potential customers they always show sample application related to their client use-case, for example it is a government they always show visualization demo about disaster prevention in industrial sector or wind/shadow analysis that is happening day by day in the central city and all of this are produced using Yado-VR 3D LIDAR city model combined with Unity 3D engine. For this case, they want to expand their field into gaming market, which mean they cannot show their urban planning demo to a game companies since their use-case is very different, thus a new application with a more game-oriented is needed to show Yado-VR potential to the game companies

II. METHODOLOGY & PHASING

The first phase of this research is to plan for the whole research workflow. Planning is essential to keep the research on the right direction and of course consistent with

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the schedule, creating a research plan and gathering functional requirement information for both the application and the digital marketing plan are done in this phase.

The second phase of this research is research, the research methodology is using DOT-framework, which information will be gathered using 5 different methods which are Library, Field, Workshop, Lab, and Showroom [5].

After the research phase, a development process for the application and the digital marketing plan are also started using the information that gained from the research phase which is called a development phase.

The last phase of the research is to test the application whether it meet Yado-VR demand and also to implement the digital marketing plan strategy to see if it can help Yado-VR approach their new market.

III. Related Work

Virtual Reality with 3D city model has been used in some previous researches, such as the usage for guided virtual tourism [6], for urban planning [7], and improving public participation in the urban planning process [8].

IV. Purpose of the Digital Marketing Plan

A digital marketing plan always start with the customer; their characteristics, behaviors, needs, and wants [9]. The purpose of the digital marketing plan is described as follows:

1. Describing summary of the current condition for this business case.
2. Describing clear view about the target audience/market along with a method to approach them and get their attention to the products.
3. Providing clear business goal that wants to be achieved within a certain time period along with key performance indicators to measure it.
4. Giving information about unique value proposition from the products which will help Yado-VR to compete against the competitor.
5. Offer an overview information about the business model from this business case to shows how the monetization method works.

The content of the digital marketing plan is described below:

- Situation analysis: Our markets, our customers, our competitors, intermediaries, influencers and potential partners, SWOT summary. SWOT is the analysis of Strengths, Weaknesses Opportunities, Threats.
- Business model canvas.
- Business objective: Specific, measurable, achievable, realistic, time-bound
- Strategy: Positioning, marketing mix, brand awareness, online content and social media marketing, engagement strategy
- Business model

V. Purpose of the 3D LIDAR City Model Application

Information gained from stakeholders interview stated that they require example portable application preferably smartphone applications for demonstration purpose to the potential customers and to show the use case of the LIDAR based 3D city models. This application called 3D City Simulation Application where it has virtual reality features and requires a google cardboard accessories for a smartphone to use the application. The main idea of the application is to allow the user to explore Eindhoven city using an automatic moving rollercoaster cart in a 3D virtual environment that generated from LIDAR data in virtual reality mode. After a set of research and development phase for the 3D City Simulation Application in Unity platform, this kind of prototype product is constructed to show Yado-VR sample use case to potential customers and can be seen in the following Fig. 1, 2, 3.

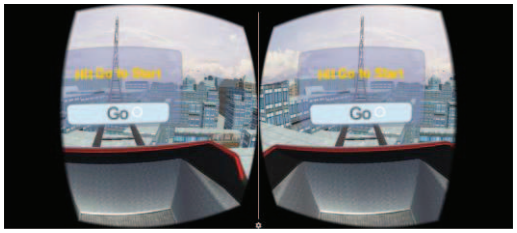

Figure 1. 3D City Simulation Application (1)

Figure 2. 3D City Simulation Application (2)

Figure 3. 3D City Simulation Application (3)

VI. Relation between the Application and the Digital Marketing Plan

The relation between these two things is that 3D city simulation application is used as an instrument to show the use case of the 3D LIDAR based city models in the form of prototype application to potential customers. This phase will

come right after Yado-VR successfully approaches and establish a connection with their potential customers using the marketing plan strategies. It would be more promising to show the customers a concrete product for the city models along with its example application to show Yado-VR unique value to the customers rather than just showing the raw version of the city model which hardly showing any values just like in the following Fig. 4.

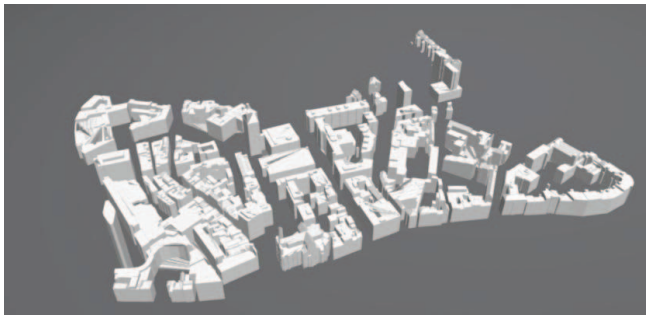

Figure 4. Raw 3D city model

So the conclusion is that the 3D city simulation software supports the marketing plan execution process and help the potential customers to see and understand Yado-VR unique value. Directly or indirectly meeting with customers is Yado-VR chance to show their unique value in order to take the business one step further. The relationship between the 3D city simulation software and the marketing plan can be seen in the following Fig. 5.

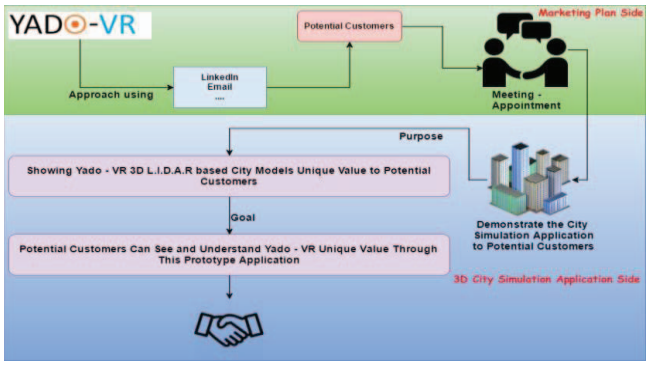

Figure 5. 3D City Simulation Application relation with the digital marketing plan

VII. Similar Competitors Strategy

Since all of the Yado-VR competitors produce similar product, the following aspect are important to differ Yado-VR from other competitors, which are Time (Which technology can produce 3D city models with the fastest producing speed?), Quality (Which technology can produce the most accurate 3D city models?), and Cost(Which technology have the least cost to produce those 3D city models? Less cost means higher revenues for company and much cheaper price for customers). This following aspect came together with the name of Project Management Triangle concept just like in the following Fig. 6.

This concept will be useful for customers when they want to pick one of the best candidates from multiple choices of companies who produce similar products. To compete against the competitor, Yado-VR has to analyze this 3 aspect in their business process and also for their competitors as well in order to position themselves and compete in the markets.

Figure 6. Project Management Triangle.

VIII. S.W.O.T Business Analysis

After a couple of research and interview with a few stakeholders, the following data is showing Yado-VR's S.W.O.T analysis for the current situation:

Strengths: Process and produce 3D city models from LIDAR data with automation, very fast, accurate, and with flexible output format.

Weakness: Have no capabilities to generate/gather LIDAR data.

Opportunities: There is no Netherlands city model used in any games in the existing game industries, Very little usage of Europe city model in gaming industries.

Threats: Depend on available/open-sources data from third party providers, Gaming markets have a high expectation about the level of detail for the game environment.

Strengths – Opportunities Strategies: Giving insight to the game companies to try a new game environment mainly like big cities in Europe such as Amsterdam, Paris, and Berlin. Using Yado-VR core technology, they are able to deliver those city models with very fast production time and accurate models.

Strengths – Threats Strategies: Yado-VR produces 3D city models with flexible output format that allows the models to be reworked in another 3D modeling platform such as Sketchup, AutoCAD, and 3ds Max to meet customer demands.

Weaknesses – Opportunities Strategies: Establishing a connection to government outside Netherlands, for example, France, Germany, and United States in order to get access to their open source LIDAR data. Meanwhile, Yado-VR already has the LIDAR data for the whole Netherlands.

Weaknesses – Threats Strategies: Seeking connection with an international third party service provider which

have capabilities to deploy aircraft with scanning capabilities to generate LIDAR data for Yado-VR especially for certain area/countries that still didn't have open LIDAR data.

IX. Transforming LIDAR Data Into 3D City Model

The following is a workflow for transforming Raw LIDAR data into usable 3D Models:

1) *Raw LIDAR data imported into Yado PCM Software.*
The imported LIDAR data can be seen in Fig 7.

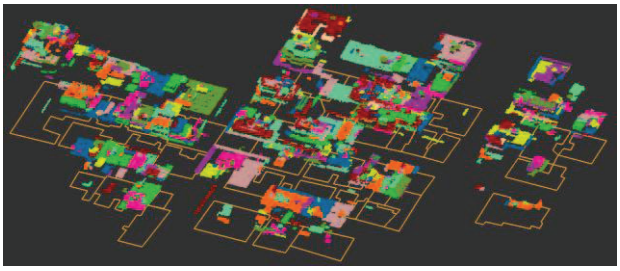

Figure 7. Raw LIDAR data.

2) *Construct the 3D City Models.*
After importing the data, 3D city models will be built, as can be seen in Fig. 8.

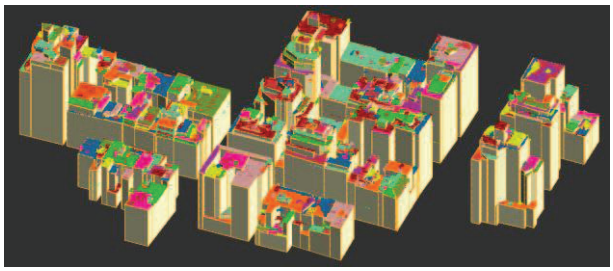

Figure 8. 3D city model.

3) *Export the models with a Shapefile extension from Yado PCM Software and import the models using Blender with the help of G.I.S add-on.*
The result can be seen in Fig. 9.

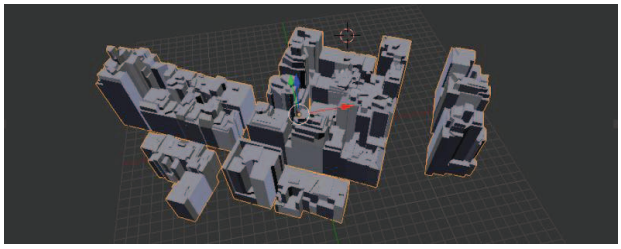

Figure 9. 3D city model in Blender.

The G.I.S add-on will help to place the models in a precise position in the workspace automatically without overlapping with other models position.

4) *Adding UV Mapping to the models.*
UV mapping will be attached to the models, because the models cannot be textured in Unity3D platform if there is no UV mapping. Blender already have built-in feature for this step. The result can be seen in Fig.10.

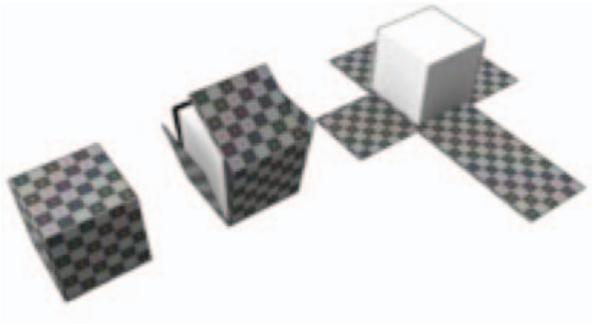

Figure 10. UV Mapping.

5) *Export the models as Filmbox with the option of Z forward coordinate.*
This option is to transform the model's coordinate principle which is left-handed coordinate system into a right-handed coordinate system, as shown in Fig. 11.

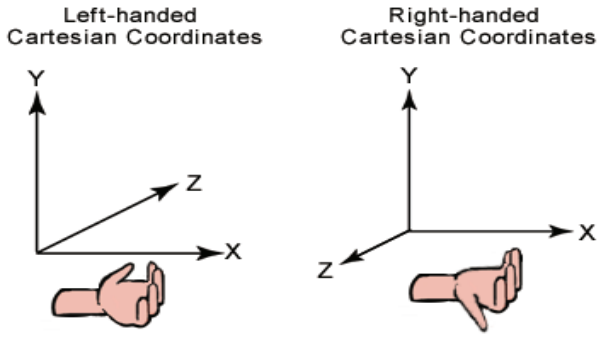

Figure 11. Cartesian coordinate system.

Yado PCM Software has OpenGL coordinate principle which is left handed coordinate, meanwhile, Unity3D has right-handed coordinate. Not changing the coordinate system resulting a lot of building wall and roof parts missing when imported in Unity3D.

X. Conclusion

From this research can be concluded several things i.e.:

- The prototype product for 3D city simulation can be used as a demonstration tool to show the use case and the potential of Yado-VR L.I.D.A.R based 3D city models to potential customers using Google Cardboard.
- On the business side, the Digital Marketing Plan has been completed and ready to be used by Yado-VR to expand their business into gaming markets.

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