DEVELOPMENT OF SMART ASSET DATABASE SYSTEM

By

Mas Iliani Rosli

Civil Engineering

13866

FINAL YEAR PROJECT DISSERTATION

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Supervised by, Associate Professor Dr. Abdul Nassir Bin Matori
Internal Examiner: Associate Professor Ir. Dr. Indra Sati Hamonangan Harahap
External Examiner: Mr Mohd Yazip bin Matori

UNIVERSITI TEKNOLOGI PETRONAS
Bandar Seri Iskandar
31750 Tronoh

CERTIFICATION OF APPROVAL

Smart Asset Tagging for Building Information System

By

Mas Iliani binti Rosli

A project dissertation submitted to the

Civil Engineering Programme

Universiti Teknologi PETRONAS

in partial fulfilment of the requirement for the

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Approved by,

____

Associate Professor Dr. Abdul Nassir Bin Matori

Universiti Teknologi PETRONAS

Bandar Seri Iskandar

31750 Tronoh

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible to the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources and person.

(Mas Iliani binti Rosli)

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ABSTRACT

The urgency of the asset management rise when the needs of effective and efficient agenda to build an information building database become vital to the shareholder and owner of the building as the cost of maintenance and repairs are overly in the high edge for the organization. The major issue with the asset management is the lack of latest and accurate information about the asset over the years. There is no advanced management system to organize and maintain the information the asset. Thus, in order to reduce maintenance and repairs costs of the asset as well as to deliver effective and efficient asset management system in the organization, the objective of this study is to develop the information database of the building's asset. The usage of laser scanner device as data collection and data processing in the asset management has come out as trend that gives fastest exact 3D modeling result that later will represent as the location of the asset. Furthermore, the integration Geographic Information System (GIS) into asset management has proven over the years the effectiveness and efficiency that can assist organization to track location, condition as well as analyze, manage and display information of the asset. In this study, the implementation of laser scanner technology and GIS will be used vastly in the computer laboratory in order to create the database information and yet to achieve effective asset management system.

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INTRODUCTION

1.1 Background

According to Institute of Asset Management (2014), an asset is an item, thing or entity that has potential or actual value to an organization such as plant, machinery, property, buildings, vehicles and other items. An asset of the building also can be refer to as the component of the building itself for example the assets of an office building could be the desks, computers, chairs, elevators that surrounded inside the building. The urgency of the asset management rise when the needs of effective and efficient planning to build an information building database become vital to the shareholder and owner of the building. Zhang et al. (2009) stated that nowadays the force that the owner and managers have to face from the financial sustainability and competitiveness spirit have made them realize to minimize the asset total cost of ownership and restructure their asset management operation plan. Institute of Asset Management (2014) described asset management as coordinated activities of an organization to realize the value from assets. These activities include collection, processing, analysis and maintenance of data information of the asset in order to plan work to be executed to maintain these assets at an operational level in the most cost-effective fashion possible. Building asset management also can be defined as a structured process and decision that assist the owner to maintain the whole systems which fully cover the physical life service of the assets which significant from the beginning until end of the life cycle (CHOA, 2010). According to ESRI (n.d.), the asset management is an approach to have a proficient and practical allocation for resources and the fact that it is a new medium for people to

- Tracks location, condition and ages of the asset
- Monitors the use and distribution of assets across department and business function
- Measure asset’s life cycles, maintenance cost and depreciation.

McKibben and Davis (n.d.) defined the main objective of asset management system is to reduce the long term cost of owning, operating, maintaining, and replacing while continuously provide an anticipated quality of service of the assets. According to Vanier (2001), a huge amount of money has been spend by United States to reinstate and fix the damaged tools, machines and other component of infrastructure which Government Accounting Standards Board (GASB) has estimated at an annual cost of $140 to $150 billion. The maintenance cost takes down larger cost than operating the building itself as the reactive maintenance system is keenly being implemented where the service is conducted only during the time asset is malfunctioned. Therefore, an effective and efficient information database system about the assets of the building must be included in order to have the successful asset management system. Nowadays, majority of the existing buildings do not have their recent information database system about their assets as the time pass by many renovations and changes took place in the building are not frequently updated. The computer aided design (CAD) of as-built drawings that they build up earlier, maybe are not practically suitable to use in the upgraded asset management system. As Zhang et al. (2009) mentioned is his paper, the implementation of more integrated information technology (IT) could lead to a better arrangement of services and maintenance resources for work on the right asset at the correct location which eventually reduces costly maintenance mistakes as well as can increase the quality of service provided. ESRI (n.d.) stated that using geographic information system (GIS) to do the asset management activities gives users a more accurate of real world circumstances and allows organization to make better business decision. GIS is used to input, maintain, manipulate and query location based information. ESRI (n.d.) added the usage of GIS in asset management has direct and measurable benefits for public works, finance, and homeland security because basically GIS can

- Facilitate data input, storage and display
- Build public accountability for infrastructure management
- Improve service delivery
- Provide budgeting tool and a means of justifying maintenance needs
- Track maintenance costs according to where they are expended.

However, the data collection and analysis of the assets are vital towards an implementation of GIS into asset management system. The requirements of 3D information and features have been obviously increased during this past few years and its visualization provides more understanding and better analysis for making decision (Lee et al., 2013). He added that the most common methods for producing 3D data is currently through the use of laser scanners as laser scanners are fast and efficient in collecting surface to provided high accuracy measurement of visible objects. According to FARO (n.d.) which is the apprentice of laser scanning technology, the 3D laser scanner works when it emits a laser beam form a rotating mirror out towards the area being scanned. Then, the unit distributes the laser beam at a vertical range of 305 degree and a horizontal range of 360 degree. The laser beam is then reflected back to the scanner by objects in its path. The distance to the objects defining an area is calculates as we as their relative vertical and horizontal angles.

Lee et al. (2013) explained that the immediate result produced by laser scanner is a series of point cloud and each point is represented by 3D coordinates (x,y,z). The data is then processed to obtain the accurate and correct model of the objects. He added based on the point clouds obtained from the laser scanner, the information such as object size, shape form, location and surface characteristic of objects in the real world also could be acquired. This information data provide by the laser scanner will assist to construct the 3D asset models using its software and then manage to convert it in the GIS data format which eventually helps to store, manage, display and manipulate the asset's information using the key features in the GIS.

1.2 Problem Statement

According to Zhang et al. (2009), the implementation of the asset management process requires a significant amount of information and data that is accurate and up to date. Nowadays, lack of information database about the asset in the building especially existing building as the past information is not practically valid anymore. This serious issue will lead to the major management problem especially the maintenance and repair of the asset as over the life of every building, the owners are required to periodically make decision and take action to maintain the various physical components of their buildings (Homeowner Protection Office, n.d.). According to Vanier (2001), when reliable data and effective decision tools are in place, the costs for maintenance, repair and renewal will be reduced and the services will be timely with less disruption. Zhang et al. (2009) added that all design data, change orders, contract correspondences, maintenance, records, repair data and renewal information are required to give the owners the ideas regarding condition of their building.

1.3 Objectives

The primary objective about this study is to create the database information about the building's asset. Since the effective information system is very crucial in building up the successful asset management, the input information about the building must be the latest and accurate therefore in order to achieve our objective the integrated information technology must be implemented in the system. Hence, the implementation of Geographical Information System (GIS) as a medium to conquer elements in the asset management system and 3D laser scanner technology as data collection and analysis device for the asset are vital in order to complete this project.

1.4 Scope of study

Because there is time frame given to complete this project, author has picked only one room as area to be scanned instead of one entire building. The proposed location for this project is the computer room which located at Block 14 Faculty of Civil Engineering in Universiti Teknologi PETRONAS (UTP). The computer room is used by the students whom pursuing their master and PhD in UTP to do their research on projects.

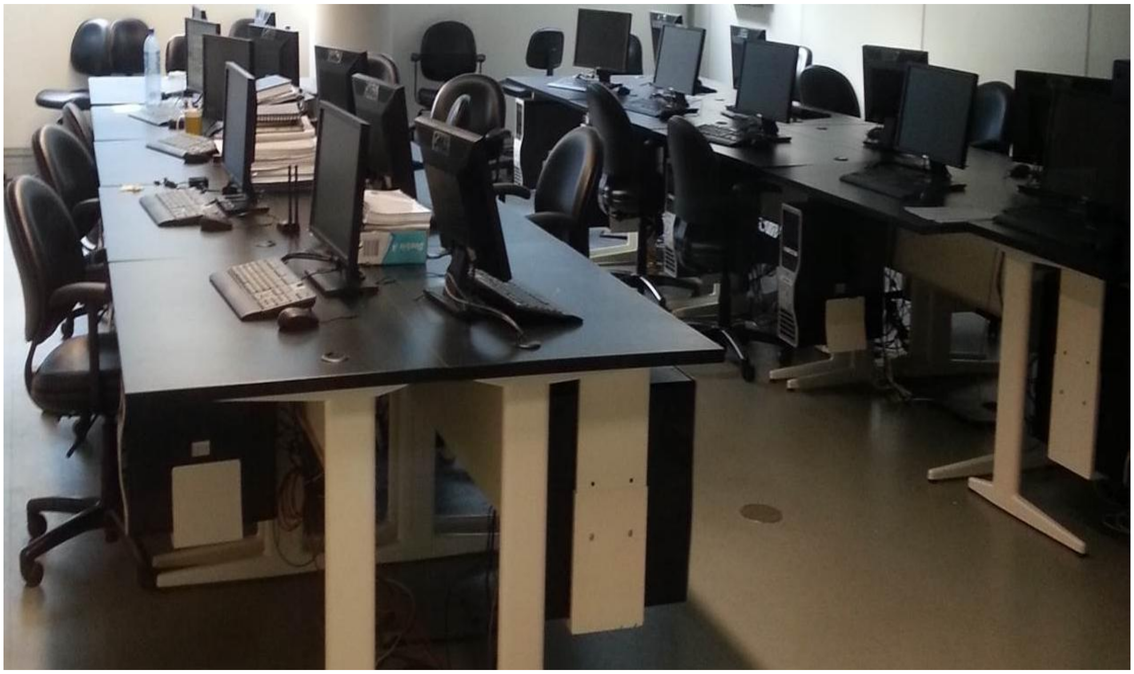


Figure 1: Computer Room at Block 14

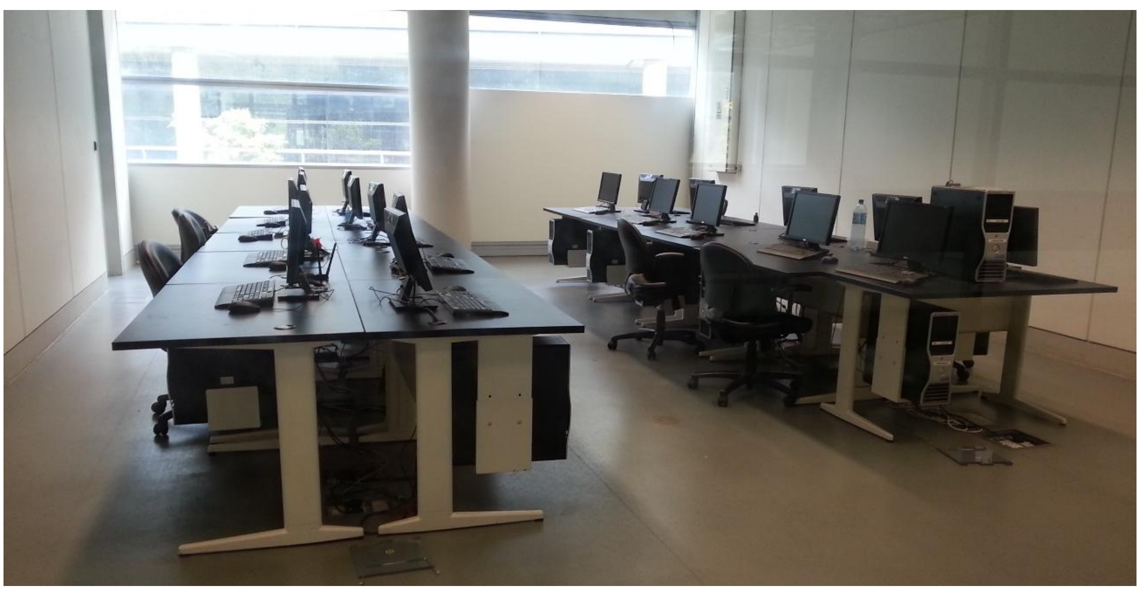


Figure 2: Computer Room at Block 14

CHAPTER 2

LITERATURE REVIEW OR THEORY

2.1 Introduction to Building Asset Management

Vanier (2001) suggested six key questions to be answered as responses towards leading to the successful effective asset management system.

What do you own?

The main thing for owner or asset managers need to be alert and aware about their building is the types of facilities or assets that they have. It is common for them to have an inventory and records describing details of the assets. For the sake of building up effective inventory management, a structured system of the building usage, its location and condition as well as design, construction, fit up, operational maintenance records are highly needed. The renovation or changes towards the assets for example new equipment added, refurbishment as well as demolition has to be updated and maintained consistently and continuously in inventory in order to achieve effective asset management (Zhang et al., 2009).

What is it worth?

Zhang et al. (2009) stated that it is an obligatory for the owner or asset managers to create the assets' value once an organization discovers the scope of its assets. For the building owner and asset manager, it is crucial to get the information about the value of the building assets while they are in operation system and the market value of the assets if they were sold to the open market today. This information gives a solid decision making based as the owner or manager can make a good judgment whether the asset is worth to repair and maintain or to renew and get replacement.

What is the deferred maintenance?

De Sitter in his "Law of Fives" (De Sitter, 1984) acknowledged that the repairs cost required five times of the maintenance costs if maintenance is not performed. Meanwhile if the repairs are deferred, the renewal expenses can reach five times of the repair cost. That is a solid reason the building owner or mangers need to have sufficient and updated records on the projects, repairs and maintenance actions that have been postponed, phased or neglected (Zhang et all, 2009). Vanier (2001) added that these data could also be used to establish trends for strategic planning for future project development.

What is its condition?

The current status of the building's asset is one of attributes that must be included in the information database for asset management in order to give the owner or managers the clear state vision about the lifecycles of their building components. Zhang et al. (2009) stated that this information will guide the owner or asset manager the current remaining building life service and assists in planning maintenance actions and re-investment decisions. As mention earlier, any physical changes to the building conditions must be monitored continuously which later will help to track down the detailed information of the assets from time to time.

What is the remaining service life?

After the entire assets in the building are known, with its value and condition determined, the asset managers must be able to estimate the remaining service life to calculate the life cycle costs (LCC) for alternative maintenance, repair and renewal strategies. The calculation of remaining service life of assets can be varied by using different methods of sophisticated mathematical modeling. This result will assist asset managers to predict the economic estimation of the assets and eventually provide the proper technique to propose the precise options for maintenance, repair and renewal of the assets (Zhang et al., 2009).

What do you fix first?

Vanier (2001) mentioned that deferred maintenance is not the only key challenge for asset managers but the continuity of new maintenance and repair requirement put more pressure on their responsibilities. When the managers know which components and assets of their building should give the priorities to fix and replace first, they could forecast the budget of the cost accordingly. The managers must be able to form an effective plans based on the information collected earlier. Zhang et al. (2009) suggested that these plans must be planned according to the political and policy requirements while still be able to maintain the building's functionality as well as performance.

These six questions indicate the standard data required for each one of the assets in the building. In order achieve effective and efficient asset management system, these six questions are included in this project. As mentioned before, the input data attribute for each of the assets is different from one and another but the data needed is still the same. For example in this project, the main asset in the computer laboratory is the computer itself and there are other asset such as desks, chairs and cabinet. The standard data such as the current condition, location, manufacturer, supplier, cost of the asset, purchased date, last maintenance date, next maintenance date, maintenance record, and the remaining life of the asset must be included for computers, desks, chairs, and cabinet. However, there is special attribute data need to be input which will depends on what type of the asset. For example, the computers in the laboratory have different kind of software in it which user want to know before using it such as type of software, the version of the software and usage of the software. Hence, in this project special data attribute related to the asset will also be included in order to achieve effective asset management.

2.2 The integration of GIS into Asset Management

A fully functional asset management system would support all aspects of asset management process and provide decision makers with adequate and reliable data or information basis for making informed asset deployment decisions (Lemer 1998). There are various tools and methodologies exist to collect, manage, display and process the required information which one of it is GIS. ESRI (2007) in their Building a Public works Information System article stated that GIS is the computerized data system which is used to create, edit, import, map, query, analyze and publish the geographic information in an area. According to ESRI (n.d.) in the GIS for Asset and Facilities Management article, GIS combines location data with both quantitative and qualitative information about the location, letting user to visualize, analyze, and report information through maps and charts. In the context of asset management, it is important to know the location of the asset in order to manage it. This seems simple enough but locating assets and tracking information can save an organization a great amount of time and resources (ESRI, n.d.). ESRI has made their own research about the Bureau of Indian Affair (BIA) who is responsible for administering and managing 100,000 structures across 66 million acres of land has used GIS as a solution to locate their assets that need the maintenance services. GIS truly provide BIA a cost effective way to share data throughout a diverse and widely dispersed organization and the accuracy of the data. Maintaining and managing all disparate facilities and assets in GIS allow everyone in the organization know their asset’s location and status. The data itself can be updated quickly, work order created efficiently and space used more effectively.

ESRI (2007) added in their article of Building a Public Works Information System stated that GIS and asset management can be combined to facilitate services calls as well as predictive and preventive maintenance and control overhead costs. As mentioned before, the effective maintenance management system is crucially vital for the asset management activities. According to ESRI (n.d.) in the article of Removing the Guesswork, GIS based systems can measure asset life cycles, track the maintenance costs according to where they are expended as well as measuring deterioration and predicting replacement costs. Through the implementation of GIS, the user can be trained in applications to do inventorying and assessments in the field in a small computer that can be synchronized with the rest of the system. This practice will eventually reduce the paperwork, saves time in data collection and processing and increase accuracy by the decreasing rate of the data input errors made by manual operation.

2.3 Data collection and analysis

Many GIS data can be provided in 3D visualization. Due to the rapid development of technology, there are several approaches available to acquire 3D data such as image-based approach, point cloud-based approach and integrated approach (Lee et al., 2013). Laser scanners are rapidly gaining acceptance as a tool for three dimensional (3D) modeling, data collection and analysis in the architecture, engineering and construction (AEC) field. The technological advances have led to laser scanners capable of acquiring range measurement at rates of tens to hundreds of thousand points per second, at distance of up to a few hundred meters and with uncertainties on the scale of millimeters to a few centimeters. Laser scanner is well suited to densely capturing the geometry of the building interiors and exteriors, process plants and infrastructure. As mentioned earlier, Lee et al. (2013) explained that the immediate result produced by laser scanner is a series of point cloud and each point is represented by 3D coordinates (x,y,z). The data is then processed to obtain the accurate and correct model of the objects. He added based on the point clouds obtained from the laser scanner, the information such as object size, shape form, location and surface characteristic of objects in the real world also could be acquired.

The scanner can digitize all the 3D information concerned with a building down to millimeter detail. A series of scan externally and internally allows an accurate 3D model of the building to be created. This novel technology improves the efficiency and quality of the construction such as maintenance of buildings or group of buildings that are going to be renovated for new series (The Scope in the INTELCITIES, n.d.). The scanner is targeted to the physical objects to be scanned and the laser beam is directed over the object in a closely spaced grid of points. By measuring time of laser flight, which is the time of travel of the laser beam from the scanner to the physical object and back to scanner, the position in 3D space of each scanned point on the object is established. The result is a “cloud of points” which consists in thousands of point in 3D space provides dimensionally accurate representation of the existing object. Chen at al. (2005) stated in his research paper that the 3D scanner technology is the most effective way to quickly get the data of the observed object. This innovation is significant because it has potential to solve the problems that are always been associated with the design and construction of existing building for reuse goals. The figures below show how the laser scanner is used for asset management system.

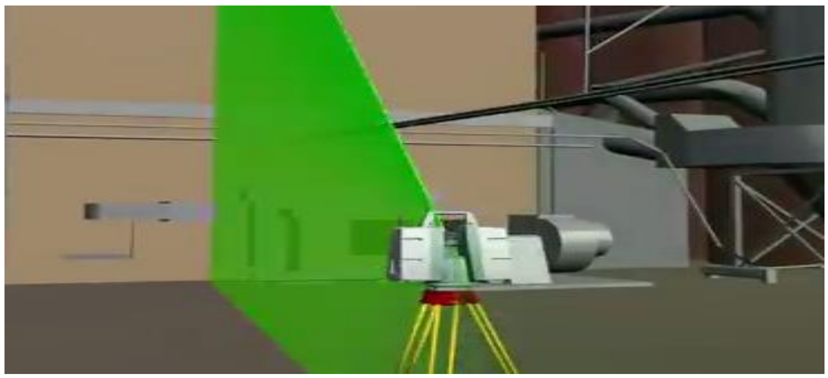


Figure 3: Laser scanner is used to scan the asset

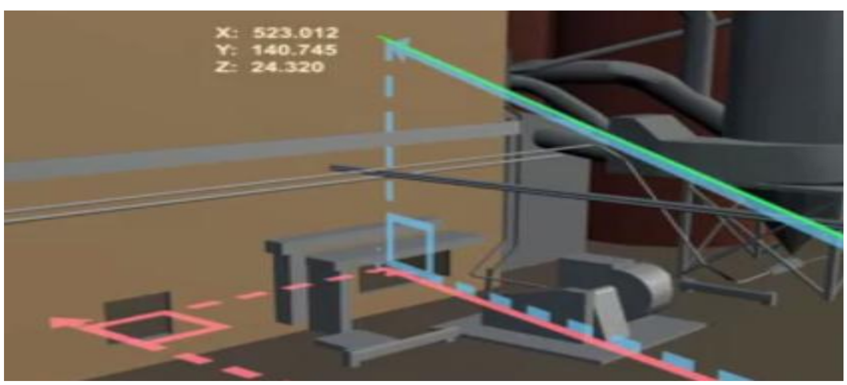


Figure 4: The x, y, z coordination of the asset is obtained

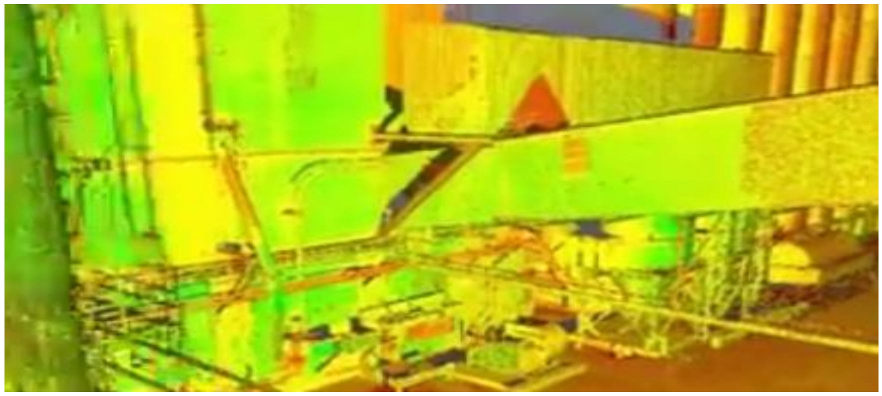


Figure 5: The 3D modeling of the asset often called as point cloud

CHAPTER 3

METHODOLOGY OR PROJECT WORK

3.1 Project Methodology

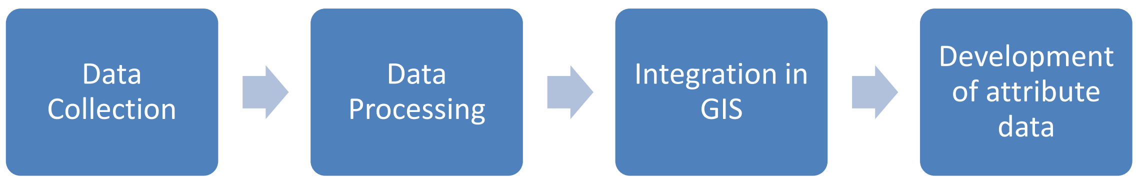


Figure 6: The experimental setup of the project

This project is broken down into four major sections. The first part is planned as a preparatory stage which gives great emphasis on data collection of the building assets by using laser scanner technology. The usage of the laser scanner gives the accurate dimensional data of an asset such as the shape and length. During this process, series of points cloud data of the asset will be obtained which represent the asset by x, y, and z coordinates. The second segment of this project will cover the advanced processing data obtained from the laser scanner by using available software to convert it into 3D modeling. Conversion of the data also interpret the exact location of the asset in the building. The next part of this project will be focus on the integration of GIS with data information of the assets collected by manually and using the laser scanner. The interpretation of data in the implementation of GIS is essential towards the successful building asset management system especially maintenance management. GIS is not just store the data information but then analyze, manage and eventually display the spatial attribute of the assets using the characteristic and special features in the software.

The last part of this project is the development of attribute data for each asset. The subjective attributes of the assets in this case for the computers in the laboratory; the model of the computer, manufacturer and supplier of the computer, date of purchased, date of latest maintenance, date of next maintenance and others are important to collect manually as the data information are varies from one to another..

3.2 Project Milestones

Throughout this project, there are several key milestones that need to be done in order to achieve the objective of the project.

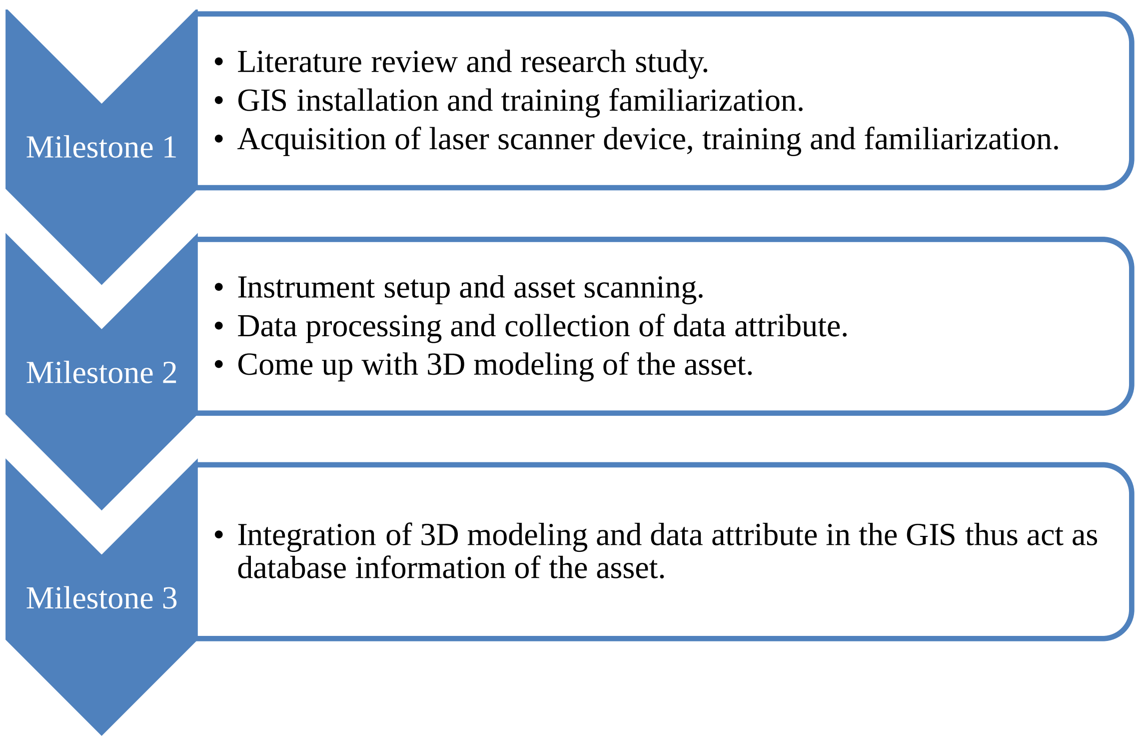


Figure 7: Key Milestones of the Project

3.3 Expected Result

At the end of milestone 3, the end result of this project will be look like figure below with other special attribute data which will cover the six questions discussed earlier in order to achieve effective asset management system. As the user input the asset ID and name of the asset, various information about the asset will come out as well as the 3D modeling of the asset which will represent the location of the asset.

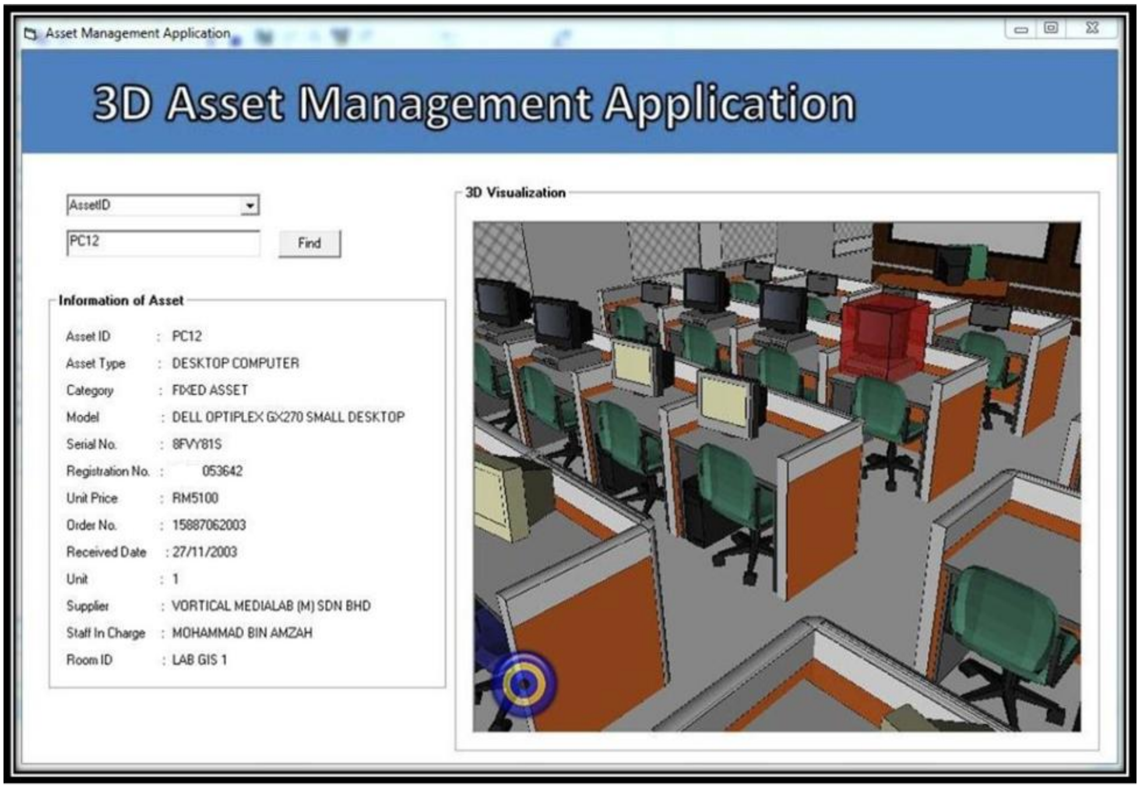


Figure 8: The expected result of this project

3.4 Gantt Chart

A Gantt Chart detailing the major project activities expected to be carried out and completed throughout the life cycle of this Final Year Project is as illustrated in Figure 9.

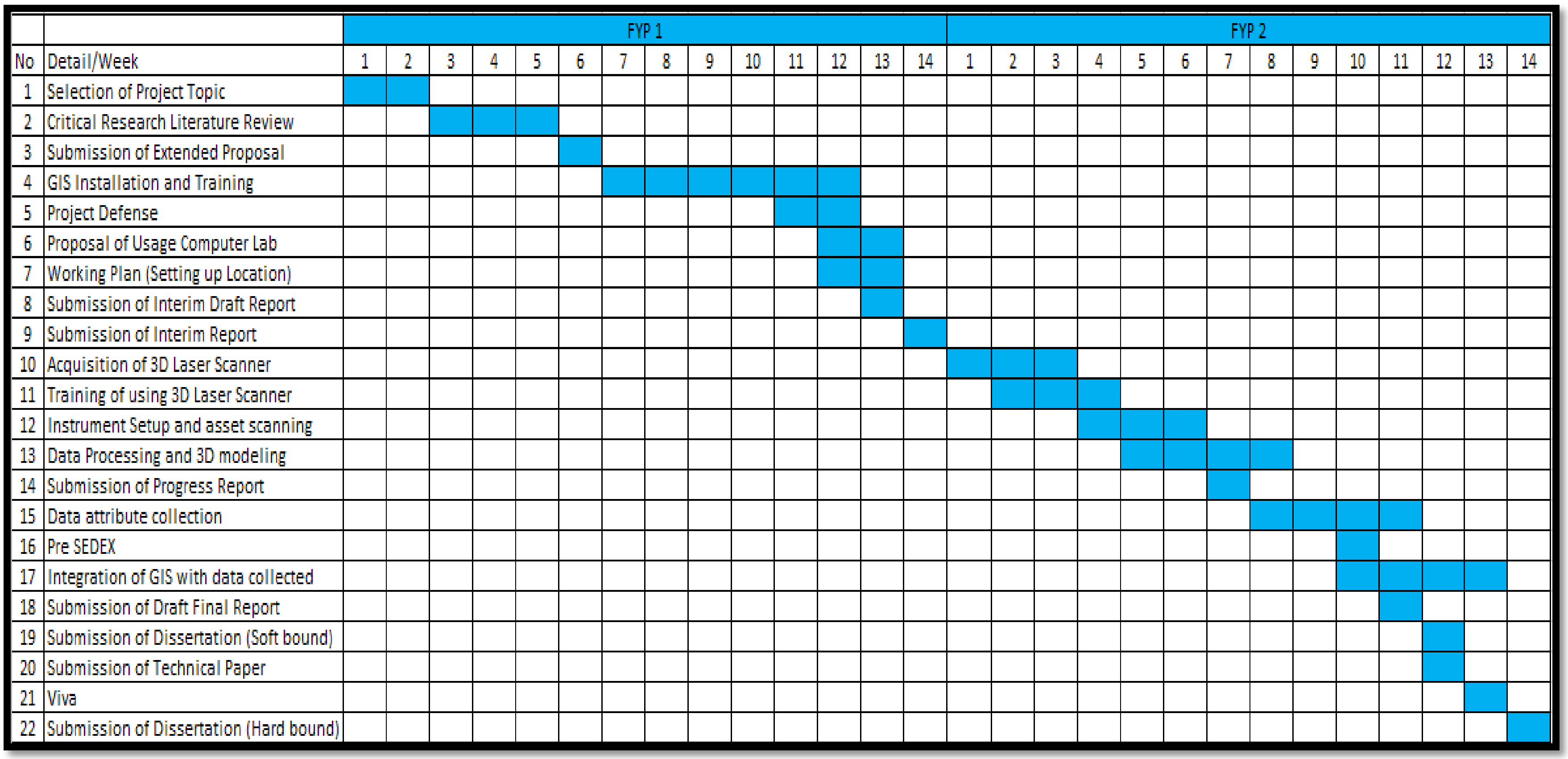


Figure 9: The Gantt Chart of the project

CHAPTER 4

RESULT AND DISCUSSION

4.1 Preliminary Data

At the end of week 7 of Final Year Project II, there are some progress towards implementation of this project. Author has proceed with the data processing step by using trial data collection from Universiti Teknologi Malaysia (UTM) while waiting for the laser scanner to arrive at the area to be scanned. In this stage, author has carried out several steps towards processing the data by using MeshLab and CloudCompare which act as pre-processing software. By using these software, the point cloud data can be seen more clearly as the object scanned. These software have many functions and features that help and assist author to process the data. The unwanted points and density of points can be reduced as well as point cloud also can be mesh together. The expected result of these software is the 3D visual image of the object scanned. By doing this, author can analyze the compatibility of each software to be used for the project implementation. The compatibility of software is very important towards this project as author need to find out the most suitable software that can process and manage the point cloud data in a faster way. However, the preliminary data that author used in this project is not technically same as author's scope of study for this project. The preliminary data shown below indicates the 3D data of exterior of the buildings of one area meanwhile author's scope of study as stated earlier indicates the interior of the buildings which is computer room. Even though the data it is not same, the procedure and methodology of implementation this project is still same. This prove that the methodology used is suitable for any type of assets that owners or shareholder want to be scanned and tagged. By using this preliminary data, author can familiarize myself with the software to be used in the future undertaking. Figures below shows the point cloud data which is the raw data from the laser scanner is imported in the software CloudCompare.

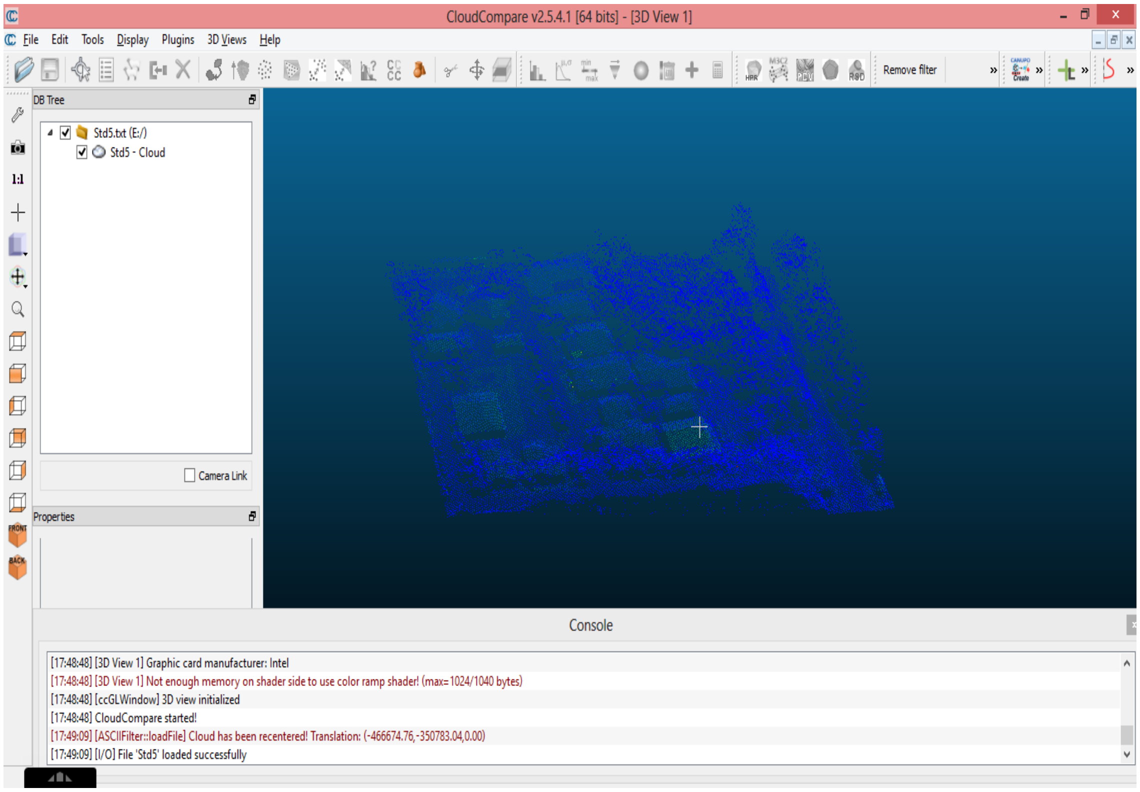


Figure 10: Raw data of point cloud

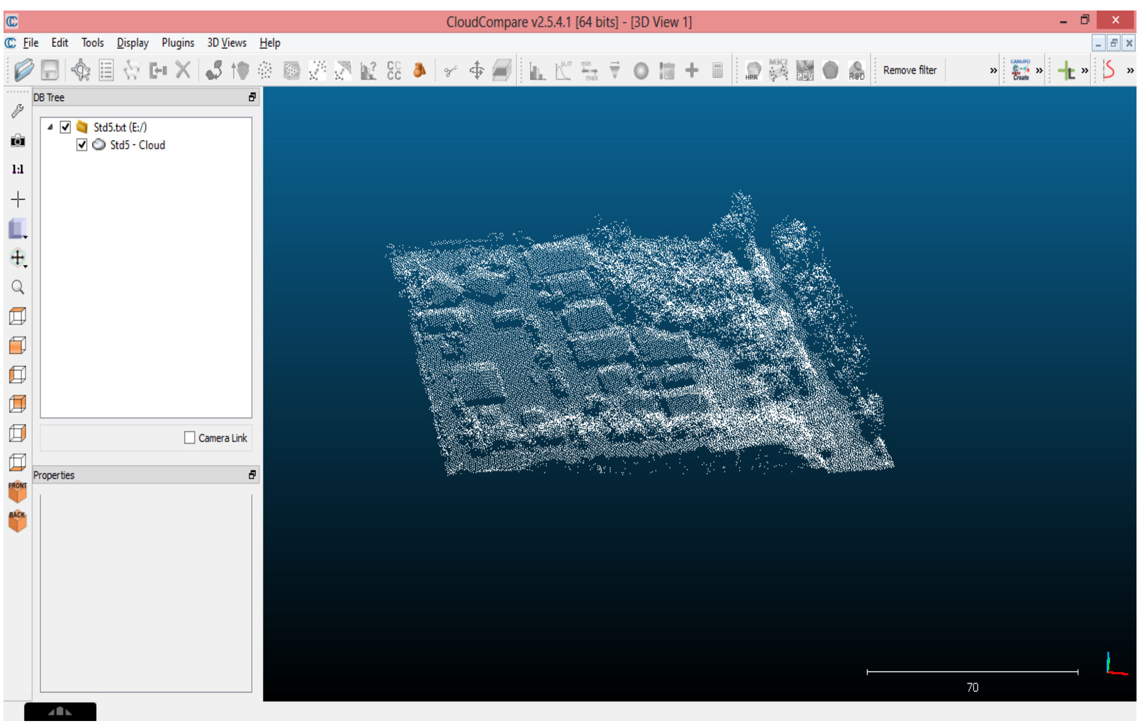


Figure 11: Density of points are reduced

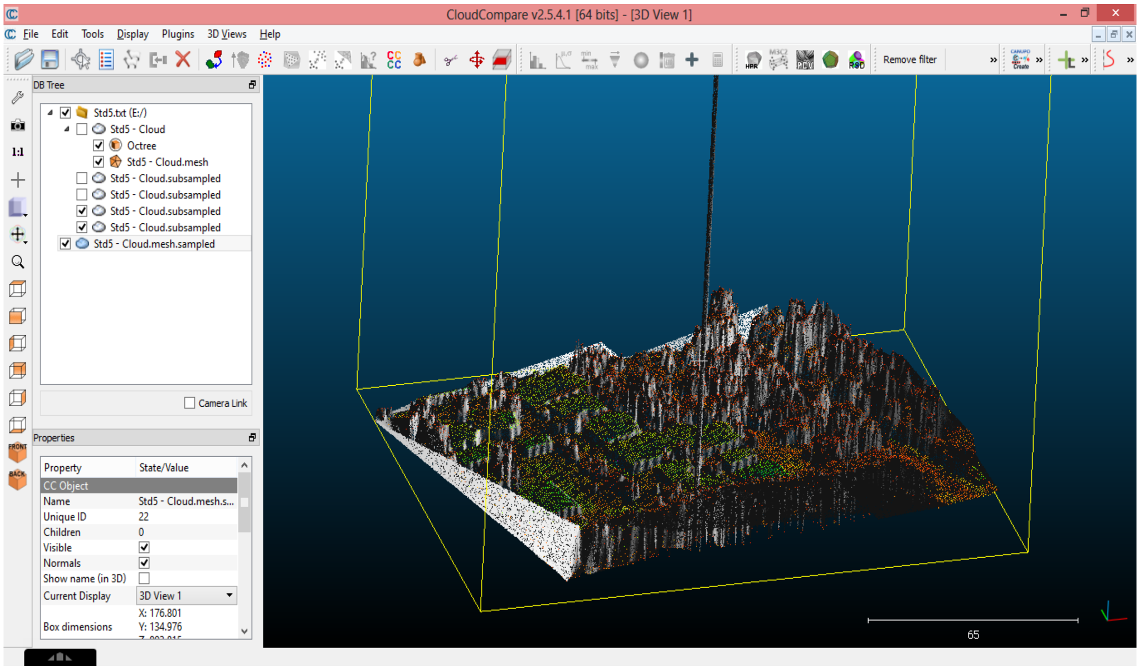


Figure 12: The point cloud mesh together

In order to check the compatibility of pre-processing software with GIS, author has carried out a simple trial run using the same data from UTM. In this stage, author has been able to create the simple database for the point cloud data. By using ArcCatalog, author has created the feature class for the point cloud data. For this example, author has added attribute ‘NAME’ for the data and selected data type for the attribute. This step is very important for the author’s project data as many attributes are needed to be included for the entire asset. For the future undertaking with actual data, there is a standard list of attributes data that author has figured out in order to achieve effective asset management system which cover the basic six questions of asset management as stated earlier. There are include:

- Name
- Location
- Ownership
- Category

- Model
- Registration No
- Received Date
- Status
- Maintenance Date
- Repair Date
- Unit Price
- Service Life
- Supplier / Manufacturer
- Staff in Charge

However, these attribute data can be added and updated accordingly towards asset's functions and capabilities. The standard list of attributed shown above is considered as benchmark for all of assets to have as soon as their availability in the system.

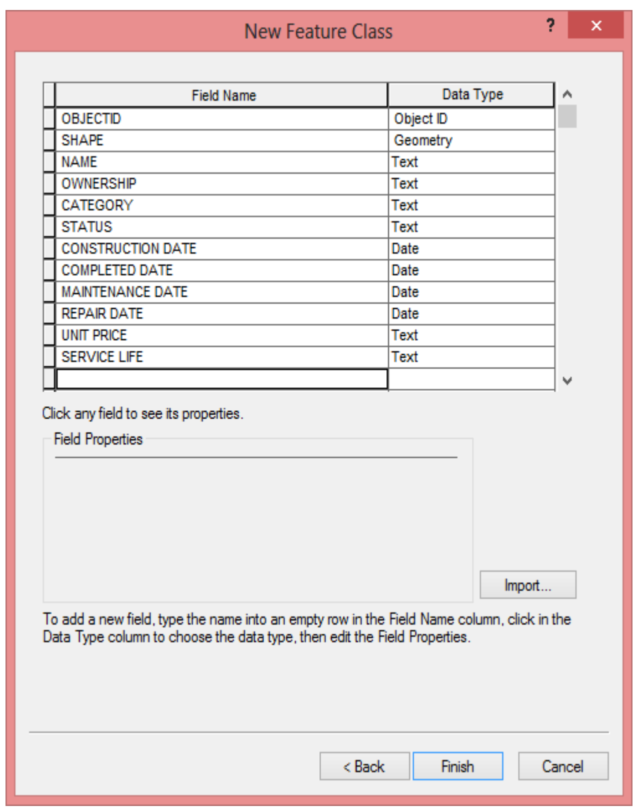


Figure 13: Register attribute data by using ArcCatalog

Then, author has imported the point cloud from the CloudCompare into ArcMap. By using ArcMap, author has selected the specific assets to be managed as clearly shown below in the Figure 15. By selecting the specific assets, author has managed to tag the assets that are required for the database information system. Also by using features in the ArcMap, author managed to fill the attributes data for each asset. For this case, author has selected 16 types of assets and named it R01 until R16 as shown in the Figure 16. In this stage, it will takes some times to fill in the attributes data for each new registered asset. However for the future long term services, it will save more time for the organization and employees as they just only need to update database in the system.

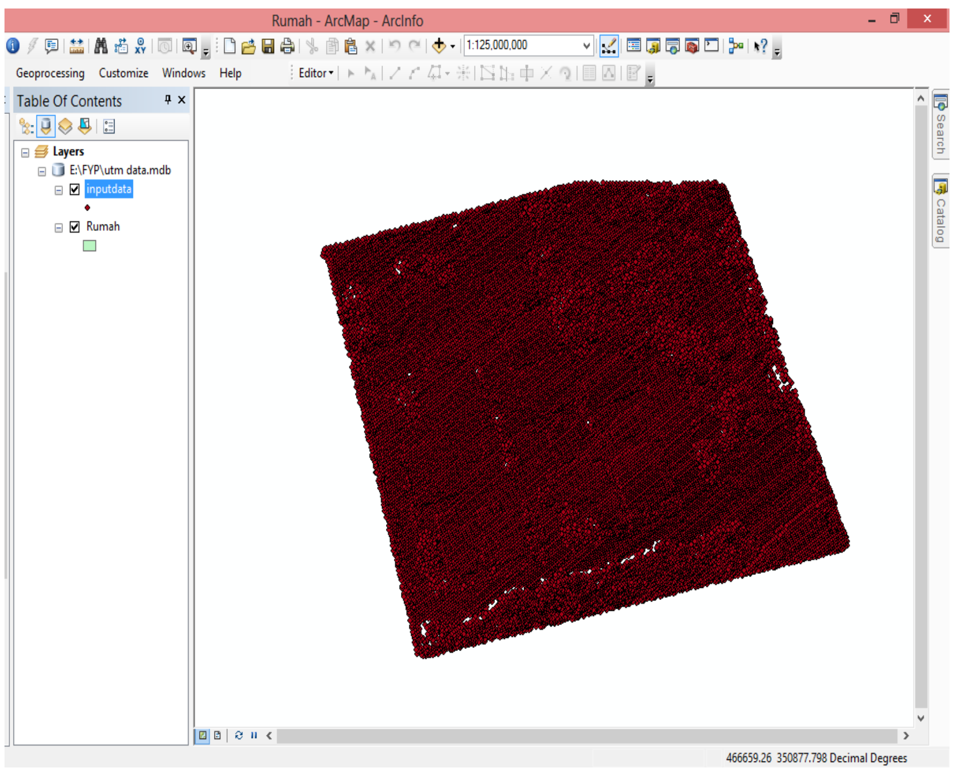


Figure 14: Point cloud data from pre-processing software

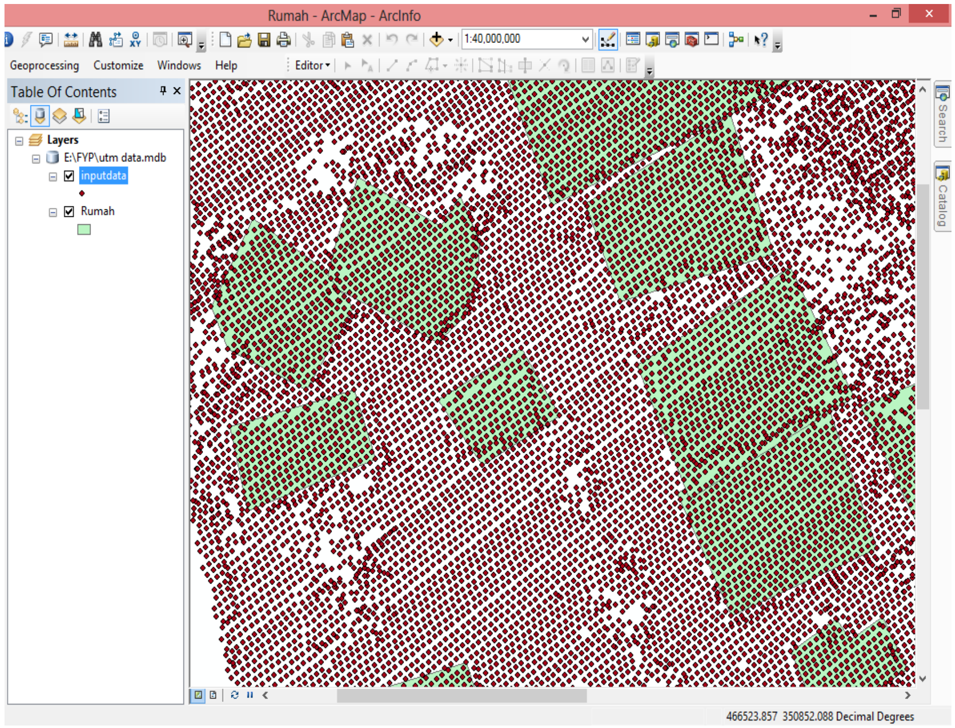
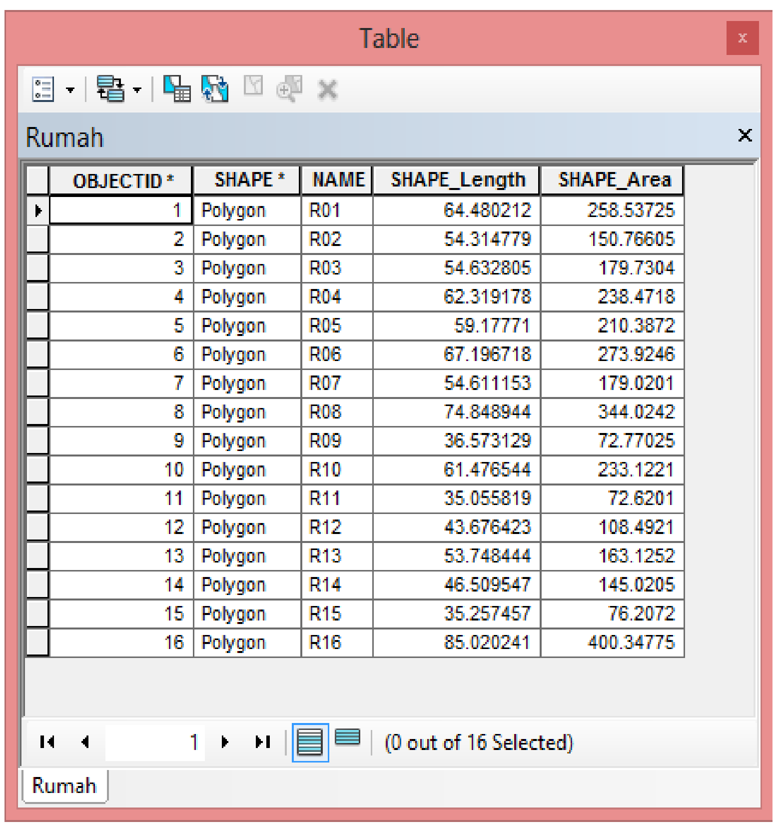


Figure 15: Specific assets are selected



Table

Rumah

OBJECTID *	SHAPE *	NAME	SHAPE_Length	SHAPE_Area
1	Polygon	R01	64.480212	258.53725
2	Polygon	R02	54.314779	150.76605
3	Polygon	R03	54.632805	179.7304
4	Polygon	R04	62.319178	238.4718
5	Polygon	R05	59.17771	210.3872
6	Polygon	R06	67.196718	273.9246
7	Polygon	R07	54.611153	179.0201
8	Polygon	R08	74.848944	344.0242
9	Polygon	R09	36.573129	72.77025
10	Polygon	R10	61.476544	233.1221
11	Polygon	R11	35.055819	72.6201
12	Polygon	R12	43.676423	108.4921
13	Polygon	R13	53.748444	163.1252
14	Polygon	R14	46.509547	145.0205
15	Polygon	R15	35.257457	76.2072
16	Polygon	R16	85.020241	400.34775

1 (0 out of 16 Selected)

Rumah

Figure 16: The attribute table is filled

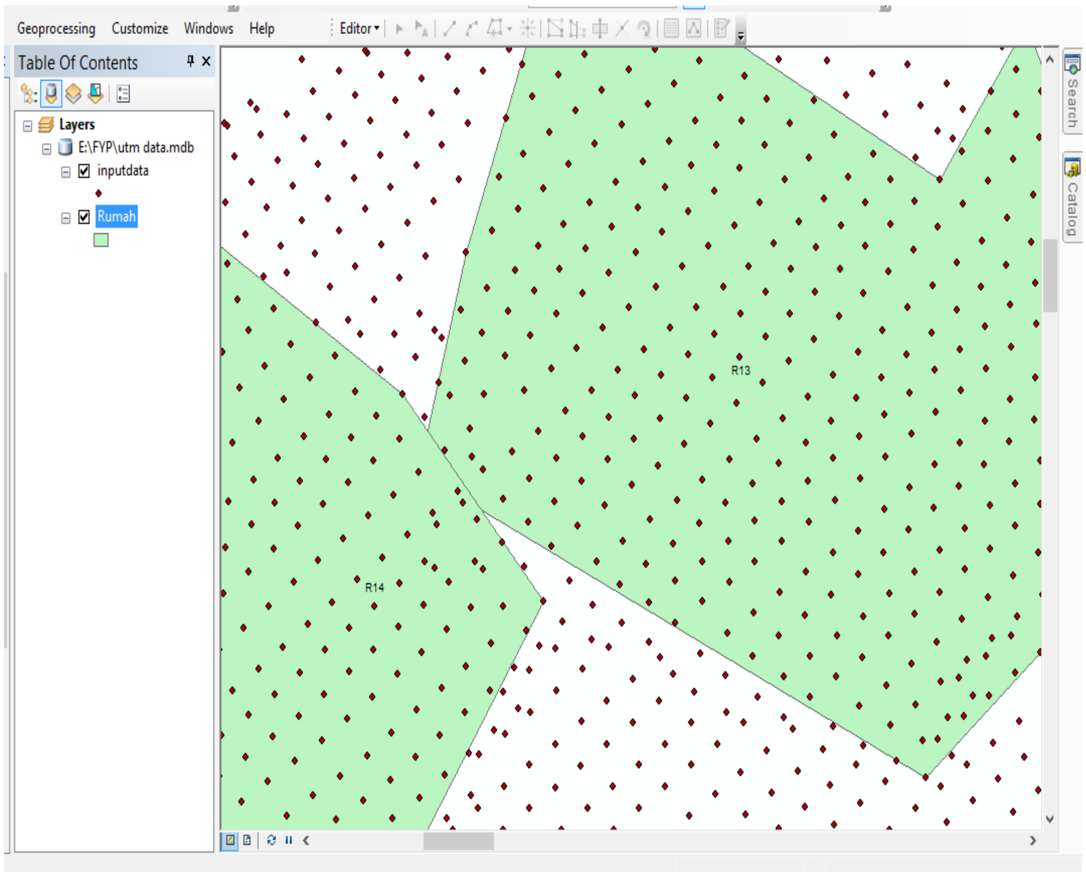


Figure 17: Assets are labeled with their attribute

4.2 ACTUAL DATA

At the end of week 12, author has managed to obtain the laser scanner device from the local vendor, JuruPro Sdn Bhd for the laser scanning activity in order to get the actual data for this project. As mentioned earlier, the scope of study for this project involved computer room as area to be scanned. For the computer room, the computers are considered as the main asset for the room as without it, the room cannot be function properly.

Figure 18: Laser scanner FARO Focus 3D 120 is used for this project

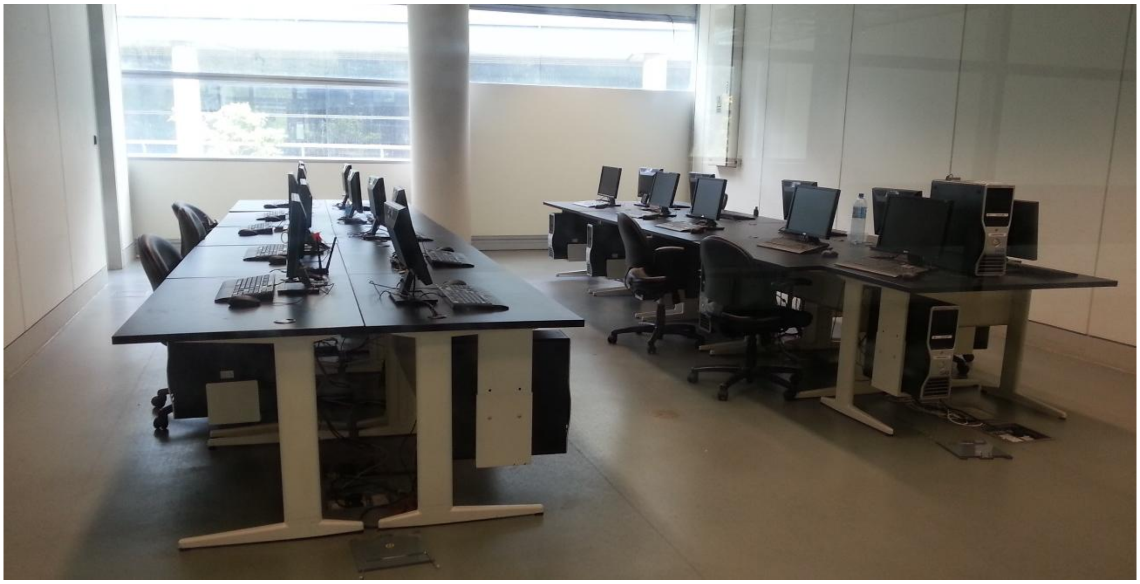


Figure 19: Computer room as area to be scanned

Figure 20: Laser scanner is installed in the computer room

Figure 21: The laser scanner indicates the touch interface features

Figures below show the result data of computer room which are obtained from laser scanner device. The result data for this actual data is processed by using processing software from the manufacturer, FARO which is called SCENE. As you can see, different software can produce different type data which clearly different from the preliminary data earlier. These figures indicate the different views of the visual images of assets that are acquired in computer room from FARO Focus 3D 120. These data later will be overlapping with each other to produce 3D modeling of the assets.

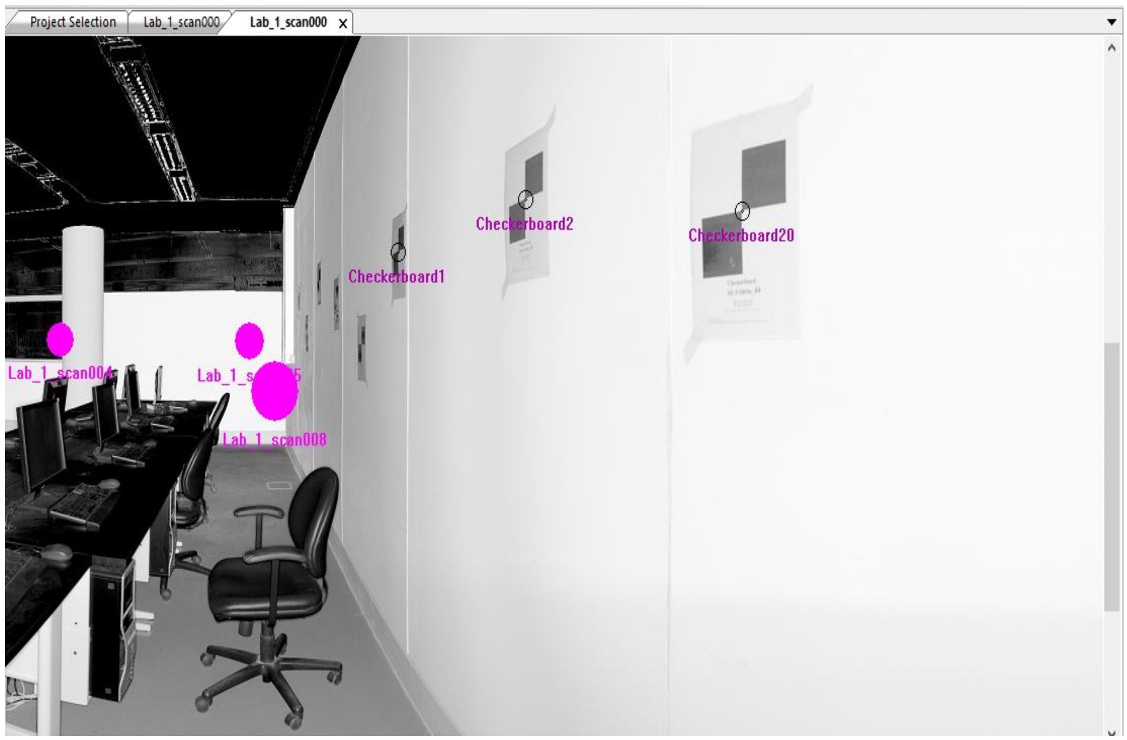


Figure 22: Scanned data of computer room from laser scanner

Figure 23: Scanned data of computer room from laser scanner

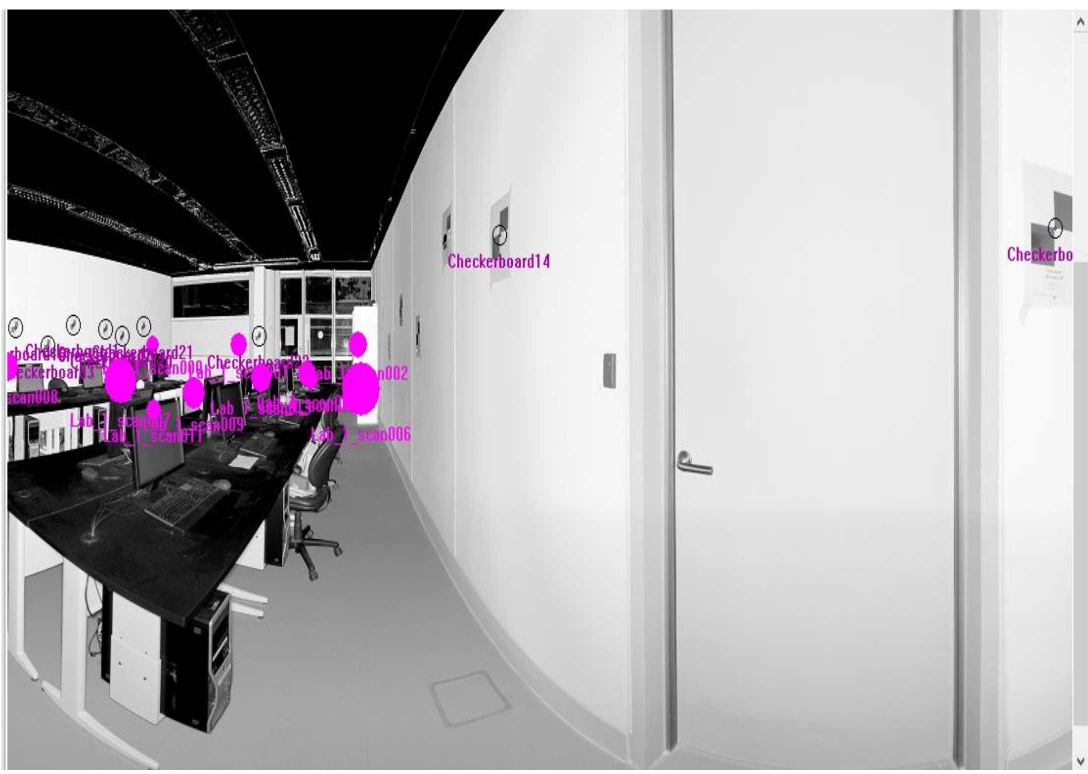


Figure 24: Scanned data of computer room from laser scanner

Figure 25: Scanned data of computer room from laser scanner

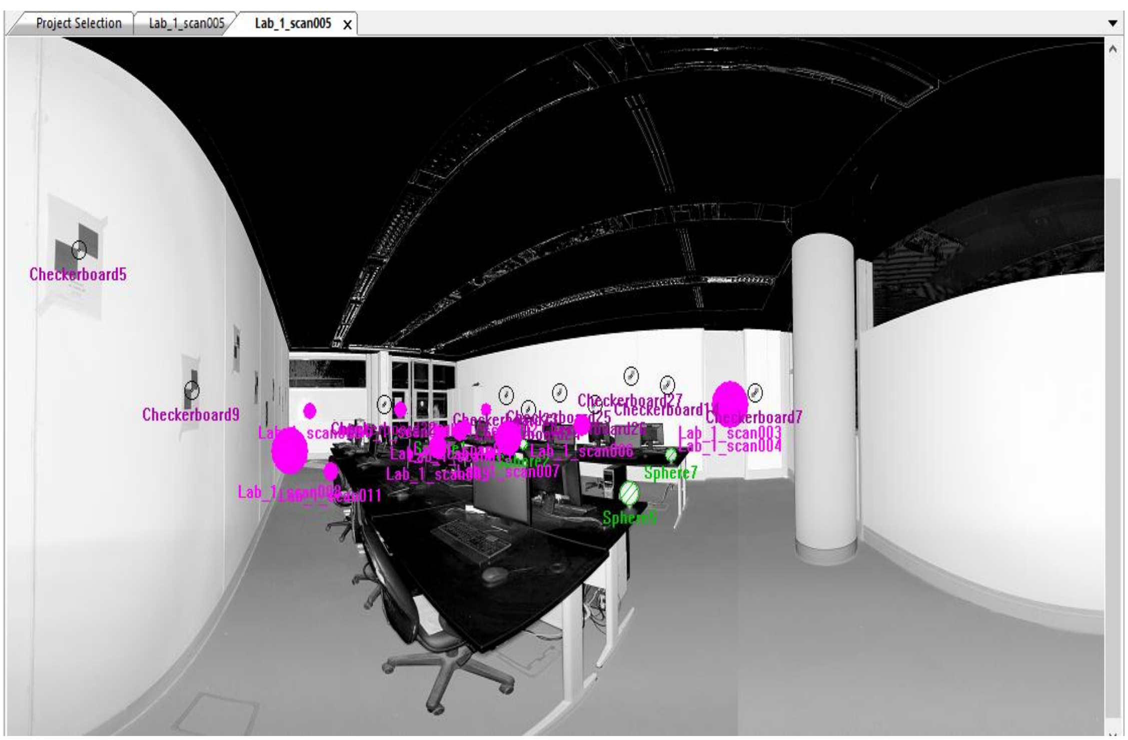


Figure 26: Scanned data of computer room from laser scanner

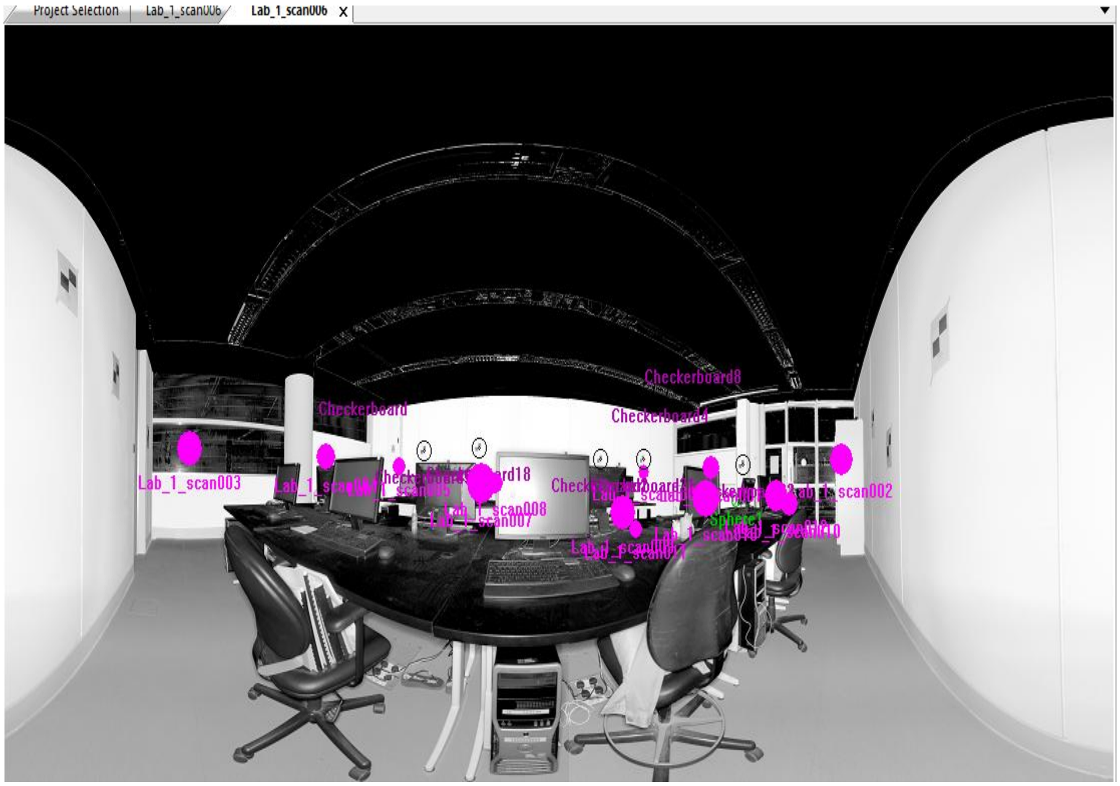


Figure 27: Scanned data of computer room from laser scanner

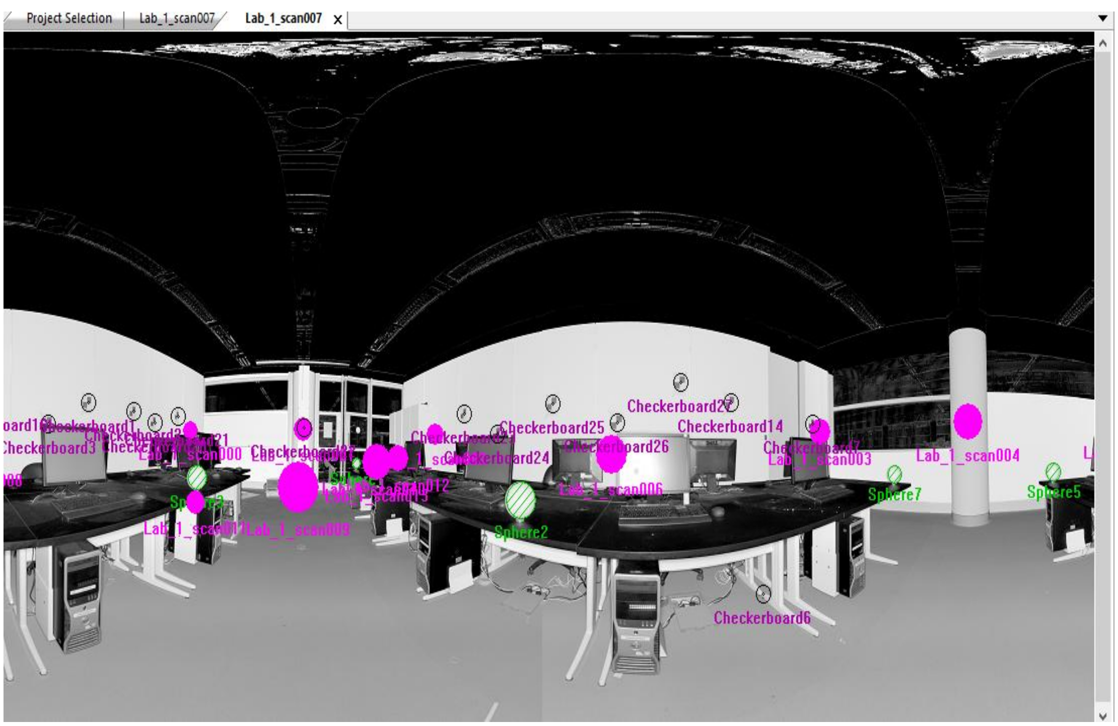


Figure 28: Scanned data of computer room from laser scanner

Figure 29: Scanned data of computer room from laser scanner

Figure 30: Scanned data of computer room from laser scanner

After data collection by using 3D laser scanner technology stage, the next step is data processing by using relevant software. For the actual data, author has decided to use software AutoCad to process the point cloud data and produce 3D modeling of the computer room. Figures below show the result of 3D modeling by using AutoCad which in format file drawing (*dwg).

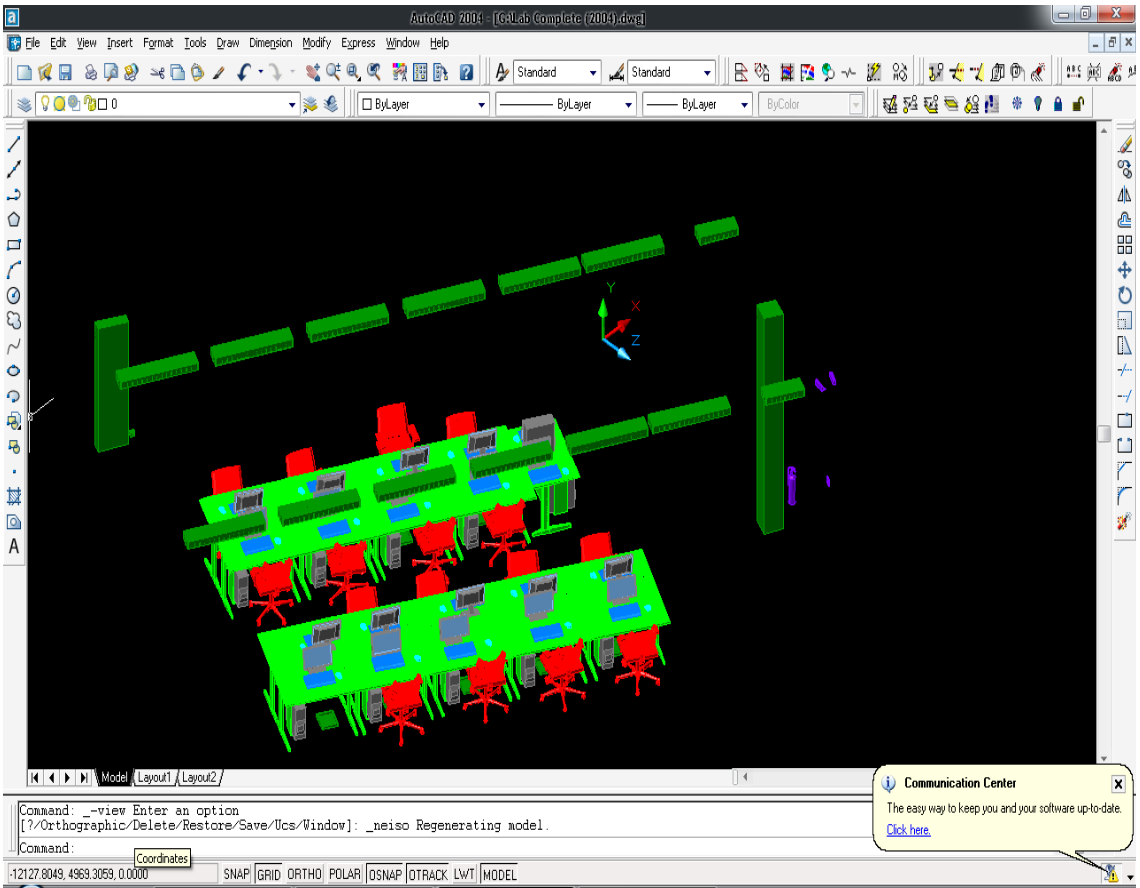


Figure 31: 3D modeling of the computer room in AutoCad

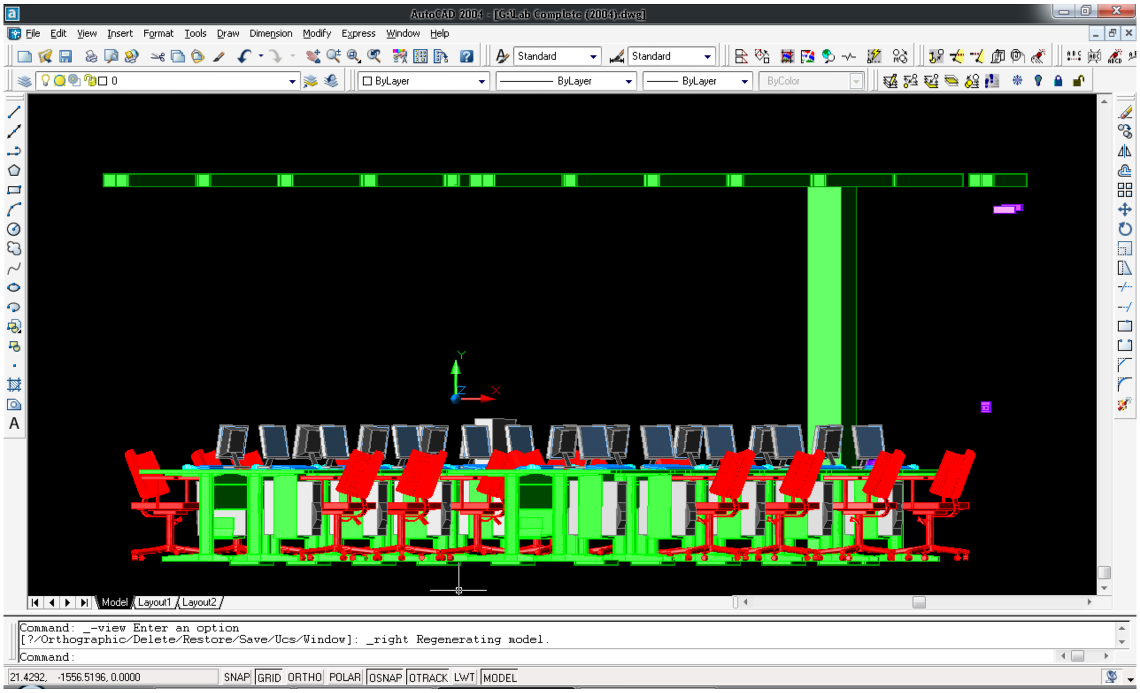


Figure 32: 3D modeling of the computer room in AutoCad

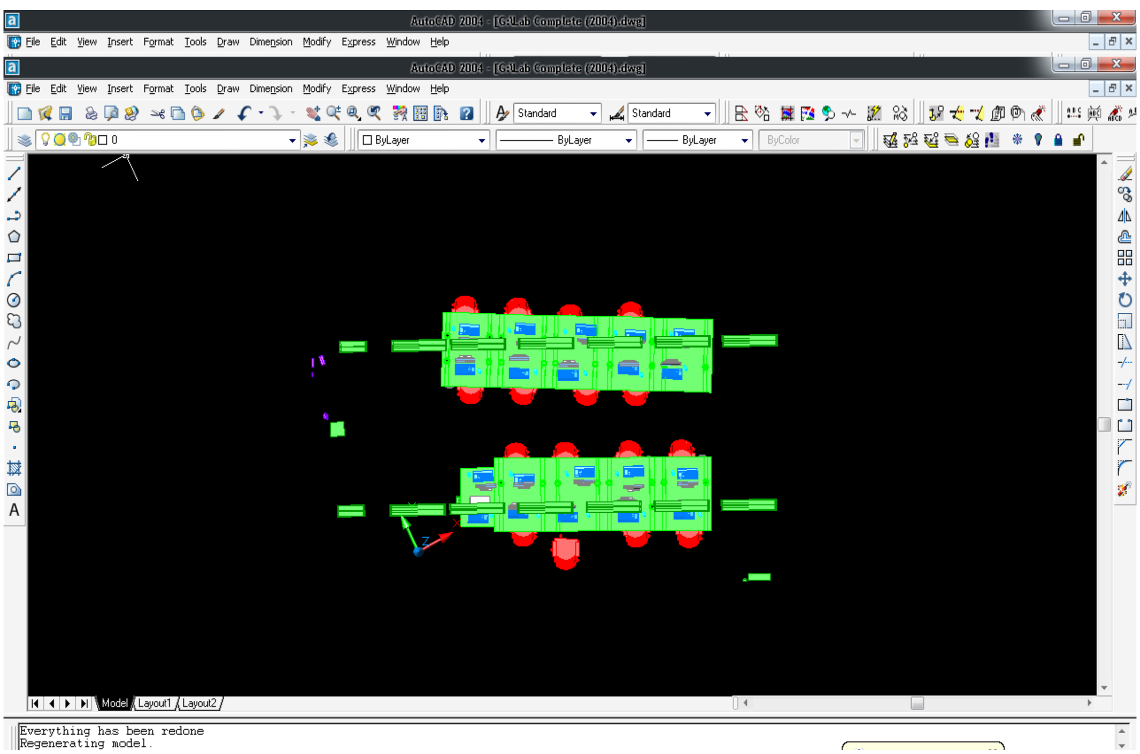


Figure 33: 3D modeling of the computer room in AutoCad

Before proceed to the integration of data, the 3D modeling in format file drawing (*dwg) must be changed to 3D Studio (*3ds) in order to make it compatible in Geographic Information System (GIS). The conversion of format file from *dwg to *3ds can be done by using features in AutoCad. After successfully converted the 3D modeling of the computer room, the next step of this project is to integrate the 3D modeling data in the GIS. Figures below show step by step on how author import 3D modeling in *3ds format file in the ArcScene.

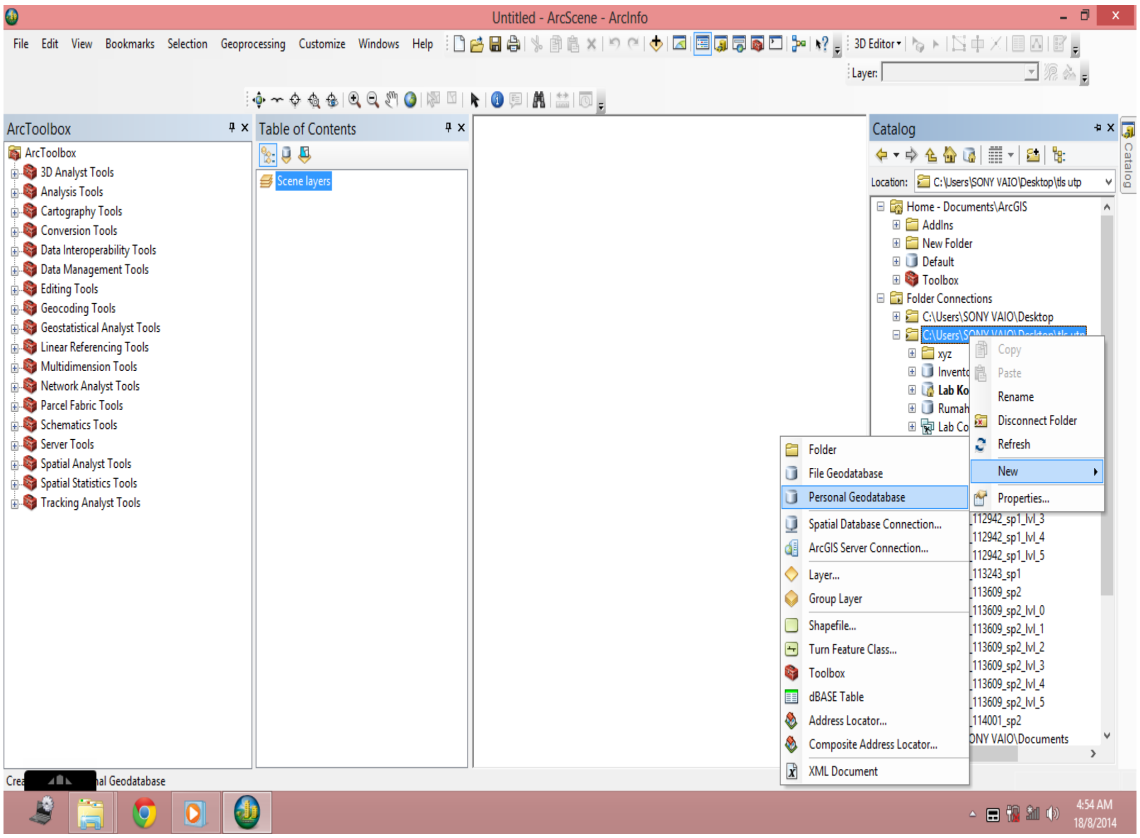


Figure 34: Create Personal Geodatabase in ArcScene

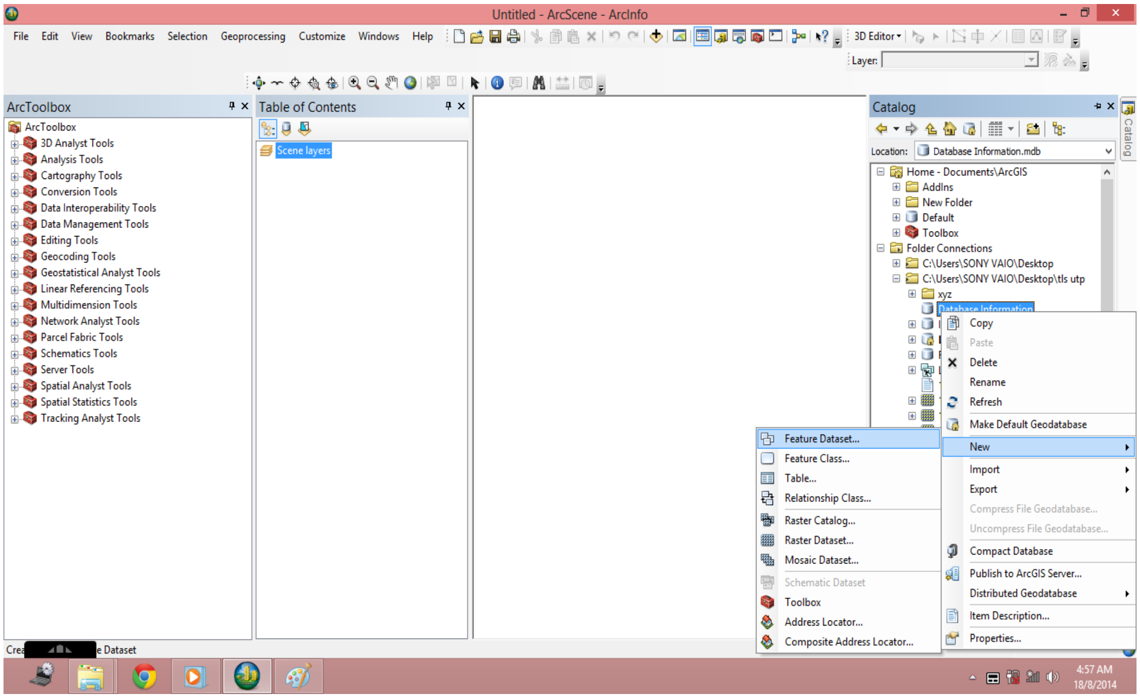


Figure 35: Create Feature Dataset in the ArcScene

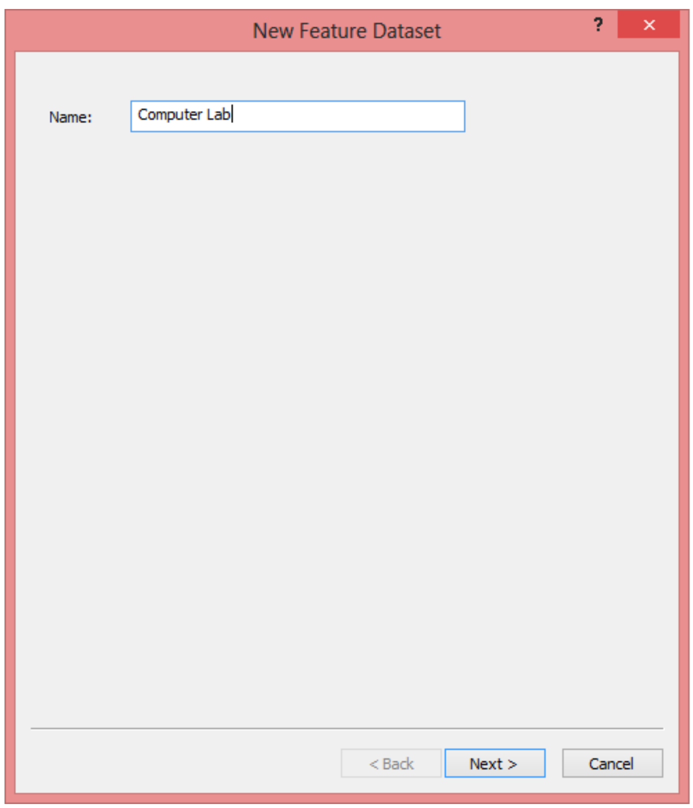


Figure 36: Provide a name for the dataset

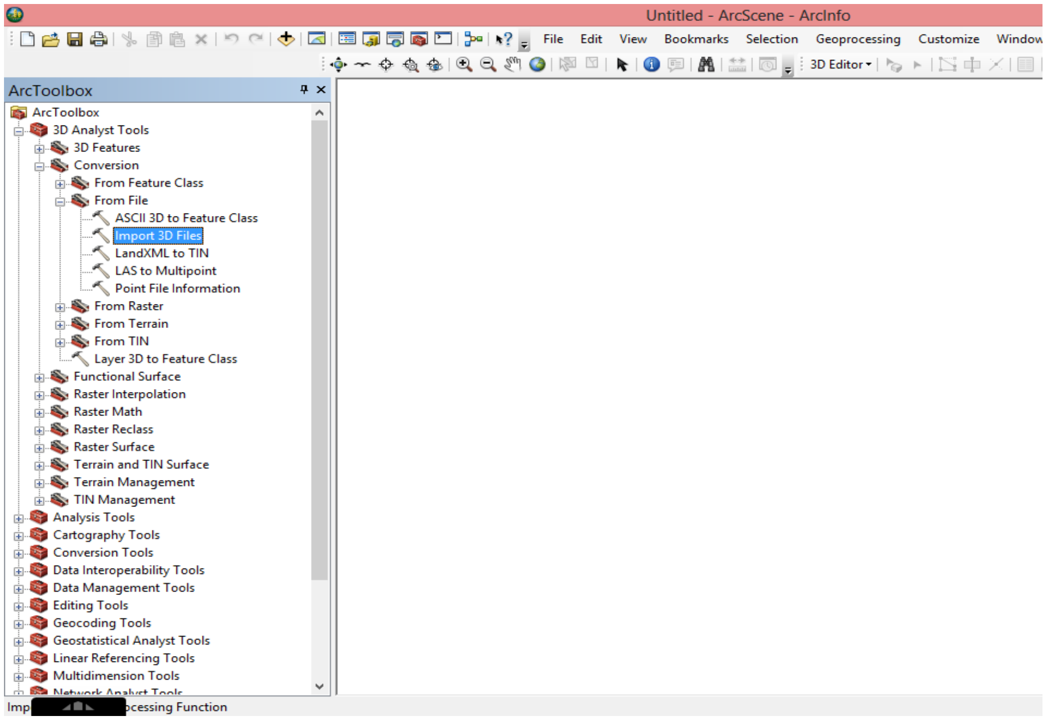


Figure 37: Use Import 3D Files feature in ArcScene to import the 3D modeling

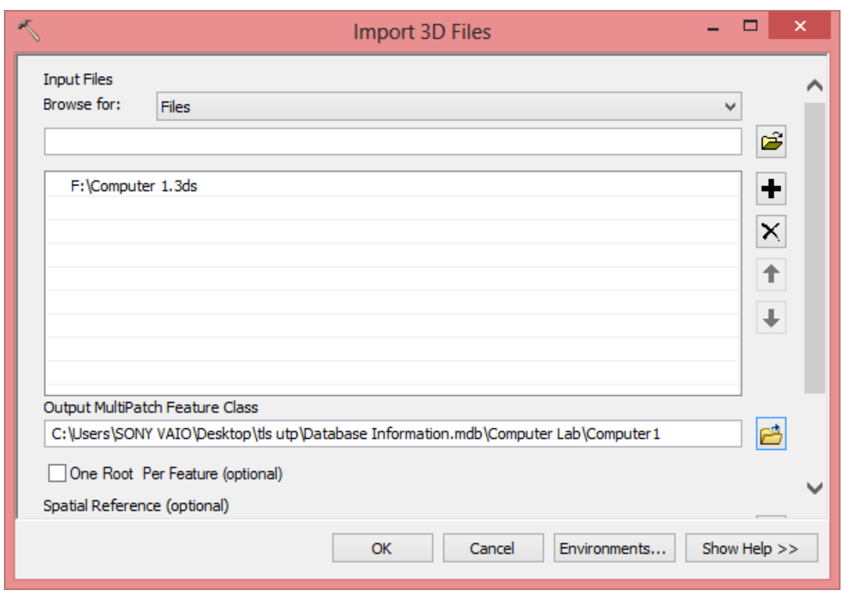


Figure 38: Import the 3D modeling in the Feature Dataset created earlier

Since this project specifically choose computer room as area to be scanned and computers are the main asset which require to be tagged individually, the step of importing all computers need to be done one by one.

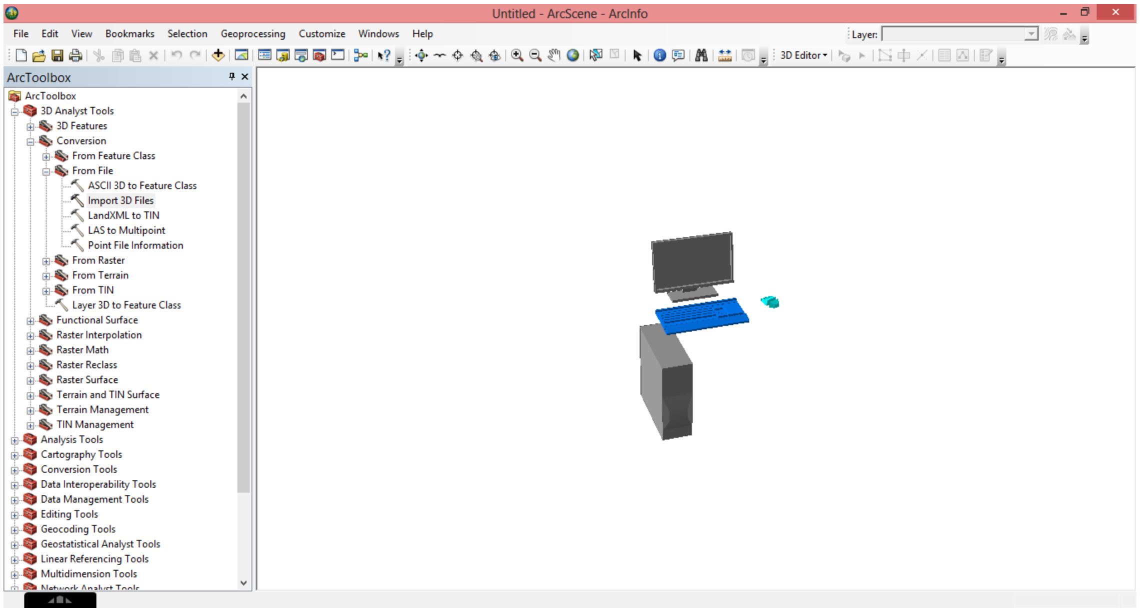


Figure 39: Example of one asset imported in the ArcScene

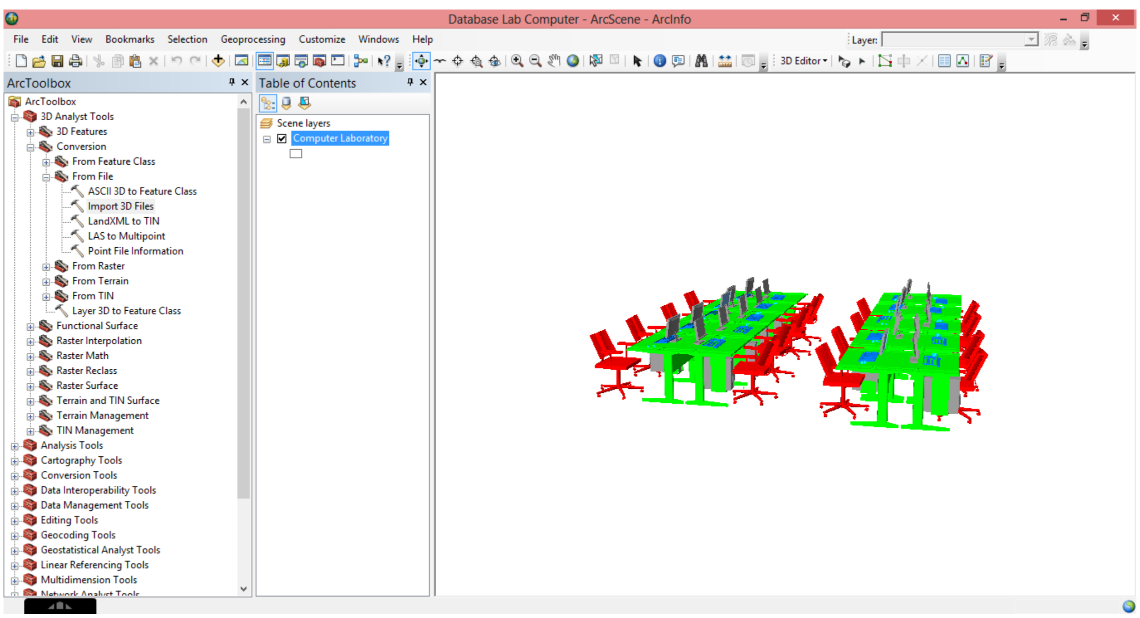


Figure 40: All assets are imported in the ArcScene

After all of the assets successfully imported in the ArcScene, the next step is the development of the attribute data of the asset. By using ArcScene, the attribute data of the asset can be input and update in a fast and easy way. Figures below show the step that author conducted in order to develop the database information system of the computer room.

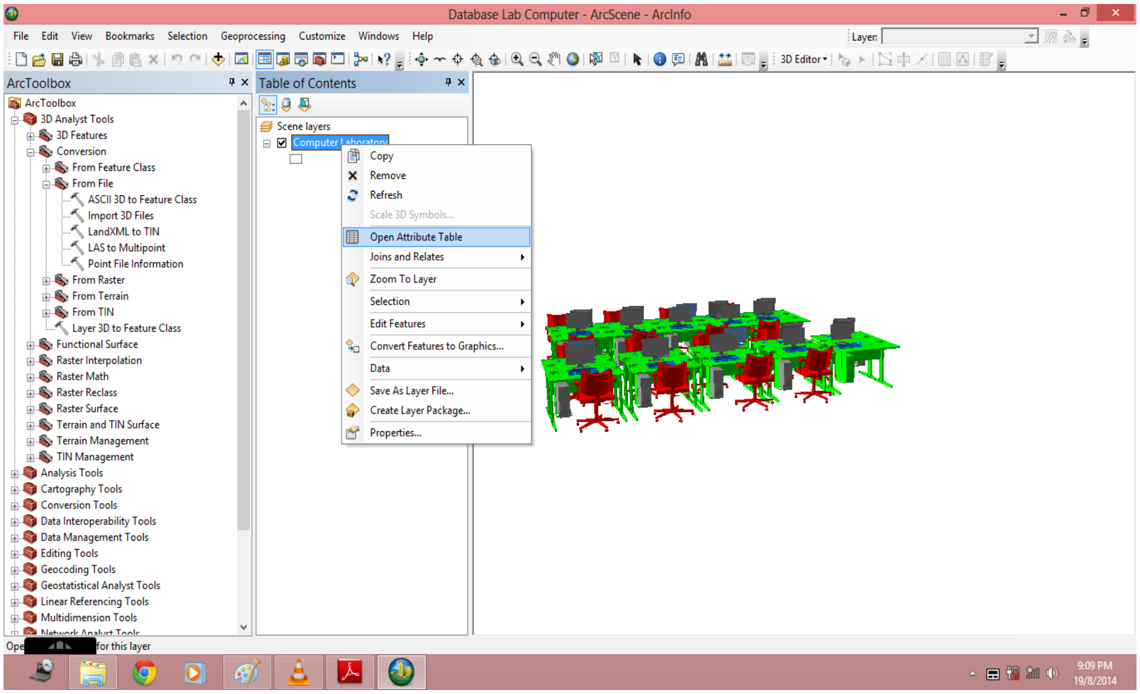


Figure 41: The attribute data can be input in the Attribute Table

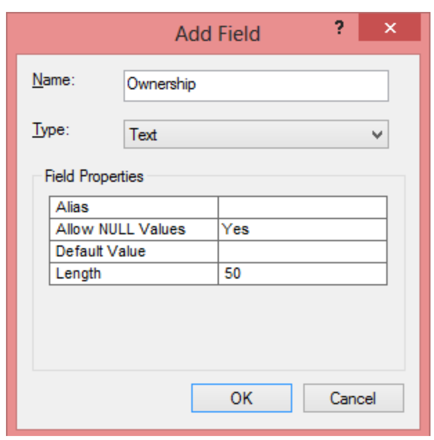
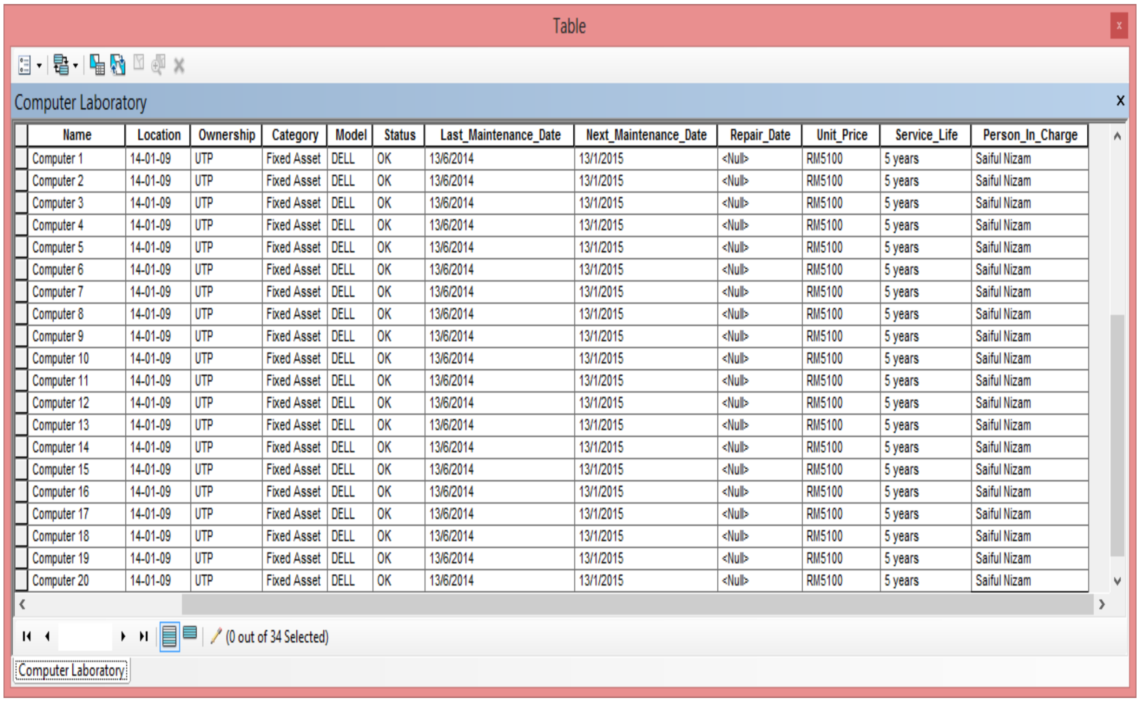


Figure 42: The attribute data section can be added by using Add Field feature



Table

Computer Laboratory

Name	Location	Ownership	Category	Model	Status	Last_Maintenance_Date	Next_Maintenance_Date	Repair_Date	Unit_Price	Service_Life	Person_In_Charge
Computer 1	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 2	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 3	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 4	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 5	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 6	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 7	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 8	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 9	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 10	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 11	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 12	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 13	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 14	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 15	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 16	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 17	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 18	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 19	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam
Computer 20	14-01-09	UTP	Fixed Asset	DELL	OK	13/6/2014	13/1/2015	<Null>	RM5100	5 years	Saiful Nizam

(0 out of 34 Selected)

Computer Laboratory

Figure 43: Attribute data has successfully developed in the ArcScene

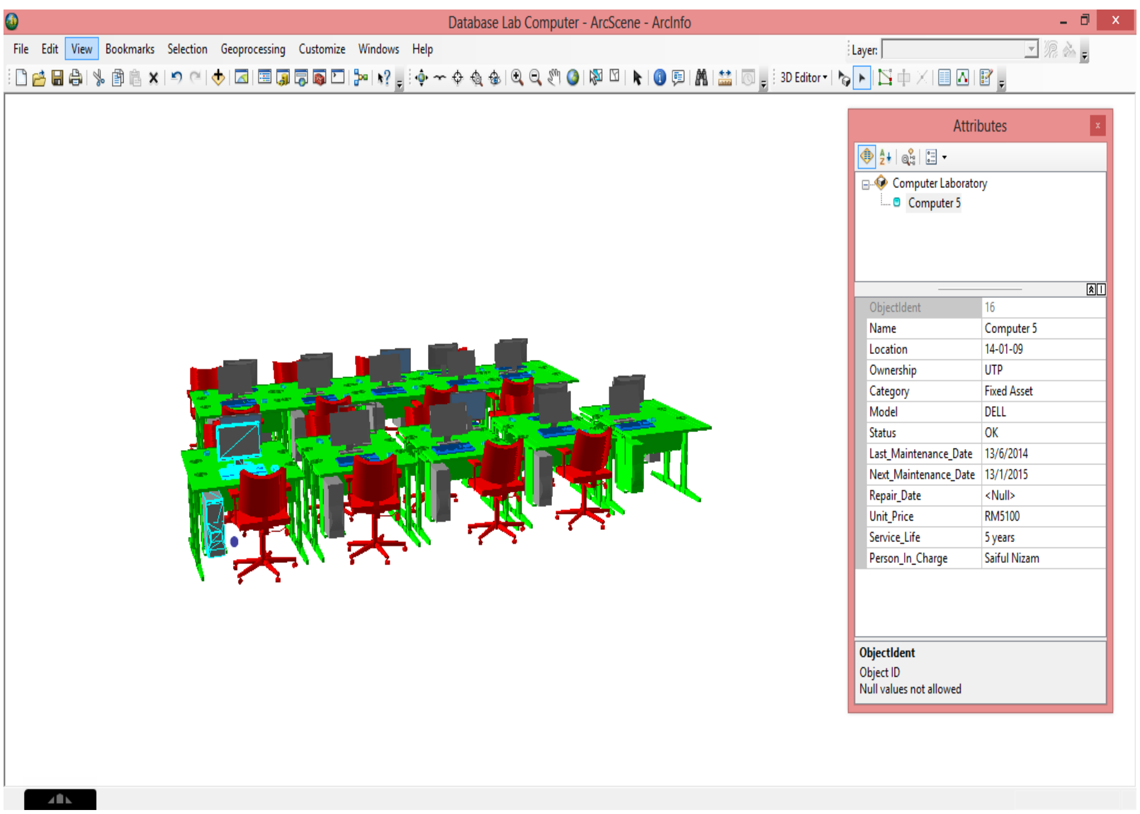


Figure 44: End result

CHAPTER 5

CONCLUSION AND RECOMMENDATION

This project implementation will address the pressing issues and challenges towards achieving successful building asset management system. The function of this project to be carried out is not just to establish the database information system of the building's assets but also to assist the owner and managers of the building to be more aware and active in knowing their assets conditions especially when it comes to maintenance and repair services. As stated earlier if maintenance is not performed, the repairs equaling five times the maintenance costs are required. If, in turn those repairs are deferred, the renewal expenses can reach five times the repair cost (De Sitter, 1984) and according to Vanier (2001), Canada cities has spent between $12 billion to $15 billion annually for this services only.

The importance of effective information system is the key to many organizations. The centralized, accurate and latest data information of the assets will help the users to facilitate and explore the planning strategic activities towards the assets. The integration of GIS into building asset management system will enhance and enrich the effectiveness and efficiency of the system. GIS helps to input, store, manage, manipulate, display and process the required information about the assets. One of the strength of GIS is that it gives the accurate and real spatial data about the asset in context of map views and charts. GIS also assist in preparing schedule preventive and predictive maintenance as well as provide accurate financial summary information of repairs of the assets. The implementation of GIS in the asset management will reduce the paper works, amount of time as well as allocation of resources.

As stated earlier, the data collection and analysis is the key in implementing GIS into asset management. The 3D modeling data information of the building's asset extracted by using laser scanning technology is moving rapidly nowadays. Laser scanner provides an effective, efficient and fastest methodology in capturing the physical image of the assets. This laser scanner produces point clouds of data which can interpret the asset’s size, shape form, location as well as give a real yet accurate sample modeling of the building’s asset. The integration of the data information collected by using laser scanner into GIS will gives the owner/managers of the building a proficient and strong strategic planning towards a realization of successful asset management system. In this Final Year Project, author only used small rooms as the study areas as there is time frame to complete this project. In the future undertaking, in order to accomplish effective building asset management system for existing building, the project shall include entire building and all the assets contain in it to achieve maximum effective management system.

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