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Academic Report on Measuring Jin Li Gwan Building in Ansan University Using BIM Technology

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Abstract

Korea generally known as a country of high technology and rapid in the world but the country also has a diversity of Korean architectural style. This led to the Korean inherit various building designs for generations. It is important for the identity of a country. JIN LI GWAN designs a building that has a value that is proud like facade. The main objective of this study is to see upon how BIM technology will help students in measuring historical building. Students from CART Polipd combined with students from Ansan University integrate BIM technology in measuring and documenting JIN LI GWAN. Research found that integrating BIM technology in measured drawing project help students to produce high accuracy documentation in a short period of time. Façade development also becomes easy with BIM technology. Drone made the process faster in documenting façade and roof for tall building. Integrating BIM technology in measured drawing make easy for documentation process involving the generation and management of digital representations of physical and functional characteristics of buildings and places. BIM technology allows students to create documentation from the data collected in short period of time. This technology also allows students to produce high detail of digital model that make it easy for visualization in the presentation.

Keywords: Measured drawing, BIM, Facade, Documentation

1. Introduction

Methods of Documentation and Measured Drawing is a importand course conducted in Polythenic Port Dickson that aims to develop an understanding of the principles of building preservation and the method of recording it in three documentation methods; measured drawings, written documentation and photographic documentation. The ideas of application and management of architectural historic documentation will be presented as part of the overall knowledge of building preservation. For measured drawings, students are to document BIM technology and architecturally significant buildings in the form of as-built drawings. The task requires 14 students per group that involve field works consisting measuring technique such as photographing, sketches, drone use of laser measuring and measuring tape. The outcomes of the subject are collections of plans, sections, elevations, details and axonometric views / models; complemented with a report that explains about the background, history, culture architectural style, construction and ornamentation of the given building.

2. RESEARCH OBJECTIVES

The aims objectives of the module are to introduce several methods of documenting BIM (Building Information Modelling) in the three documentation methods of measured drawings, written documentation and photographic documentation to preserve an accurate record of BIM properties that can be used in research and other preservation activities as well to introduce basic preparation of measured drawings of an approved building or structure to prescribed standard. Upon successful completion of the module, we will be able to identify and classify architectural historic structure as well as method to document them in the appropriate means to ensure it can be used as a reference in the future. Through the report writing, we would also able to explain the application of architectural historic documentation, as-built building constructions, architectural details, elements and the list goes on. In the future, we would also be able to recall and recognize the techniques of measured drawing and documentation when having a site visit, especially the BIM buildings that needed much documentation for preservation and conservation purposes. On the other hand, we would be able to execute fieldwork and hands-on measurements before translating the data into scale drawings.

3.0 BIM DEFINITION

Building information modelling (BIM) is a process involving the generation and management of digital representations of physical and functional characteristics of places. Building information modellings (BIMs) are which can be extracted, exchanged or networked to support decision-making regarding a building or other built asset. Current BIM software is used by individuals, businesses and government agencies who plan, design, construct, operate and maintain diverse physical infrastructures, such as water, refuse, electricity, gas, communication utilities, roads, bridges, ports, tunnels and many more. Traditional building design was largely reliant upon two-dimensional technical drawings (plans, elevations, sections,) Building information modeling extends this beyond 3D, augmenting the three primary spatial dimensions (width, height and depth) with time as the fourth dimension (4D) and cost as the fifth (5D) BIM therefore covers more than just geometry. It also covers spatial relationships, light analysis, geographic information, and quantities and properties of building components (for example, manufacturers' details).

BIM involves representing a design as combinations of "objects" – vague and undefined, generic or product-specific, solid shapes or void-space oriented (like the shape of a room), that carry their geometry, relations and attributes. BIM design tools allow extraction of different views from a building model for drawing production and other uses. These different views are automatically consistent, being based on a single definition of each object instance. BIM software also defines objects parametrically; that is, the objects are defined as parameters and relations to other objects, so that if a related object is amended, dependent ones will automatically also change. Each model element can carry attributes for selecting and ordering them automatically, providing cost estimates as well as material tracking and ordering.

For the professionals involved in a project, BIM enables a virtual information model to be handed from the design team (architects, landscape architects, surveyors, civil, structural and building services engineers,) to the main contractor and subcontractors and then on to the owner/operator; each professional adds discipline-specific data to the single shared model. This reduces information losses that traditionally occurred when a new team takes 'ownership' of the project, and provides more extensive information to owners of complex structures.

3.1 BIM ORIGIN AND ELEMENT

The concept of BIM has existed since the 1970s. The term 'building model' was first used in papers in the mid-1980s: in a 1985 paper by Simon Ruffle eventually published in 1986, and later in a 1986 paper by Robert Aish- then at GMW Computers Ltd, developer of RUCAPS software - referring to the software's use at London's Heathrow Airport. The term 'Building Information Model' first appeared in a 1992 paper by G.A. van Nederveen and F. P. Tolman. However, the terms 'Building Information Model' and 'Building Information Modeling' did not become popularly used until some 10 years later. In 2002, Autodesk released a white paper entitled "Building Information Modeling," and other software vendors also started to assert their involvement in the field. By hosting contributions from Autodesk, Bentley Systems and Graphisoft, plus other industry observers, in 2003, Jerry Laiserin helped popularize and standardize the term as a common name for the digital representation of the building process. Facilitating exchange and interoperability of information in digital format had previously been offered under differing terminology by Graphisoft as "Virtual Building", Bentley Systems as "Integrated Project Models", and by Autodesk or Vectorworks as "Building Information Modeling".

As Graphisoft had been developing such solutions for longer than its competitors, Laiserin regarded its ArchiCAD as then "one of the most mature BIM solutions on the market" but also highlighted the pioneering role of applications such as RUCAPS, Sonata and Reflex (on 23 June 2016, the UK's Royal Academy of Engineering presented its Prince Philip Gold Medal to Jonathan Ingram, the developer of Sonata and Reflex, for his pioneering work on BIM). Following its launch in 1987, ArchiCAD became regarded by some as the first implementation of BIM, as it was the first CAD product on a personal computer able to create 2D and 3D geometry, as well as the first commercial BIM product for personal computers.

3.2 BIM THROUGHOUT THE PROJECT LIFE –CYCLE

Use of BIM goes beyond the planning and design phase of the project, extending throughout the building life cycle, supporting processes including cost management, construction management, project management and facility operation.

3.2.1 MANAGEMENT OF BUILDING INFORMATION MODELS

Building information models span the whole concept-to-occupation time-span. To ensure efficient management of information processes throughout this span, a BIM manager (also sometimes defined as a virtual design-to-construction, VDC, project manager – VDCPM) might be appointed. The BIM manager is retained by a design build team on the client's behalf from the pre-design phase onwards to develop and to track the object-oriented BIM against predicted and measured performance objectives, supporting multi-disciplinary building information models that drive analysis, schedules, take-off and logistics. Companies are also now considering developing BIMs in various levels of detail, since depending on the application of BIM, more or less detail is needed, and there is varying modeling effort associated with generating building information models at different levels of detail.

3.2.2 BIM IN CONSTRUCTION MANAGEMENT

Participants in the building process is constantly challenged to deliver successful projects despite tight budgets, limited manpower, accelerated schedules, and limited or conflicting information. The significant disciplines such as architectural, structural and MEP designs should be well coordinated, as two things can't take place at the same place and time. Building Information Modeling aids in collision detection at the initial stage, identifying the exact location of discrepancies. The BIM concept envisages virtual construction of a facility prior to its actual physical construction, in order to reduce uncertainty, improve safety, work out problems, and simulate and analyze potential impacts. Sub-contractors from every trade can input critical information into the model before beginning construction, with opportunities to pre-fabricate or pre-assemble some systems off-site. Waste can be minimised on-site and products delivered on a just-in-time basis rather than being stock-piled on-site. Quantities and shared properties of materials can be extracted easily. Scopes of work can be isolated and defined. Systems, assemblies and sequences can be shown in a relative scale with the entire facility or group of facilities. BIM also prevents errors by enabling conflict or 'clash detection' whereby the computer model visually highlights to the team where parts of the building (e.g.: structural frame and building services pipes or ducts) may wrongly intersect.

3.2.3 BIM IN FACILITY OPERATION

BIM can bridge the information loss associated with handling a project from design team, to construction team and to building owner/operator, by allowing each group to add to and reference back to all information they acquire during their period of contribution to the BIM model. This can yield benefits to the facility owner or operator. For example, a building owner may find evidence of a leak in his building. Rather than exploring the physical building, he may turn to the model and see that water valve is located in the suspect location. He could also have in the model the specific valve size, manufacturer, part number, and any other information ever researched in the past, pending adequate computing power. Such problems were initially addressed by Leite and Akinci when developing a vulnerability representation of facility contents and threats for supporting the identification of vulnerabilities in building emergencies.

Dynamic information about the building, such as sensor measurements and control signals from the building systems, can also be incorporated within BIM software to support analysis of building operation and maintenance. There have been attempts at creating information models for older, pre-existing facilities. Approaches include referencing key metrics such as the Facility Condition Index (FCI), or using 3D laser-scanning surveys and photogrammetry techniques (both separately or in combination) to capture accurate measurements of the asset that can be used as the basis for a model. Trying to model a building constructed in, says 1927, and requires numerous assumptions more complex than building a model during design.

3.2.4 BIM IN LAND ADMINISTRATION AND CADASTRE

BIM can potentially offer some benefit for managing stratified cadastral spaces in urban built environments. The first benefit would be enhancing visual communication of interweaved, stacked and complex cadastral spaces for non-specialists. The rich amount of spatial and semantic information about physical structures inside models can aid comprehension of cadastral boundaries, providing an unambiguous delineation of ownership, rights, responsibilities and restrictions. Additionally, using BIM to manage cadastral information could advance current land administration systems from a 2D-based and analogue data environment into a 3D digital, intelligent, interactive and dynamic one. BIM could also unlock value in the cadastral information by forming a bridge between that information and the interactive lifecycle and management of buildings.

3.3 BIM SOFTWARE

The first software tools developed for modelling buildings emerged in the late 1970s and early 1980s, and included workstation products such as Chuck Eastman's Building Description System and GLIDE, RUCAPS, Sonata and Reflex. The early applications, and the hardware needed to run them, were expensive, which limited widespread adoption. ArchiCAD's Radar CH, released in 1984 was the first modelling software made available on a personal computer. Due to the complexity of gathering all the relevant information when working with BIM on a building project some companies have developed software designed specifically to work in a BIM framework. These packages differ from architectural drafting tools such as AutoCAD by allowing the addition of further information (time, cost, manufacturers' details, sustainability and maintenance information, etc.) to the building model.

3.5 NON-PROPRIETARY OR OPEN BIM STANDARDS

BIM is often associated with Industry Foundation Classes (IFCs) and aecXML – data structures for representing information. IFCs have been developed by buildingSMART (the former International Alliance for Interoperability), as a neutral, non-proprietary or open standard for sharing BIM data among different software applications (some proprietary data structures have been developed by CAD vendors incorporating BIM into their software). Poor software interoperability has long been regarded as an obstacle to industry efficiency in general and to BIM adoption in particular. In August 2004 a US National Institute of Standards and Technology (NIST) report conservatively estimated that $15.8 billion was lost annually by the U.S. capital facilities industry due to inadequate interoperability arising from "the highly fragmented nature of the industry, the industry's continued paperbased business practices, a lack of standardization, and inconsistent technology adoption among stakeholders". An early example of a nationally approved BIM standard is the AISC (American Institute of Steel Construction)-approved CIS/2 standard, a non-proprietary standard with its roots in the UK.

3.6 MALAYSIA

BIM implementation is targeted towards BIM Stage 2 by the year 2020 led by the Construction Industry Development Board (CIDB Malaysia). Under the Construction Industry Master Plan 2016-2020, it is hoped more emphasis on technology adoption across the project life-cycle will induce higher productivity.

3.6.1 ANTICIPATED FUTURE POTENTIAL

BIM is a relatively new technology in an industry typically slow to adopt change. Yet many early adopters are confident that BIM will grow to play an even more crucial role in building documentation. Proponents claim that BIM offers:

1. Improved visualization
2. Improved productivity due to easy retrieval of information
3. Increased coordination of construction documents
4. Embedding and linking of vital information such as vendors for specific materials, location of details and quantities required for estimation and tendering
5. Increased speed of delivery
6. Reduced costs

BIM also contains most of the data needed for building energy performance analysis. The building properties in BIM can be used to automatically create the input file for building energy simulation and save a significant amount of time and effort. Moreover, automation of this process reduces errors and mismatches in the building energy simulation process. Explorations are underway to pair computer network users' personal, private and public authentication choices, geographic mapping systems and evolving cloud computing security architecture models, together, to offer customers of geospatial securitization services intuitive new ways to organize their personal, private and public applications and storage. For individuals, businesses and government authorities who generate and manage building information, new ways to discover, share and work on data, within the context of particular places on earth, will be offered. David Plager, AIA, conjectures that today's web will give way to tomorrow's geo-web where data will be structured first by place (e.g. a postal address) and then by space (Personal (one user), Private (a group of users) and Public (all users)

4.0 RESEARCH AND MEASUREMENT METHODOLOGY

4.1 Job Distribution

The 14 members are led by the one leader, Erec Kurniawan Sofri Bin Syofyan. Everyone is given at roles to be in charged throughout the whole project where that are in charge of measuring. Revit, drone, elevation, details, section, site plan, interview, media and report writing.

4.2 RESEARCH PROCESS

This research collaboration between CART POLIPD and Ansan University occurred on 09th Januray to 21st January 2017. Data and information obtained for this report are from interviews, Ansan university library, Ansan authorities and heritage societies. All the arrangement for the studies are planned and made prior to the site visit. Research letter were given as proof to our identity and being a Polythenic Port Dickson student doing this coursework.

4.3 MEASURING INSTRUMENT AND TECHNIQUE

4.3.1 EQUIPMENT

1. Measuring Tape

To measure length, distance or height of any elements or component of the building, many variation of measuring tape was being used.

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Figure 1 Measuring Tape

2. **Laser Measuring Device**

To measure height or distance that is not easily reached like height of ceiling or length of roof trust, a BOSCH DLE 40 Professional was used. It is also used to extreme length easily with less effort compared to a normal measuring tape.

Figure 2 Laser Measuring Device

3. Drone

A drone, in a technological context, is an unmanned aircraft. Essentially, a drone is a flying robot. The aircrafts may be remotely controlled or can fly autonomously through software-controlled flight plans in their embedded systems working in conjunction with onboard sensors and GPS.

Figure 3 Drone

4. Digital Camera

The digital camera recorded and storing images in digital form. Many current models are also able to capture sound or video, in addition to still images.

Figure 4 Digital Camera

5.4 LIMITATION OF MEASUREMENT AND RESEARCH

5.4.1 TIME LIMITATION

The most dependent limitation is the time given for the measurement activity and the overall assignment itself. Two weeks are unable to complete the thoroughly because BIM is the very new software for students.

5.5 PROCESS

5.5.1 REVIT

Autodesk Revit is building information modeling software for architects, structural engineers, MEP engineers, designers and contractors developed by Autodesk. It allows users to design a building and structure and its components in 3D, annotate the model with 2D drafting elements, and access building information from the building model's database. Revit is 4D BIM capable with tools to plan and track various stages in the building's lifecycle, from concept to construction and later demolition.

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5.5.3 PIX4D

Pix4D is a solution to converting thousands of aerial images taken by lightweight, unmanned aerial vehicle (UAV) or aircraft into geo-referenced 2D mosaics, 3D surface models and point clouds. With its advanced automatic aerial triangulation based purely on image content and unique optimisation techniques, Pix4D software enables civilian light-weight drones to become the next-generation mapping and surveying tool.

5.5.4 POINT CLOUD

A **point cloud** is a set of data points in some coordinate system. In a three-dimensional coordinate system, these points are usually defined by *X*, *Y*, and *Z* coordinates, and often is intended to represent the external surface of an object. Point clouds may be created by 3D scanners. These devices measure a large number of points on an object's surface and often output a point cloud as a data file. The point cloud represents the set of points that the device has measured. As the output of 3D scanning processes, point clouds are used for many purposes, including to create 3D CAD models for manufactured parts, metrology/quality inspection, and a multitude of visualization, animation, rendering and mass customization applications.

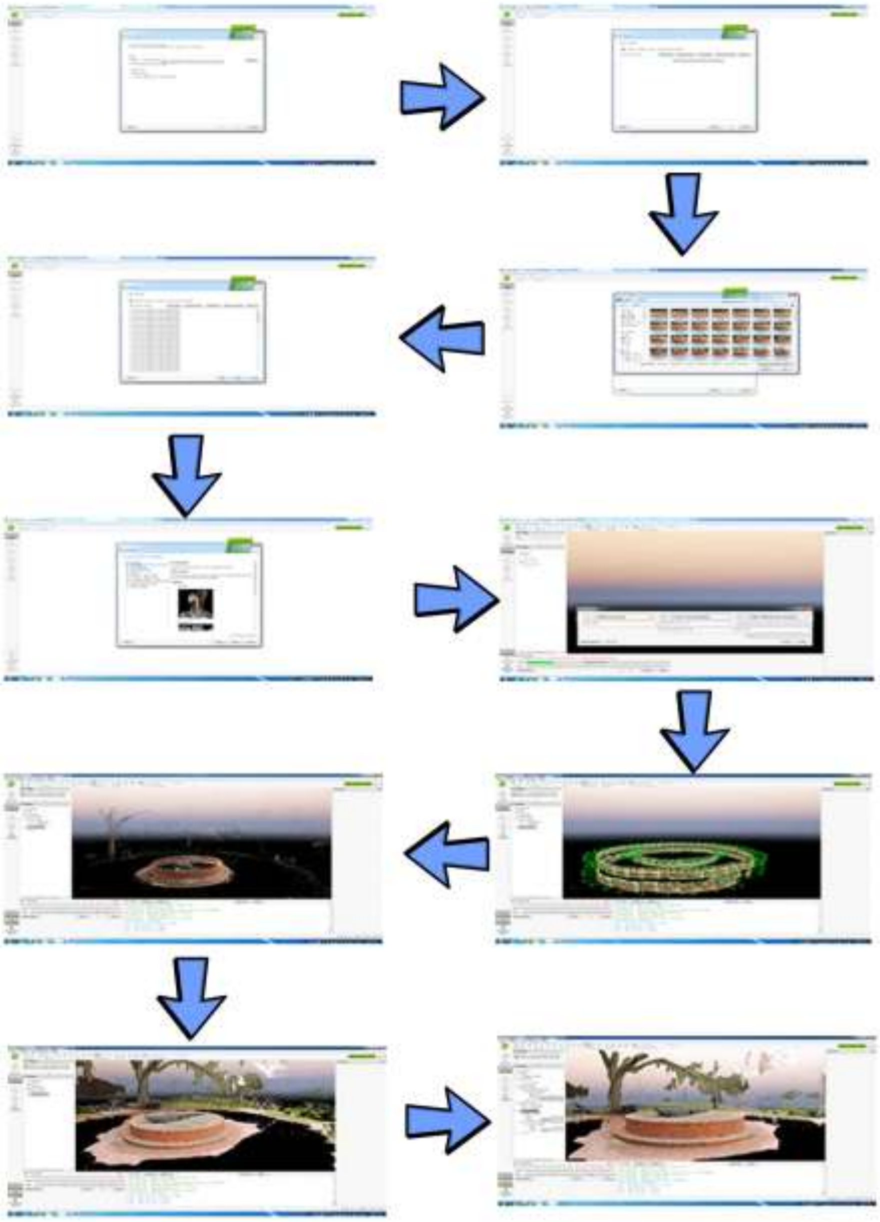

Figure 5 Point Cloud Process

5.5.5 ARCHICHAD

ARCHICAD is an architectural BIM CAD software for Macintosh and Windows developed by the Hungarian company Graphisoft. ARCHICAD offers computer aided solutions for handling all common aspects of aesthetics and engineering during the whole design process of the built environment buildings, interiors, urban areas, etc. Development of ARCHICAD started in 1982 for the original Apple Macintosh. Following its launch in 1987, with Graphisoft's "Virtual Building" concept, ARCHICAD became regarded by some as the first implementation of BIM. ARCHICAD has been recognized as the first CAD product on a personal computer able to create both 2D and 3D geometry, as well as the first commercial BIM product for personal computers and considered "revolutionary" for the ability to store large amounts of information within the 3D model. Today, it has over 120,000 users.

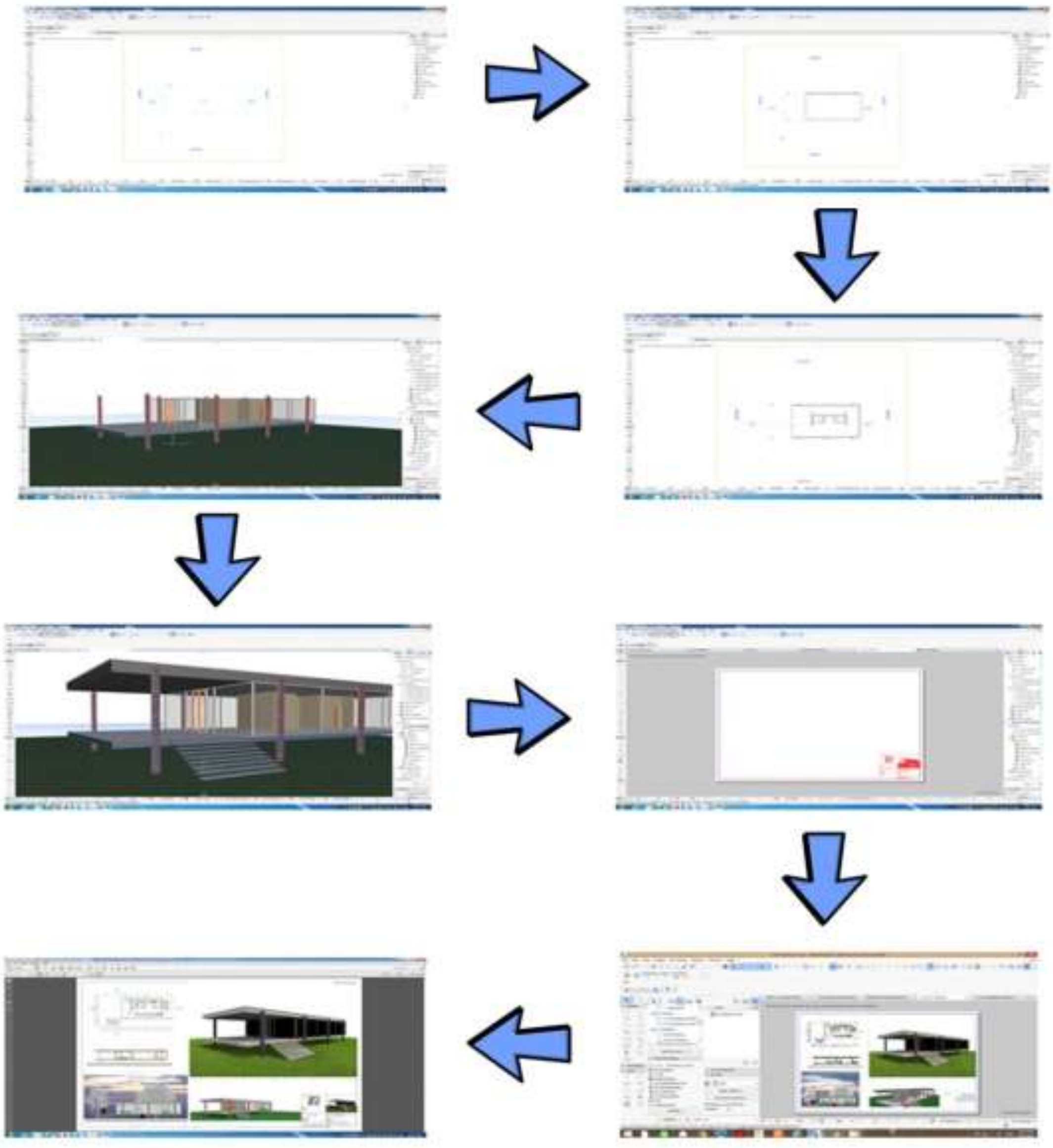

Figure 6 ArchiCad Process

5.5.6 RECAP 360

Create accurate 3D models with reality capture. ReCap 360 reality capture and 3D scanning software helps make building renovation, construction verification, and complex modeling projects more efficient. Import, view, and convert real-world objects into point clouds for conceptual modeling. Work collaboratively to measure, tag, and annotate the model with project stakeholders. ReCap 360 Pro does the heavy lifting for you. Your laser scans and photos are registered automatically, creating an accurate 3D model in just a few minutes. With less manual processing, you'll have more time to focus on other important parts of your business.

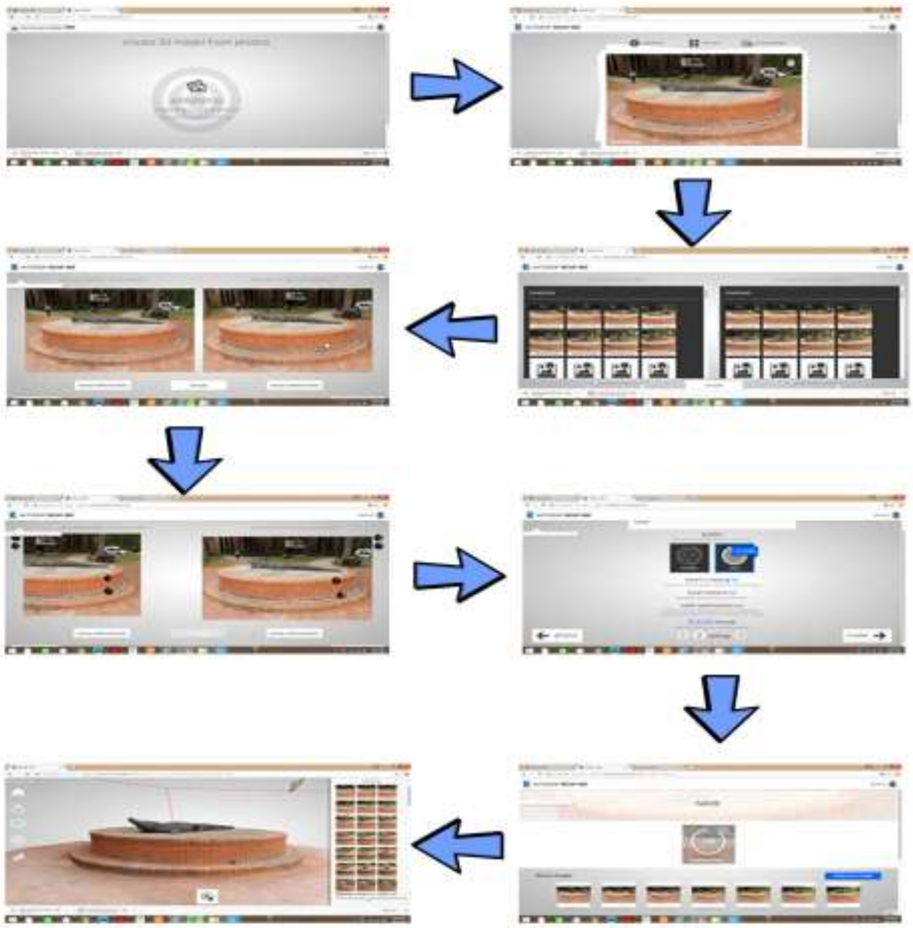

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Figure 7 Recap 360 Process

5.5.7 BIMX

Multi-award winning BIMx features the Hyper-model, a unique technology for integrated 2D and 3D building project navigation. BIMx helps bridge the gap between the design studio and the construction site

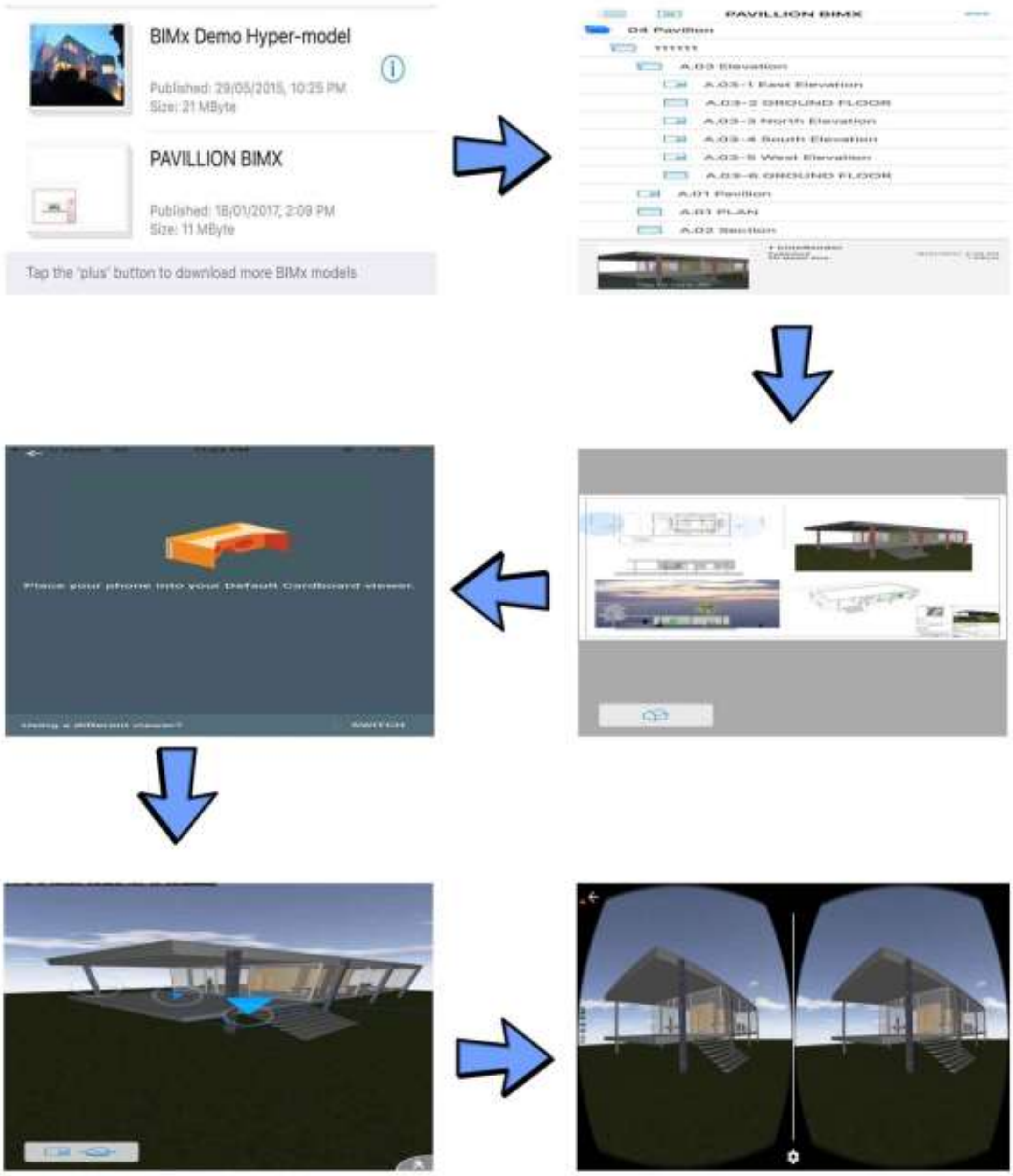

Figure 8 BiMX Process

6.0 RESEARCH OUTCOME AND SIGNIFICANCE OF RESEARCH

The significance of this research is for us to document and understand the architectural, BIM (Building Information Modelling) JIN LI GWAN. This also allows us to have all necessary measurements and data stored in the BIM archive or passed to legitimate owner, organization or caretaker of the building for conservative or restoration purposes and even reconstruction due to unexpected disaster. Through this research, it enabled us, the younger generation to appreciate historical architecture context, as well to ignite the sense of patriotism by understanding history and culture in an architectural perspective.

SAMPLE OF THE STUDENTS PRODUCTS

7.0 CONCLUSIONS

This study shows several advantages in measuring building with BIM Technology. Some of the advantages are time saving in developing drawing and informations. With one drawing BIM Technology allows student to develop working drawing and 3D digital model. Another of the advantages of BIM is the increasing number of simulation tools that allow students to visualize building after several data being taken after the measurement. Simulation also will allow students to get the roof shape easily data provided from the drone. Detailing is another aspect of the advantages using BIM Technology in measuring building. Data collected, with the help of point cloud technology, made it possible to produced detail 3D model in a short period of time. Furthermore BIM tools that allow shared model make it less need for rework and duplication of drawings for the different type of drawing required for measured drawing documentation. As a conclusion BIM technology allow students to create documentation from the data collected in short period of time. This technology also allows students to produce high detail of digital model that make it easy for visualization in the presentation.

REFERENCES

Beetz J., Laat, R., Berlo, V.L. and Helm, P. (2010). Towards an Open Building Information Model Server. Aviable at www.bimserver.org , Accessed November, 2018.

Berlo V. L. A. H. M., Beetz J., Bos P., Hendriks H. and Tongeren R. C. J. V. (2012). Collaborative engineering with IFC: new insights and technology, Available at www.bimserver.org. , Accessed November, 2012.

Gu, N., Singh, V., London, K., Brankovic, L. & Taylor, C. (2008) Adopting building information modeling (BIM) as collaboration platform in the design industry. *13th Conference on Computer Aided Architectural Design Research in Asia.* Chiang Mai (Thailand), The Association for Computer Aided Architectural Design Research in Asia (CAADRIA).

Kim, K., and Cho, Y. K. (2015). "BIM-Based Planning of Temporary Structures for Construction Safety (ASCE)." *2015 International Workshop on Computing in Civil Engineering*, ASCE, Austin, TX, 436–444.

Krueger, R. (2002). Designing and conducting focus group interviews, The University of Minnesota, Available at http://www.eiu.edu/~ihec/Krueger-FocusGroupInterviews.pdf, Accessed November, 2012.