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## *Individual Essay*

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## Introduction

Physicians are invaluable and that is why they must not be far enough from those who require medical assistance. And more and more individuals continuing to seek medical treatment, physicians need to make their assistance available to their patients. Online appointment scheduling for patients is one way they can achieve this. You ought to take leverage of the possibilities provided by the online appointment scheduling system. for physicians offers today's age in which anything and everything can be found on the internet. The online appointments will provide the comfort for both administrative staff and patients (Clark, 2020a). The key advantages of the appointment scheduling management information system (ASMIS) are the following:

- **Savings in time**

Nursing staffs spend less time booking and handling meetings on the phone, therefore allocating their timetable for more relevant and urgent tasks. Scheduling an online appointment will minimise the amount time patients usually dedicated to calling or holding their calls at their medical centre (2020a).

- **24-Hour Comfort**

Usually, arranging appointments over the phone allows a person to call in during business hours, because few facilities have the all-round-clock call appointments. For certain patients, this is an annoyance, because they too are busy at this time. An online appointment scheduling system facilitates the services for 24-hours (MOCDOC, 2020a).

- **Schedule appointment at any place**

Sufferers are able to organise a consultation meeting wherever they are situated and at any moment through their mobile devices and the internet. It was one of the biggest advantages of using an online appointment scheduling method. Of course, many people do utilise the telephone consultation meeting process, these approaches, however have many drawbacks, among which, the patient cannot call to schedule an appointment when they want. For this, the telephone lines must be open within the business hours. However, with the online system, at any time and from any location, patients can schedule an appointment (MOCDOC, 2020b).

- **Improve the schedule management**

You are placed in charge of your calendar and appointments through an online scheduling system. Now excluding the worry of the postponements in last moment on the side of patients, you can coordinate your physicians' plans and prepare ahead for the day. You can regulate the number of patients who can access the physicians' appointments list with the online system and quick changes can be made to the schedule, as well. In this way, you are aware about how many patients your physicians can attend to in one day (2020b).

Today, no organisation's online portal can choose to disregard the dangers raised by cybercrimes. In truth, cyber criminals are hardly on the hunt and are searching for an opening either directly or by exchanging valuable information to make money. Therefore, if you are taking your organisation online and providing an appointment scheduling site for patients, if you are not informed and careful about it, it will automatically become prone to hacking (8

Big Security Threats to Cybersecurity in Healthcare | 2018, 2020). Then what are the big cyber risks on here? Here are the commons ones:

➤ **Tentative of malware and phishing**

An entire device can be infiltrated by advanced malware and phishing mechanisms which thief usernames and passwords. An entire device can be infiltrated by sophisticated malware and phishing programs that plant malicious scripts on a computer or steal login credentials. Among the most complex challenges with malware is that the introduction of a malicious cyber existence into your system involves only one apparently legitimate link. Training workers to identify typical phishing attacks is critical. One popular technique is to request login details from emails from authentic-looking websites, which is never inquired via email, by trustworthy organisations. If the information is provided by a user, the hacker will log in to the device on the other end (Online Travel: Cybersecurity Threats and How to Prevent them - TravelCarma Travel Technology Blog, 2020a).

➤ **DOS or Denial of Service Attacks**

In this sort of crime, your online appointment schedule system could be flooded with massive quantities of scammer traffic prior to your web connection is overwhelmed and your organisation is destroyed and your server becomes non-respondent. DDOS, a distributed denial of service where several machines are used to overwhelm the system, is another variation of this kind of attack (Online Travel: Cybersecurity Threats and How to Prevent them - TravelCarma Travel Technology Blog, 2020b).

Before begin with the implementation, a threat modelling needs to be identified and applied to the implantation to prevent the above-mentioned cyber risks. Threat modelling aims to conduct a constructive evaluation of cyber security threats. To identify risk factors and focus on improving mitigation, security personnel use threat modelling insights, ensuring the efficient distribution of resources and attention. During security planning, design and implementation, this prioritization can be implemented to ensure that alternatives are as efficient and effective. STRIDE is a model of a threat which focuses on the attacker's objectives (Manager et al., 2020). For the types of threats, it covers, STRIDE is an acronym which is described in *Table 1*, together with the violated properties.

Threats	Property Violated
Spoofing	Authentication
Tampering	Integrity
Repudiation	Non-repudiation
Information Disclosure	Confidentiality
Denial of Service	Availability
Evaluation of Privilege	Authorisation

*Table 1 - STRIDE acronym description and violated properties*

When implementing an online portal, it also involves the design of a Unified Modelling Language (UML), which is a modern approach to modelling and documenting the system which is a practical approach to system's modelling and documentation. The UML is centred on the diagrams of the online system. As the old proverb notes, "a picture is worth a thousand

words." Therefore, we are capable of better understanding potential faults or poor decisions in organisation's implementations by using visual representations. There are several UML types, but the activity diagram and class diagram will be considered for this system (All You Need to Know About UML Diagrams: Types and 5+ Examples, 2020a).

#### ▪ Activity diagram

The activity diagram is a behavioural UML diagram. For doing business process modelling, activity diagrams are possibly the most critical UML diagrams. In general, it is used in system implementation to show the interaction of several activities and processes, which can be both sequential and concurrent. They define the objects an activity uses, utilizes or generates and the interaction between the different ones activities (All You Need to Know About UML Diagrams: Types and 5+ Examples, 2020b). Below are the different activity diagrams used to better understand the ASMIS.

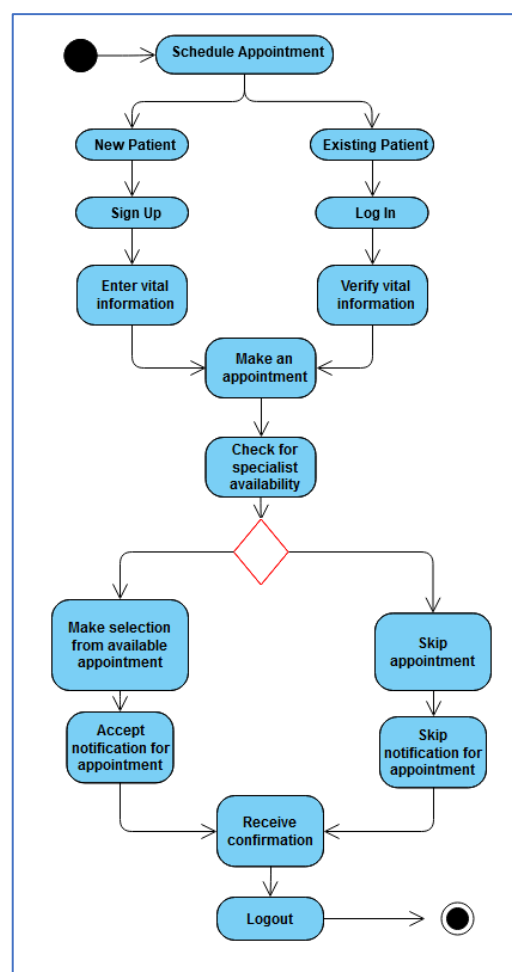


Figure 1 - ASMIS Principal Activity Diagram

Figure 1 is a principal activity diagram of scheduling an appointment in the ASMIS case study as it illustrates the process data flow of the entire system.

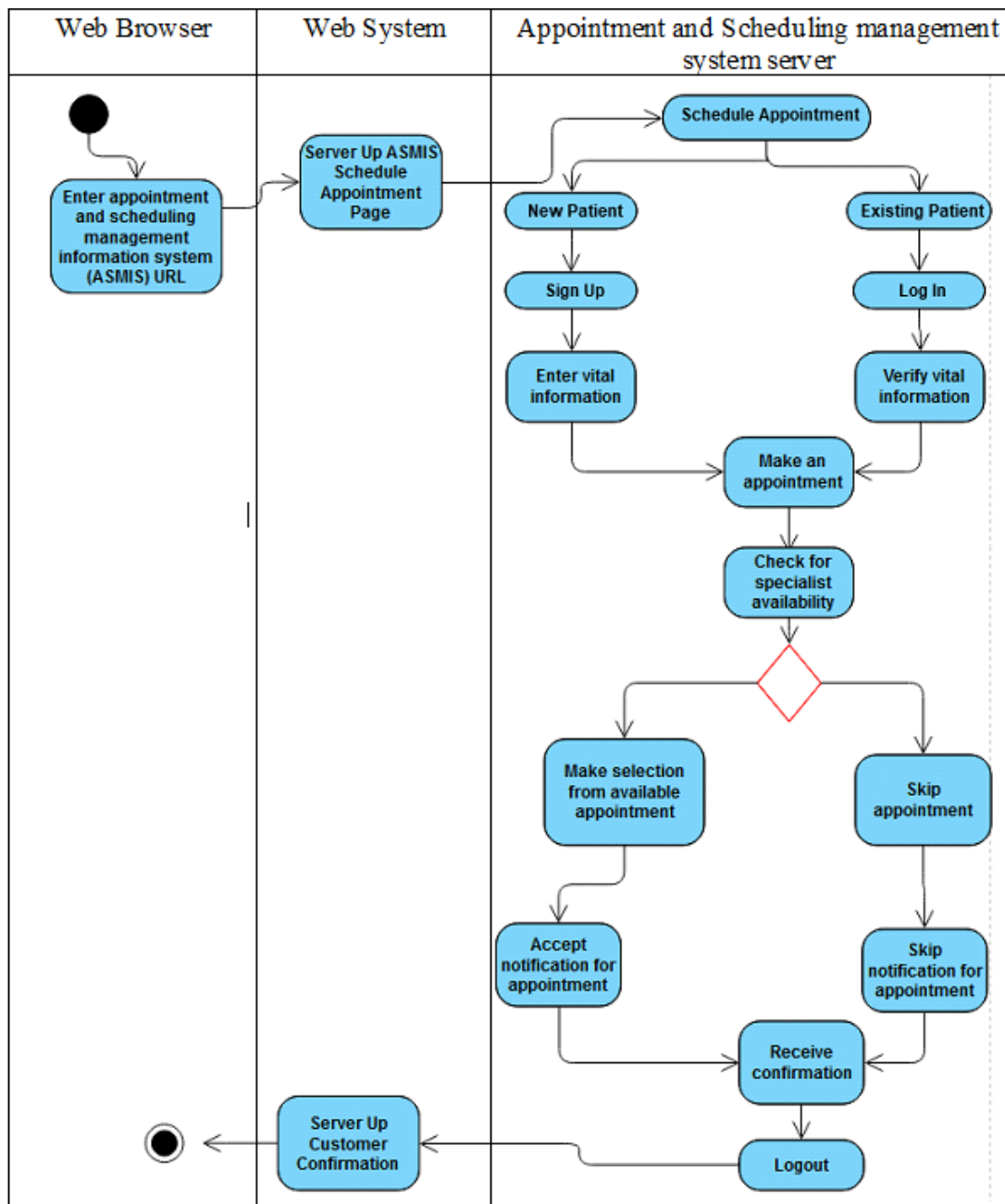


Figure 2 - ASMIS technology-oriented perception

Figure 2 illustrates a more technology-oriented perception on the level of multi-tier architecture responsible for the operations of ASMIS, which could be more appropriate for risk assessment.

Activity Diagram Element Type	Activity Diagram Item
Actors	Patient
	Anonymous user
	Administrator
Activities	Sign Up
	Login
	Insert vital information
	Verify vital information
	Make an appointment
Condition	Specialist availability
Activity Edges	Web pages served by Web server
	Patient anonymous request/response
	Admin CRUD operations on Web pages
	Web application reading, creating, updating an appointment

Table 2 - ASMIS Activity Diagram List of Elements

Table 2 puts an emphasis on the appointment scheduling process, but involves a general operation, similar to all web-based systems.

Activity Diagram Element Type	S	T	R	I	D	E
Actor	•		•			
Activity	•	•		•	•	•
Condition		•	•	•	•	
Activity Edge		•	•	•	•	

Table 3 - STRIDE Mapping to ASMIS Activity Diagram Elements

Table 3 illustrates the risk assessment of the structure by mapping the STRIDE thread modelling technique to the activity diagram.

#### ■ Class Diagram

The class diagram is structural UML diagram. Together with their data fields and their functions, class diagrams contain classes. More precisely, each class consists of three fields: the class name (at the top), the class data fields (below the name) and the functions of the class (at the bottom) (All You Need to Know About UML Diagrams: Types and 5+ Examples, 2020c).

The Appointment Schedule Management Information System Class diagram describes the structure of the Appointment Schedule Management Information System classes, their attributes, methods and the relationships among objects. The main classes of the Appointment Schedule Management Information System are Person, Patient, Doctor, Appointment, Schedule.

Class of Appointment Schedule Management Information System Class diagram:

- Person Class: Handle all the activities of Person
- Patient Class: Handle all the activities of Patients
- Doctor Class: Handle all the activities of Doctors

- Appointment Class: Handle all the activities of Appointment
- Schedule Class: Handle all the activities of Schedule

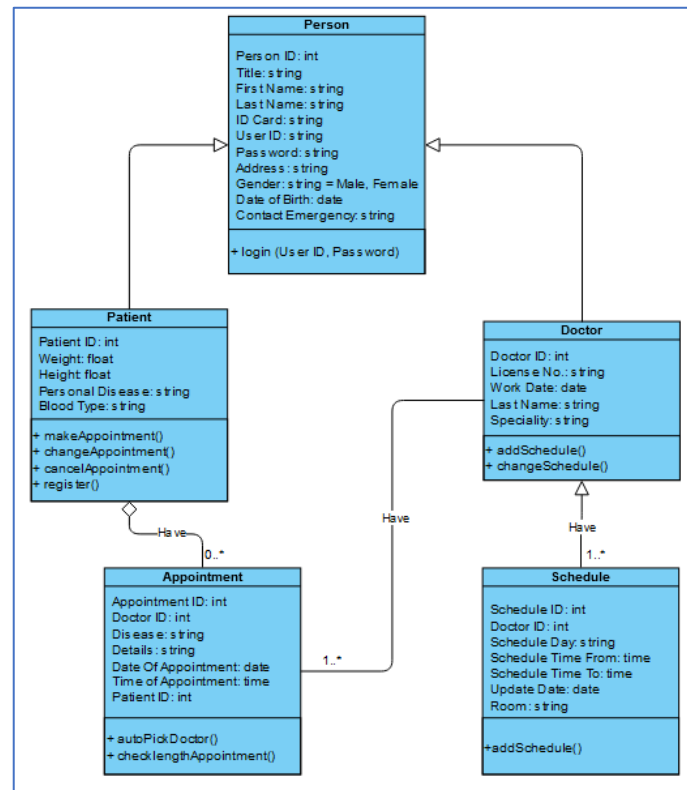


Figure 3 - AS MIS Class Diagram

Figure 3 illustrates the classes with their respective data fields and functions of the Appointment Schedule Management Information System Class diagram.

Using the online services for organisation can have its advantages, as previously stated. Though this may even raise the possibility of security breaches and fraud. Your organisation and its integrity may be severely harmed by a mere cyber-attack. Therefore, to help safeguard AS MIS from cyber-attacks, the following measures can be used (How to protect your business from cyber threats | business.gov.au, 2020a).

### 1. Configuring a firewall

The firewall may either be a software or hardware that behaves as the decision maker for all incoming and outgoing traffic between the server and the browser of your organisation. Establishing a firewall thus protects the organisation's internal infrastructure (How to protect your business from cyber threats | business.gov.au, 2020b).

### 2. Encrypt important information

Before you send it over the internet, encryption transforms your data into a secret code. Thus, when saved or sent online, ensure you toggle on your system encryption and encrypt important data. This decreases the risk of fraud, damage or exploitation as hackers find it complex to decrypt the secret code.

### 3. Make use of two-factor authentication

Two-factor authentication (2FA) is a security mechanism for two-step authentication that you'll have to generate before your profile can be reached. To verify who you are, you use two distinct authentication criteria, such as your password and the key sent to your smart phone or your biometric. An extra layer of protection is applied to the two-factor authentication scheme, rendering it even more difficult for hackers to access your computer or login credentials (How to protect your business from cyber threats | business.gov.au, 2020b).

### 4. Login Management

To secure access of the system that contain significant confidential details, use strong passwords. Using a password like '111111' or even weaker, puts your users' data at risk to being breached. All the users' accounts might be threatened if they make use the exact password for anything and somebody got a copy of them. Therefore, enforce the use of complex passwords which includes alphanumeric, special characters and strong character limits. Moreover, notify users to frequently change their password.

## Conclusion

A special right that just physicians and a couple other experts possess is having the capacity to support due to illness people improve. While seeing your patients recovering, provides great satisfaction, you want to ease streamline the entire treatment for them.

As stated above, the encryption strategies, system user identifiers and multiple user access levels should be included in the selected online appointment scheduling system.

ASMIS is going to be a trend that will enable greater fame with the security enforcement of cyber-threats. It is here to grow up and make the organisation's appointment scheduling a piece of cake for the patients (Clark, 2020b).



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