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Managing Asset And Inventory In Institute Of Higher Learning Using Model-View-Controller Method

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Abstract:
An Asset Is Something That Has Value For An Organization. Managing Assets Is Among One Of The Important Activities In Any Institute Of Higher Learning (Ihl). Generally, The Assets In Ihl Can Be Defined As Property Or Possession Derived From Purchases, Hire Purchases, Donations, Grants, Gifts, Or Legislation. These Assets May Be Located At Various Buildings At One Campus Or Spread Out To Different Locations Off-Campus. No Matter Where These Assets Are Located, They Need To Be Tracked And Maintained.

Without A Proper Recording System, It Becomes Difficult For The Ihl To Monitor And Control All The Asset Activities Such As Asset Registration, Asset Location, Asset Movement And Asset Disposition. With Manual Asset Data Entry Only, It Will Lead To Human Errors, Time Consuming And Misinterpretation. Hence It Will Create Additional Costs To The Ihl.

In View Of The Above Problems, A New Digitized System Named *Sistem Pengurusan Aset Dan Inventori* (Spai) Was Developed As One Of The Total Campus Management System (Tcms) Module. Spai Has The Goal To Manage The Entire Assets Of The University Which Include Capital Assets, Inventory, And Stocks Effectively And Efficiently. Spai Which Is Placed Under The Authority Of The Asset Management Department (Amd) Is Expected To Be Able To Enable The Management Of University Assets, Especially From The Following Lenses:

Introduction

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1. Automate Processes Such As Borrowing, Transfer And Disposal Of Assets That Facilitate The Affairs Of The Responsibility Centers With The Amd.
2. Generate, Print, Label, And Scan Bar/Qr Codes On Assets In An Integrated Manner.
3. Systematically Monitor The Condition And Location Of Assets Through Type, Location, And Status Search Functions.
4. Produce Asset Related Reports Promptly For Matters Such As Meetings/Discussions, Presentations, Audits, And Decision Making That Require Immediate Action.
5. Establish Value-Added Functions Such As Warranty, Insurance, And Current Valuation Of Assets

Literature Review

Assets And Inventories Management Is A Challenging Problem Area In Supply Chain Management (Nazar Et Al, 2018). Managing Assets And Inventories For Institute Of Higher Learning (Ihl) Included. With Thousands Of Assets And Inventories To Be Managed, Keeping Track Of The Movement Of Assets Is Challenging. Hence, Most Ihl Commits To The Development Of A System Specifically Focusing On Maintaining Assets Which Includes Registration Of Assets, Movement Of Assets And Disposal Of Assets.

Asset And Inventory Management System Is Essential For Ihl. This Is Due To The Need Of Having Accurate Records Of Assets And Inventories At Any Time For Supporting Ihl Operations. Assets And Inventories Reporting Are Mandatory Especially During Financial Audit That Normally Occurs At The End Of The Year. Basically, Benefits Of Having Assets And Inventories Management System Are:

I) Enables A Firm To Account For All Of Its Assets
Ii) Helps Produce A More Accurate Reports In Terms Of Valuation
Iii) Able To Identify And Manage Risks
Iv) Remove Ghosts Assets In Assets Listing For Organizations
V) Able To Track Assets And Inventories Whereabouts

For This Project, Spai Will Be Developed Using A Laravel Based System Which Will Be Integrated With The Current Financial And Human Resource System For The Ihl. The Main Objectives Of The System Are To Allow The Management Of Assets And Inventories. Laravel Has Been Chosen As The Development Tools For This Project Due To Its Development Efficiency Compared To Traditional Web Design. Some Of The Laravel Capabilities Include Standardization Of Development Process, A Non-Business Logic Relationship That Is Processed Automatically And Its Scalability (Parkar Et Al., 2016).

Laravel Is Based On The Model View Controller Pattern Which Is Shown On The Following Diagram:

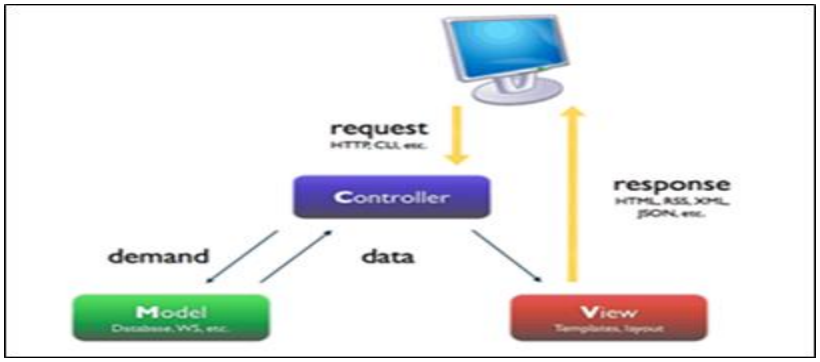

Fig. 1 The Mvc Pattern (Glorfindel, 2019)

Mvc Pattern Is Divided Into Several Roles Which Are Planning, Requirement Elicitation, Requirement Analysis, System Design, System Development, And Finally System Verification And Validation. It Allows For Low Code Development Where Roles For Development Are Taken By An Experienced Programmer (Al, 2007). In Producing The Mvc Approach, The User Plays A Decisive Role And Participates In The Formation Of Preparing Requirements And System Or Prototype Development (Al-Husseini & Obaid, 2018).

Methodology

Spai Is One Of The Strategic Projects Under The Flagship Of Total Campus Management Systems 2.0 Initiated By Project Management Office (Pmo), Center For Information And Communication Technology. Project Scheduling Is Acknowledged As The Most Critical Aspect Of Project Management Especially Amid Actual Work As It Is Crucially Dependent On The Passage Of Time (Taylor Iii, 2019). Likewise, For The Spai Project, Necessary Activities With Feasible Durations Based On Predefined Stages Are Brainstormed And Scheduled By The Circle Of Business Architects (Ba). Six Stages Are Determined In The Spai Project Notably Planning, Requirements Elicitation, Requirements Analysis, System Design, System Development, And System Verification And Validation. Gantt Chart, As A Vital Instrument To Graphically Facilitate The Spai Scheduling, Resources Assignment, And Monitoring Is Constructed. Network Diagram Of Critical Path Method (Cpm) Is Also Built To Illustrate Relationships And Dependencies Of Assets And Inventories Management Activities. Cpm Is Advantageous In That The Method May Establish A Trade-Off For Optimum Balancing Between The Scheduled Time And Cost Of The Project (Abdullah Et Al., 2012). University Entities Who Directly Deal With The Assets And Inventories Management Must Be Identified Prior. The Purpose Of This Identification Is To Ensure Neither Relevant Entities Nor Their Respective Roles And Tasks Are Missed Or Left Out. As For Unisel, Two Entities Are Mostly Involved Namely The Assets Management Department (Amd) And Finance Office. These Parties Are Stipulated As The Primary Stakeholders Of Spai, And Their Requirement Inputs Are Indispensable In The Analysis, Design, And Development Of Spai.

To Elicit Exact And Complete Requirements From The Users, A Series Of Focus Group Interviews Has Taken Place Periodically By Face-To-Face And Online. Face-To-Face Approach Is By Means Of Physical Meeting And Presentation. Online Meeting Utilizes Video Conferencing Tools Such As Microsoft Teams, Zoom, And Google Meet Exceptionally In The Times Of Movement Control Order Or Lockdown Enforced By The Malaysian Government Due To The Covid-19 Pandemic. Video Conferencing Technologies That Run On Voice Over Internet Protocol Via Synchronous Communication Is A Powerful And Nowadays A Well-Accepted Avenue For Meeting Interviewees Or Respondents (Lacono Et Al., 2016). The Method Is Timesaving, At The Comfort Of Home Or Workplace, And Supports Meeting Recording That Enables Playback Useful For Reference And Proof. Focus Group Interview Is A Methodology Of Data Collection That Depends On The Interaction Of Group Members To Collectively Formulate Answers Toward Researchers' Questions In Pursuit Of Acquiring Knowledge, Experiences, Perceptions, Opinions, And Feelings (Rosenthal, 2016). In The Case Of Spai, The Focus Group Interview Refers To The Interviews Targeting Expert Users Who Are Currently In Charge With The Assets And Inventories Management Activities. Experienced Users Are Also Engaged In This Interview Owing To Their Invaluable Past Knowledge And Insights. Both Types Of Users Contribute By Introducing New Processes, Detailing, Or Simplifying Existing Processes, And Recommending Innovative Solutions Among Others. The Group Of Assistant Registrars, Assistant Administration Officers, And Finance Officers Is The Main Input Collectors Of Spai As They Are The Frontliners Of Assets And Inventories Management Activities At Unisel. Being An Iso-Awarded Institution With The Recognition Of Iso 21001:2018 And Iso 9001:2015, The Bas Are Also Obligated To Inspect And Review Unisel's Iso Documents Especially Amds To Consolidate The Requirements Elicitation And Comply With The Iso Standards.

The Users' Inputs Gathered Out Of The Interviews Are Interpreted, Analyzed, And Formalized Into A Controlled Versioning Document Called As User Requirements Specification (Urs). Among Key Findings In The Urs Of Spai Are The Business Functions Diagrams Of Stakeholders In A Company With The Process Flowcharts Of Their Assets And Inventory Management Activities. These Are Drawn By Using The Open Source Diagrams.Net Software Which Was Formerly Known As Draw.Io. All These Artifacts Are Presented Back To The Users Including The Descriptions Of Their Roles And The Details Of Assets And Inventories Management Processes For Evaluation, Finalization, And Approval.

Apart From Tackling Issues Arising At The Early Stage, This Exercise Can Guarantee All The Requirements Collected For The Preparation Of A Subsequent Document Named As System Requirements Specification (Srs). Ali And Lai (2017) Specify One Good Srs Must Be Acceptable, Unambiguous, Complete, Verifiable, And Understandable. The Srs Of Spai Emphasizes The Facet Of System Design That Embraces The Spai Database Design And User Interfaces (Ui) Design, Respectively. The Database Design Is Shown By The Assembly Of Functional Tables With Their Interrelationships Whereas The Uis Are Effectively Visualized Using Storyboards. Storyboarding Is A Collaborative Technique In Which Participants Of Diverse Backgrounds May Interact One To Another In A Project, Internalize The Overview And Details Of The Project, And Contribute Ideas To The Project Effectively (Mollá Et Al., 2018).

The System Development Stage Of Spai Comprises Two Divisions Of Work Viz. Unit Modules Construction And System Integration. For Spai, A Programming Team Of Laravel Framework Competency Is Set Up To Code The Unit Module Engines And Coordinate The Multi-Usage Of Uis And Databases For The System Integration. The Objective Of System Integration Is For Data Interoperability And Modules Collaboration (Shen Et Al., 2012). Laravel Becomes The Tool Of Choice As It Is Very Intuitive, Friendly, And Appealing For Web Development. Laravel Is A Php-Based Framework Designed To Improve Software Quality, Simplify Authentication, Ease Routing And Access, And Increase Web Power (Soegoto, 2018).

System Verification And Validation Is The Final Phase In The Development Of Spai Yet The Decisive Phase For Users' Acceptance And Satisfaction And Software Quality. The System Verification Is Improved With Quality Assurance And Control Whilst The System Validation Is Perfected Via User Acceptance Test (Uat) And Final Acceptance Test (Fat). Pmo Assigns A Committee Of Quality Assurance And Control To Assist The Bas And Programmers In Testing Spai And Resolving Its Errors Internally Before Releasing To The Users For Uat And Fat. Spai Goes Live Only After All The Issues Raised By The Users Have Been Fully Addressed And Rectified.

Figure 3.1 Summarizes The Entire Development Modus Operandi Of Spai In Accordance With Respective Stages:

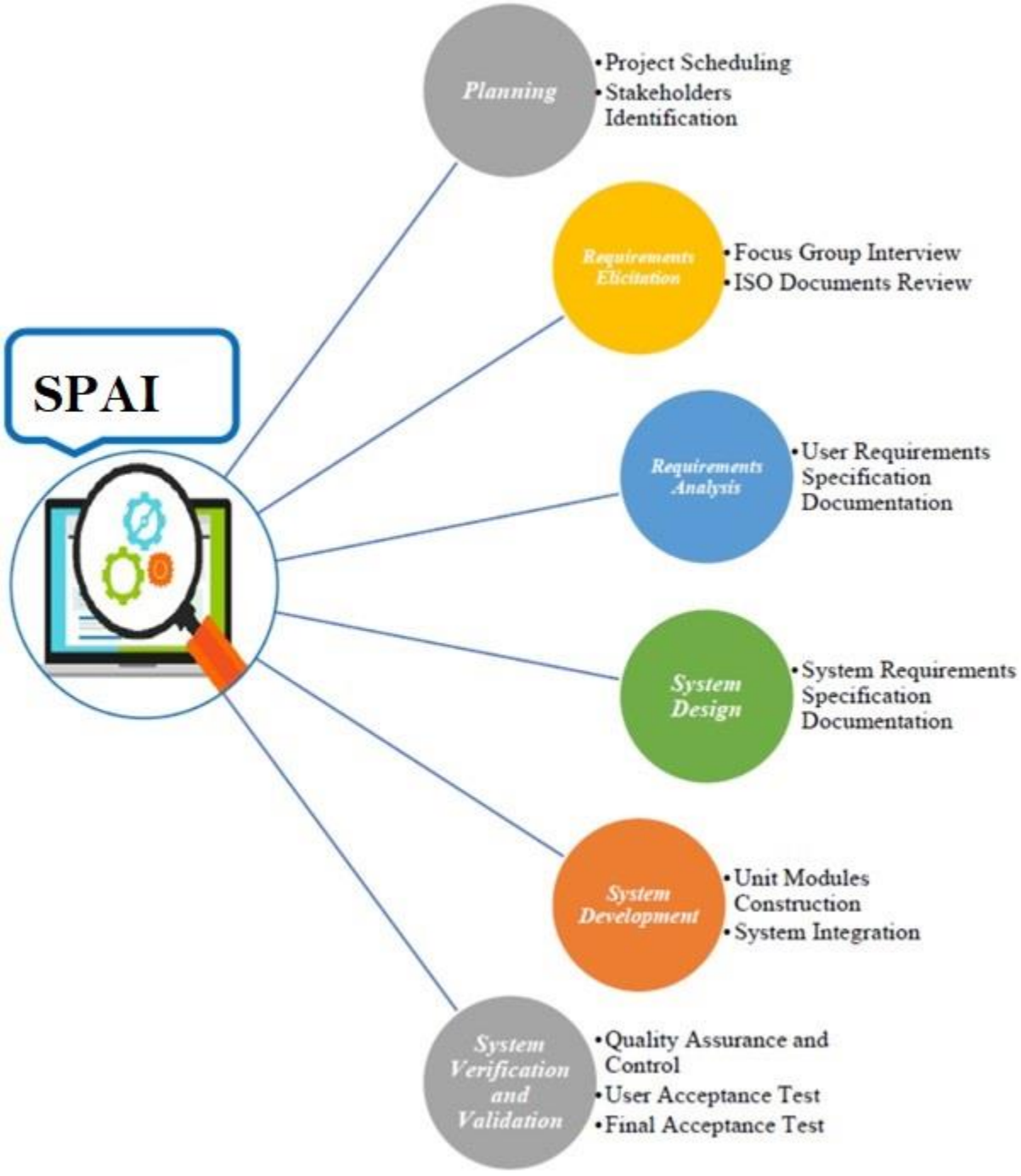

Figure 3.1: Development Modus Operandi Of Sistem Pengurusan Aset Dan Inventori (Spai)

Data Collection And Analysis

The Data Collection Was Designed To Cover The Needs Of The University To Record And Monitor The Movement Of All Its Assets And Inventories. A Data Collection Team Was Formed Consisting Of Three Business Architects And A System Analyst. It Took About Eight Months For The Team To Gather The Data Needed Before The Programming Writing Process Started. The Data Collection Started With The Understanding Of The Flow Of The Process. Such As Receiving Asset Or Inventory, Borrowing Process, Depreciation Process, Disposal Process And Other Related Processes. This Information Was Gathered By Having Various Interview Sessions With The Relevant Department In The University Named Asset Management Department. The Interview Session Was Conducted Through Teleconferencing During The Movement Control Order Period And Through Face To Face After That.

After Studying The Flow Of The Assets And Inventories Process, The Team Then Proceeds With Document Analysis. Since The University Was Certified To Iso 9001:2015 (Quality Management System) And Iso 21001:2018 (Education Organization Management System), All Documents Were Required To Be Recorded Including Those From The Asset Management Department. Relevant Documents Such As Forms, Standard Operating Procedures, Sample Of Letters And Sample Of Reports Were Collected For Analysis. Thorough Analysis Of The Documents Was Conducted Together With Continuous Focus Group Discussion With Person In-Charge From The Asset Management Department.

From The Outcome Of The Above Data Collection And Analysis Processes, A User Requirements System (Urs) Was Produced. The Final Version Of Urs Was Then Going Through Verification And Acceptance Of The Stakeholder. The Next Step Was Developing A System Requirements Specifications (Srs) Document. This Document Consisted Of User Interface (Ui) Design, Entity Relationship Diagram (Erd) And Use Case Diagram. During The Process Of Preparing The Urs And Srs, A Few Cycles Of Iteration With Stakeholders Was Conducted To Ensure That The Document Analysis Was Done Correctly. After The Acceptance By The Stakeholder, Database Design Was Developed Using Model, View And Controller (Mvc) Approaches.

Results And Discussion

There Are Seven Modules That Represent A Business Function Modelling Diagram Of Asset And Inventory Management In The University. The Modules Are Asset Registration, Asset Borrow, Asset Transfer, Asset Write Off, Asset Disposal, Asset Reporting And Register Current Asset. The Structure Is Depicted In Figure 4.1. Structure Of Asset And Inventory Management System

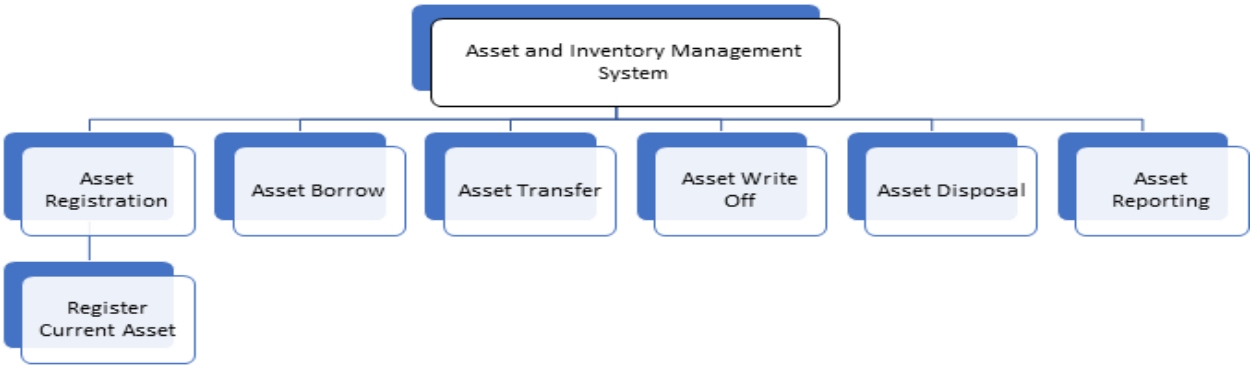

Figure 4.1. Structure Of Asset And Inventory Management System

Each Of Those Modules In The System Has Its Own Functionality To Serve The Operation Of Asset Unit In The University. The Functionalities Of Each Module Are Depicted In Table Y. Structure Of Asset And Inventory Management System.

Table 4.1. Structure Of Asset And Inventory Management System

Business Function	Description
Asset Registration	The Module Shall Enable Staff To Check In New Assets Received From Vendors/Contractors Or Return Them If The Assets Are In Poor Condition Or In The Form Of Gifts That Have Not Been Approved By The Vice Chancellor.
Register Current Asset	This Module Function Is To Check In, Current And Temporary Assets Until The Barcode Tagging Activity Is Completed.
Asset Borrow	The Module Shall Enable Any Units To Apply For Loan/Return Of Assets From Or To Asset Units.
Asset Transfer	The Function Enables Any Units To Apply For Transfer Of Assets Among The Units In The University, Between Any Area Within Any Units And From The Asset Unit To The Other Units.
Asset Write Off	This Module Works By Enabling Asset Unit Staff To Claim Insurance After Getting A Report From The Security Unit In The Event Of Loss Or Stolen Assets.
Asset Disposal	The Function Serves To Enable Any Units To Apply For The Disposal Of Assets Either Through The Method Of Sale, Destruction Or Gift Receiving.
Asset Reporting	This Module Works To Generate Several Asset Reports Required For The Purpose Of Meetings, Discussions, Presentations, Audits, Decision Making And Collaboration Between Units In The University.

Asset Registration

The Model-View-Controller (Mvc) Architecture Is Mapped And Co-Responded With The Business Process. The Sample Mvc For The Asset Registration Is Shown In Table 4.2 Which Depicts The Actual Process That Takes Place In The Intended System.

Table 4.2 Asset Registration

Mvc Architecture	**Requirements Details**
View **(User Interface/Form)**	User Interface: Asset Registration Validation: **Staffs Of The University**
Controller (Process – To Complete User Action And Manage Business Logic)	This Page Will Enable The Researcher To Do The Following: 1. Add New Record 2. Edit The Existing Record 3. Delete The Record 4. Exit From The Form. Other Processes Involved: 1. The Page Will Load The List Of Specific Asset Information Selected From The Existing Records Example – Financial References, Asset Information Such As Name, Quantity And Location/Area And Photo.
Model (Business Logic & Data Properties)	Work Registration Asset Registration Link To Tables For Example Area And Moveable Asset. The Table Created As Per The Entity Relationship Diagram Approved.

Conclusion

Asset And Inventory Management Are Major Concerns In Any Institution Of Higher Learning (Ihl). Without A Sound Record System, It Becomes Difficult For Ihl To Keep Track Of The Movement Of Thousands Of Assets And Inventories. Manual Asset Data Entry Makes It More Difficult For The Ihl To Collect Reliable Data, Resulting In Human Errors, Time Delays, And Misinterpretation. The Ihl Will Construct A New And Advanced Asset And Inventory Management System Called *Sistem Pengurusan Aset Dan Inventori* (Spai), Which Will Relate To The Current Financial And Human Resource Systems. The Spai System's Main Purpose Is To Convert The Present Manual-Intensive Asset And Inventory Management System Into A Digitized Platform That Benefits All Stakeholders. In Contrast To A Standard Design System That Uses A System Analysis And Design Methodology, The Spai System Was Developed Utilizing The Model-View-Controller (Mvc) Architecture. It Simplifies And Speeds Up The Logical Design Process. As A Novice To Mvc, The Team Encounters Hurdle In Transitioning From The Conventional Methodology To The Mvc Approach, Particularly For The Senior Software Development Team.

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