

# System Design for Mechatronics Engineering

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# 1 Revision History

Date	Version	Notes
Date 1	1.0	Notes
Date 2	1.1	Notes

## 2 Reference Material

This section records information for easy reference.

### 2.1 Abbreviations and Acronyms

symbol	description
Mechtronics Enigeering <a href="#">[... —SS]</a>	Explanation of program name <a href="#">[... —SS]</a>

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### 3 Purpose

This Document mainly talks about the design of the project, including the behavior, variables and interfaces used in the design. It will also talk about the design of the hardware component of the object, with some electrical components used and some communication protocols in the design.

### 4 Scope

The system will be designed to track the movement of the object to get the latest location information about it so that the user can always get the desired output. The user will be able to login and start the program through their own username and password. Then the information about the object will be detected through some image processing algorithms and will be stored into certain files. The user can locate desired objects through the searching interface by providing several searching keys.

#### 4.1 Context Diagram

The following pictures shows the design of the context diagram of the project. In this diagram, the user can interact with the SmartVault by logging in and provide key information about the object and SmartVault will output searching results to the user. There will be a camera located in the room that will keep sending images to SmartVault used for image processing. The motor will interact with SmartVault so to change the angular position of the camera. SmartVault will send or update information stored in the database. It will also extract desired information from the database.

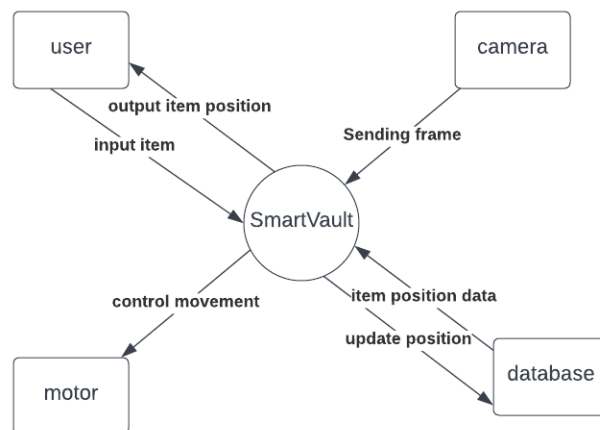


Figure 1: The Picture of Use Case Diagram

## 5 Project Overview

The purpose of this project is to create a system that help the user to locate their belongs in a certain space. SmartVault will allow user to login and start the camera, by detecting the movement of the object dynamically, it will keep recording and updating positional information about the objects that are detected in the camera. Then user can detect the position of the object by sorting through the database with certain searching information.

### 5.1 Normal Behaviour

SmartVault will start operating once the user login successfully and provide technical support when the user needs. It will store the position information of objects in the database for further use. The movement of the camera is controlled by the motor so that the monitoring angle will always in best angle. It will automatically detect the movement of object using image processing method. THIS LINE IS USED FOR OTHER MOCULE. TALKS ABOUT THE REST OF DEFINITION OF HARDWARE PART. To achieve different behaviors, different components are describes in the table below with their purpose.

Table 1: The Table of Division of Components and Purpose

Component Name	Component Purpose
Login	Manage login information and Technical Support Information
Database	Stores the position information of object detected inside the room
Image Process	Identifies movement of object and takes screen shot
Motor	Control the angle of the camera monitoring the room
Description	As part of the project hard requirement for Mechatronics group, the design can not be all software based

### 5.2 Undesired Event Handling

[\[How you will approach undesired events —SS\]](#)

### 5.3 Component Diagram

The picture shown below presents different components known as modules in this project. All the modules are divided into two big module group: Software Module and Hardware Module.

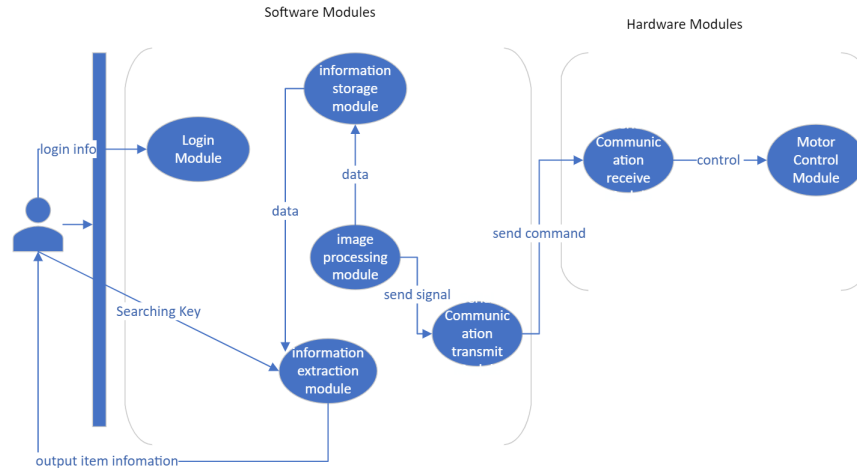


Figure 2: The Picture of Component Diagram

## 5.4 Connection Between Requirements and Design

To achieve the requirements mentioned in Software Requirement Specification Document, some specific designs are made and described in the table shown below.

Table 2: The Table of Connection Between Requirements and Design

Design Actions	Requirements
Image Processing Method	IPR1, IPR2, IPR3, IPR4,
Database	IPR5, IPR6, IPR7, IPR8, IPR9, RFR1, CAR1, LOR1
Customization Button	UIR1, UIR2
Vedio shown in the window	UIR4
Protection Cover	APR1, APR2
Text Prompt	EUR2, LER1, LER2, RFR2
Visualized Window	EUR2, UPR1, ACR1
Setting Username and Password	SCR2, AER1, INR1, INR2, PRR1, PRR2, CPR1
Technical Support Window	MAR1
Motor Communication Protocol	SCR3, RAR1



## 6 System Variables

[Include this section for Mechatronics projects —SS]

### 6.1 Monitored Variables

### 6.2 Controlled Variables

### 6.3 Constants Variables

## 7 User Interfaces

Two user interfaces will be used for this project, one is for the user to login and the other is used for searching the position information of the desired object. This section will mainly talks about these two interfaces in the following paragraphs.

### 7.1 Login Interface

The Login Interface is used to show let the user start the program. It will also provide the contact information of the technical support. The picture shown below describes the FSM of the Login Interface. When the user starts the program and enters correct username and password, the original window quits and comes up with the Search Window. If the user enters wrong username or password, the window will not change and asks the user to retry. If the user wants to get the technical support, the Technical Support will come up.

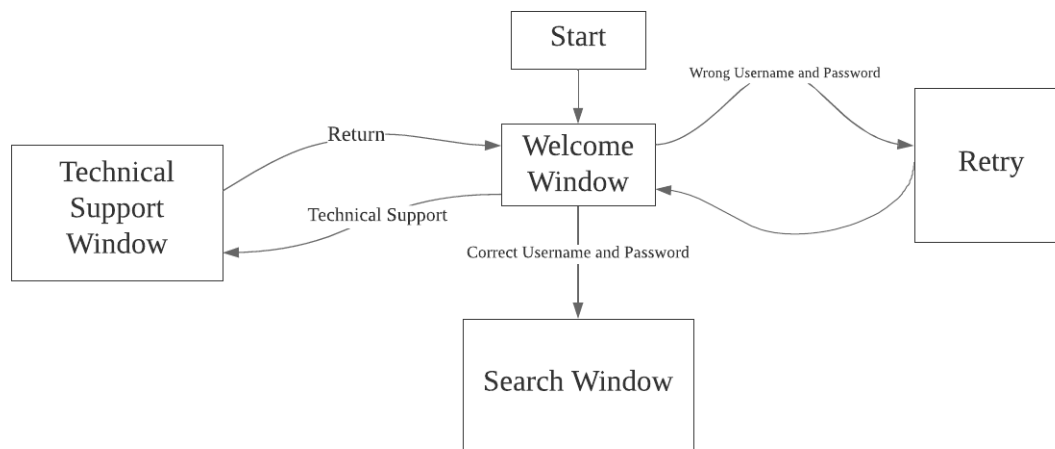
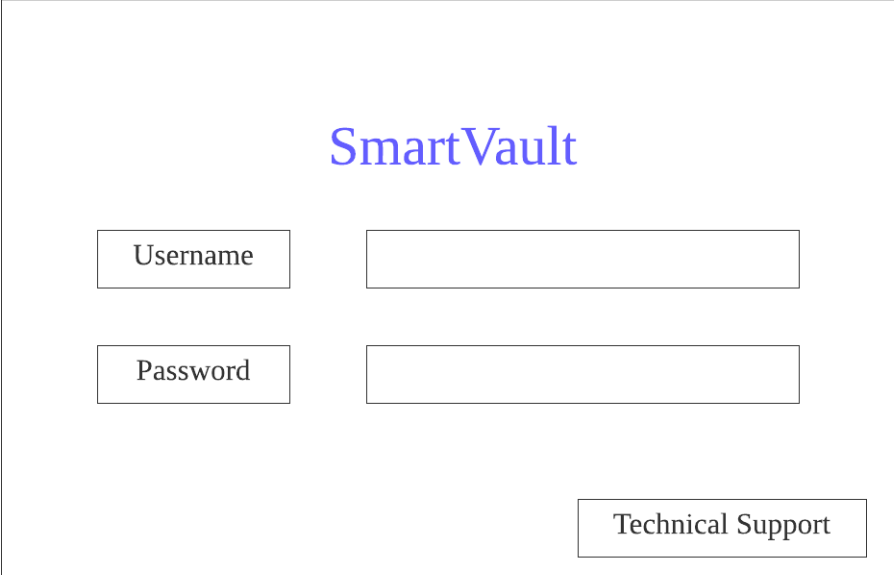


Figure 3: The Design of Welcome Window

When it comes to the Design of Window, the first one is the Welcome Window. The Welcome Window asks the user to input the username and password. If the user enters

correct username and password, the window is closed and the Confirmation Window will come up, which will be described in the paragraphs below. The Technical Support Window gives the emails of each team member. The Design of Welcome and Technical Support Window is shown in the pictures below.



The image shows a wireframe design for a login window titled "SmartVault". The title is centered at the top in a blue, serif font. Below the title, there are two rows of input fields. The first row has a label "Username" in a small box to the left of a larger text input field. The second row has a label "Password" in a small box to the left of another larger text input field. In the bottom right corner of the window, there is a button labeled "Technical Support".

Figure 4: The Design of Welcome Window



Figure 5: The Design of Technical Support Window

## 7.2 Searching Interface

The Searching Interface is used to help the user to locate the position of the object. The picture shown below describe the FSM of the project. After the program starts, the image processing method will be used to record initial condition of the object detected in the room through the image taken by the camera. The program will wait for further changes. The motor will rotate the camera if the user detected is not in the center of the camera or certain percentage of area of the images is blocked. When the movement of an object is detected, if it is moved by human, the program will track the movement of hands and update the information stored in the database. If it is moved by other objects, the program will only update it final state. The data base will only record the object that moves in the area. When the user want to search certain object, the program will allow the user to input some information about the object like the approximate time. Then a list of pictures meets the information will be provided and wait for the user to choose. If the desired object is within the list and the user has confirmed it, the algorithm will finish. If the object is not found, the initial pictures will be pulled out and let the user to choose. The object is marked "Taken out" if the object is still not found.

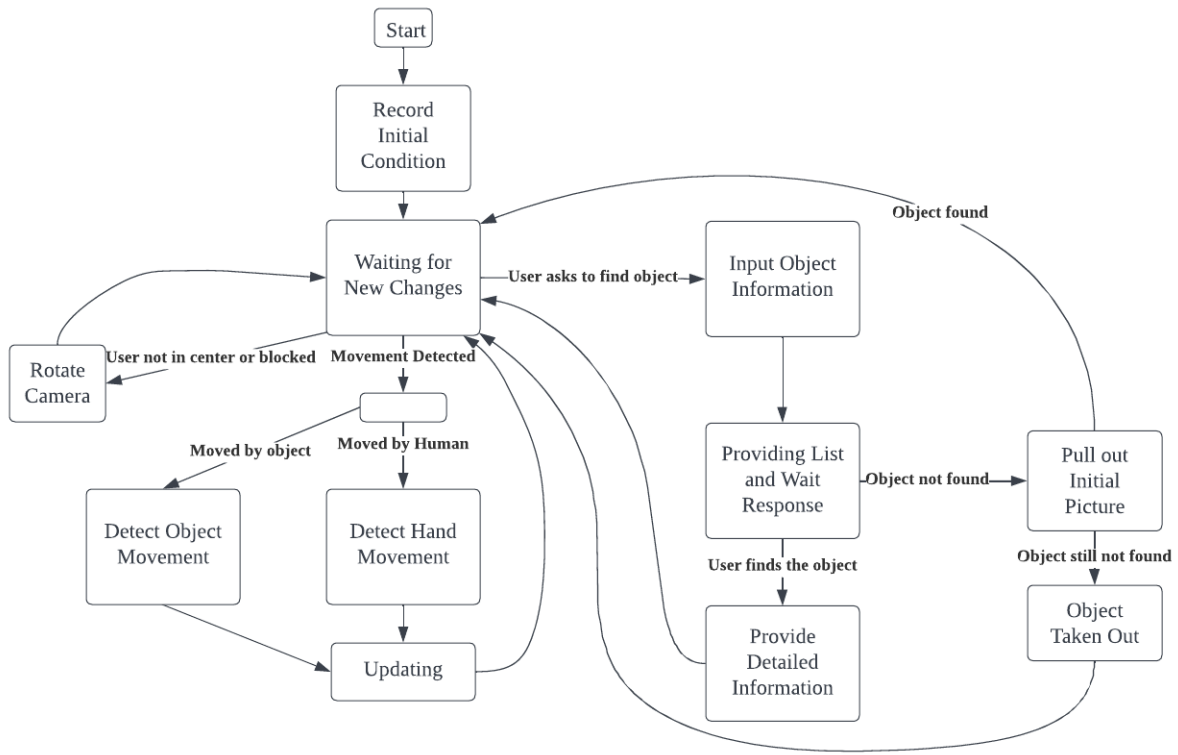


Figure 6: The Finite State Machine of Searching Interface

For the searching interface of this project, the window will come up after the use has successfully logging into the system. A simple design of that interface is shown in the figure below. On the left hand side the images taken by the camera will be shown. On the right hand side, the object-searching algorithm will be used. If the user want to search for one desired object, the system will ask the user to input several informations about that object. After user has finished entering the information and press search, a new window will appear. It will provide several pictures that meets the input information. After the user has confirmed the final result, the result window will come up with the information that the user needs about the object. If the user press "Object not Found ?" button, another confirmation window with the same payttern will come up but with pictures that present the initial condition. An error window is designed to tell the user that the object may be taken out by human. It will also leave a button to return to the Searching Window.

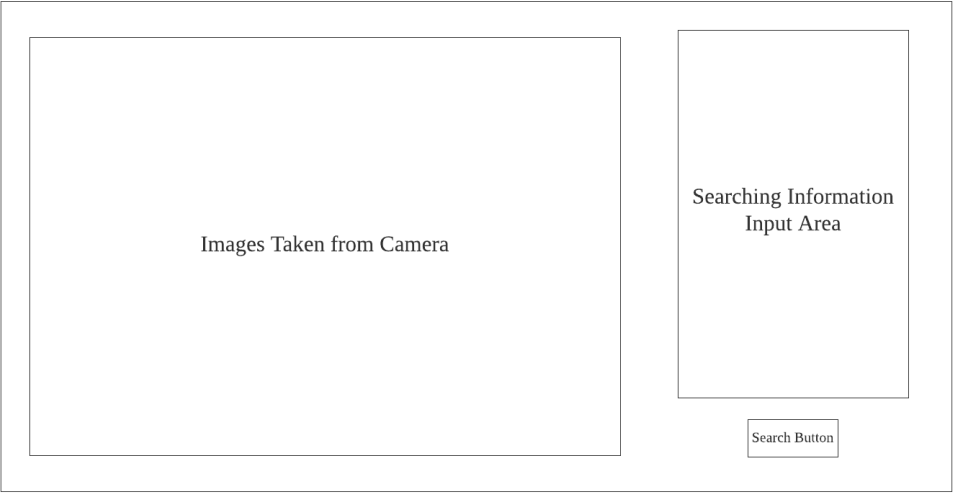


Figure 7: The Design of Searching Window

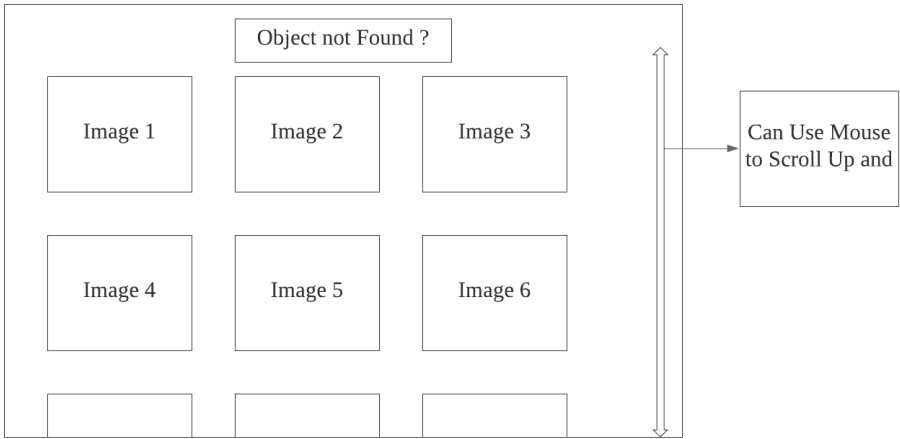


Figure 8: The Design of Confirmation Window

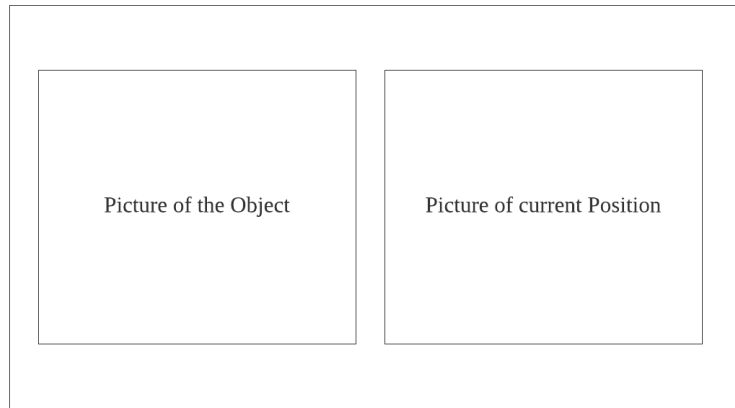


Figure 9: The Design of Output Window

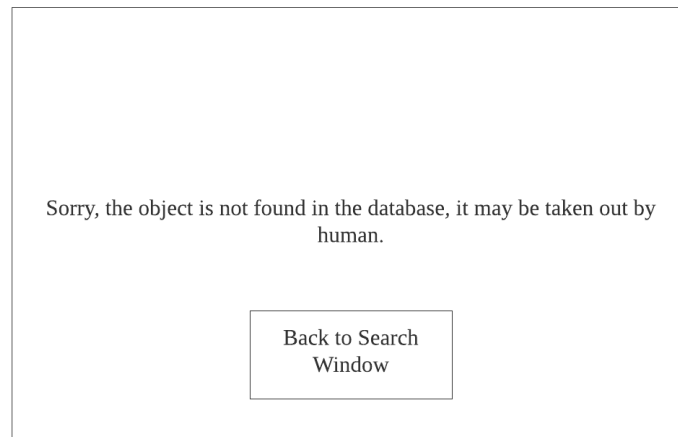


Figure 10: The Design of Error Window

## 8 Design of Hardware

[Most relevant for mechatronics projects —SS] [Show what will be acquired —SS] [Show what will be built, with detail on fabrication and materials —SS] [Include appendices as appropriate, possibly with sketches, drawings, CAD, etc —SS]

## 9 Design of Electrical Components

[Most relevant for mechatronics projects —SS] [Show what will be acquired —SS] [Show what will be built, with detail on fabrication and materials —SS] [Include appendices as

appropriate, possibly with sketches, drawings, circuit diagrams, etc —SS]

## **10 Design of Communication Protocols**

[If appropriate —SS]

## **11 Timeline**

[Schedule of tasks and who is responsible —SS]

## **A Interface**

[Include additional information related to the appearance of, and interaction with, the user interface —SS]

## **B Mechanical Hardware**

## **C Electrical Components**

## **D Communication Protocols**

## **E Reflection**

The information in this section will be used to evaluate the team members on the graduate attribute of Problem Analysis and Design. Please answer the following questions:

1. What are the limitations of your solution? Put another way, given unlimited resources, what could you do to make the project better? (LO\_ProbSolutions)
2. Give a brief overview of other design solutions you considered. What are the benefits and tradeoffs of those other designs compared with the chosen design? From all the potential options, why did you select documented design? (LO\_Explores)