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كلية العلوم والآداب في محافظة الرس
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A Test Bed for Novel Login Behavior

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Project Team.

ABSTRACT

Due to numerous security attacks on personal accounts, lack of awareness of passwords by the public and indifference to strong password conditions, this project aims to understand login behavior to protect an account even if a password is compromised. The project will aim to develop software to capture unique keystroke timings, matching previous recorded password enters in a secure database as an extra layer of protection.

Keywords: computer security, network security, login system, password, safety, security, typing keyboard

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Chapter 1

Introduction

1.1- Introduction

In our time, technology has become an essential element in our daily lives as it has become an urgent necessity that we cannot live without. Nowadays technology is constantly evolving to meet the wishes of the world.

Technology is one of the reasons for people to get together, one person connected with a landline or a telephone or a network to connect to another person in another continent in a few seconds, and if we talk about the Internet as it makes the world as a small village, with the ability to reach anywhere in the world in a few seconds. This development has led to a great financial revolution for governments and companies.

In recent years, technological innovations have increased dramatically and have facilitated our lives. In the area of industry, we have provided many advanced machines and equipment to facilitate manufacturing and ensure high quality at a lower cost, time and effort.

Technology has also contributed to the development of education as it provided modern scientific tools to facilitate the delivery of information from the teacher to the student, and also the emergence of self-learning that serves the student without the need for a teacher, and also be anytime and anywhere. Technology has facilitated human life as it has become easy to travel from one country to another in modern transportation with limited hours.

One of the many important things in technology and we use it every day is our accounts. The failure to protect our bank or personal accounts may expose us to hacking and publishing our data such as pictures, personal messages and other personal matters to others. Every person must set a strong password to protect his personal electronic properties.

These days, most people forget their password, some because their password is difficult to write and others because their password does not mean anything, the most dangerous situation is to be hacked because of the weak password.

So, this project aims to create a testbed to test the validity of recording **how** a person enters their passwords as an additional layer of security. In this way, even if the password is compromised, an account can still remain confidential.

Our project is based on creating a program to record keystrokes and timing; therefore, the password will be time-dependent and each key will have a certain time to click, from first click on the keyboard to pressing enter key. If the previous timing signature corresponds to the signature recorded in a database, it will be accepted.

1.2- Problem Statement

There are many ways to log into your account and each method differs from the other in terms of ease of access or terms of security. Each way has its advantages and disadvantages as some of them take a lot of time to log you in, but security is high, however, some of them are easy to log in and also does not take a lot of time but is weak in security.

1.3- Research Objective

- Create a program that records accurate keystroke timing to be the password of the login system.
- Develop this system to be available in all the devices, e.g. desktops, laptops, tablets and mobile phones.
- Strengthen login security.
- Understanding user login behavior.
- Make sure that in the login system the error rate is less than 15%, without compromising security.

1.4- Research Question

- Can we write a program to accurately record a user's login (User name & Password) in terms of keystrokes and timing?
- Can a user login use the same timings on different devices?
- What is an acceptable error rate for system that allows user flexibility but does not compromise security?

1.5- Report Structure

Our report contains five chapters start with the Introduction and ends with Conclusions & Future Work to represent the primary sections of the research.

- Chapter 1: General Introduction

The first chapter in our project is the general introduction, where we will talk about the introduction of our research, problem statement, research objective, research question, report structure, project plan & schedule and conclusion.

- Chapter 2: Literature Review

The second chapter is about reviewing same literature related to our research topic, and we will talk about computer security, network security, and the login system. We will also talk about related work in our research.

- Chapter 3: System Analysis

In the third chapter, we will discuss the requirements specification and we propose static and dynamic modeling diagrams.

- Chapter 4: Implementation and Testing

In the fourth chapter, we will talk about Implementation and testing where we will review the software and hardware environments then we will see the implementation of our research, e.g. which database or interface we will use, after that, we will talk about testing method and propose results.

- General Conclusions & Future Work

At the end of our research we will write about general conclusions of our research and what we will do in the future.

1.5- Project Plan and Schedule

Gantt Chart to describe the time required to complete tasks and complete the project on time.

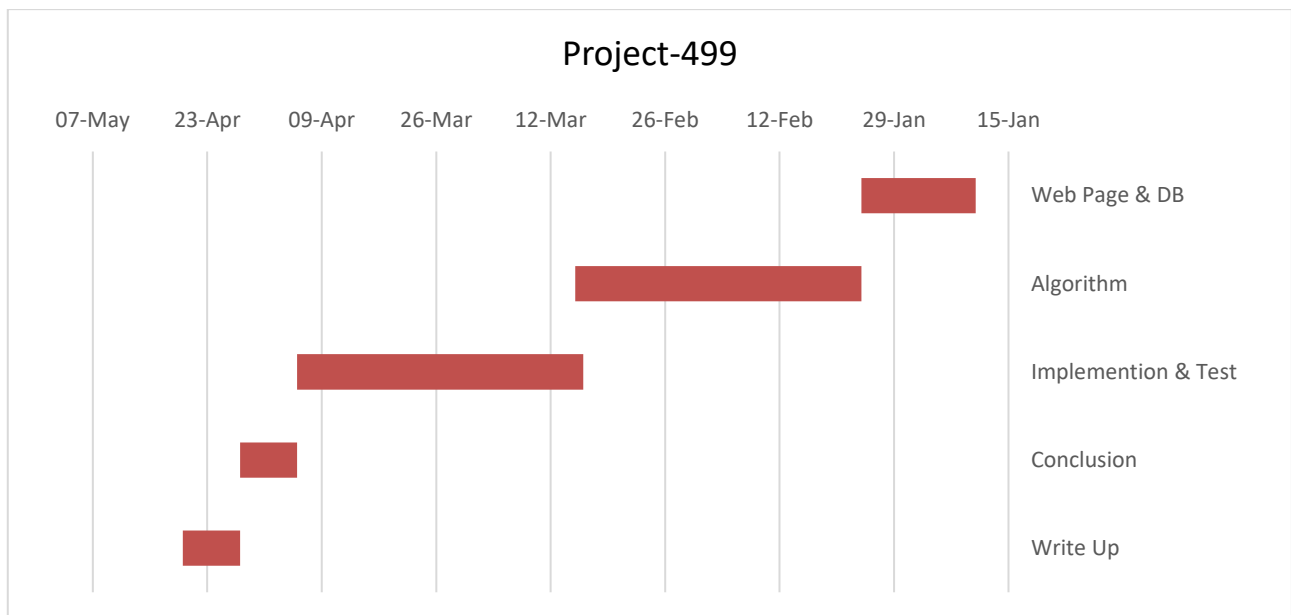


Figure 1. 1: Gantt Chart

1.6-Conclusions

In this chapter we have provided you with the introduction of project, problem statement, research objective, research question, report structure and project plan & schedule. now we present the second chapter which is the literature review.

Chapter 2

Literature Review

2.1- Introduction

In recent years, security has become the focus of everyone's attention, cyberattacks have increased, so we wanted to delve deeper into this area, and we discussed the most important themes and that is what we aim for in this research. So, in this chapter we will purely focus on three key areas related to our project, namely Computer Security, Network Security and the Login System.

2.2- The difference between Computer Security and Network Security

Computer Security is “a process and the collection of measures and controls that ensures the *Confidentiality, Integrity and Availability (CIA)* of the assets in computer systems” (Adeyemi, 2018).

Examples of what Computer Security protects:

- Computer hardware devices such as PC, phone, servers etc.
- Network devices such as routers, switches etc.
- Software, firmware, operating systems.

Network Security is “any activity designed to protect the usability and integrity of your network and data. It includes both hardware and software technologies” (Adeyemi, 2018).

Examples of what the Network Security protects:

- Firewall.
- Antivirus.
- Access control.
- Data encryption.
- Computer forensics.

2.3- Computer Security

Overview

In this topic, we will discuss computer security and also discuss some examples of personal account protection or any password uses.

So, what is security? Security means " Step to protect person or property form harm (harm may be intentional or nonintentional)" (CIAMPA, 2015).

Security is one of the most important things for large and small businesses, whether it be the security of hardware, software, networks, data or even individuals. One of the reasons for data loss or sabotage is weak security, companies must establish strict security policies, to prevent security breaches.

Our research depends heavily on security so we will now present some examples of security, namely passwords, and 2-step verification.

Examples of computer security

1-Passwords:

First what is meant by a password?

"A password is a string of characters used to verify the identity of a user during the authentication process "(Rouse, 2017). Usually, a password is used in conjunction with a user name, it is created to be known only to the user that user to login to his website or application, etc. Passwords can vary, for example, long or short passwords, numbers or letters, special characters or all of them in one password.

A password is one of the most important things in the world of the Internet, but it has many problems and weaknesses. Password security depends on choosing the type of password if it is difficult to guess or easy, however, a long password can

be difficult to remember or write them correctly, on the other hand, easy password is more vulnerable to hacking.

Cracking passwords can generate 350 billion words guess only in a second and can also break any password of eight characters in just five hours. Internet servers are exposed to thousands of attacks every day, as an unprotected computer can be infected in less than 60 seconds. "From 2005 through early 2014, more than 666 million electronic data records in the U.S. had been breached"(CIAMPA, 2015), the attacker steals personal electronic data, health records and credit card numbers.

Most web pages and programs, especially bank accounts, set password policies to be a very strong password that cannot be guessed.

These are difficult password creation requirements. See Table 2.1 below:

- 1- At least eight characters and can be of 16 to 64 or more.
- 2- Considering both uppercase and lowercase letters with case sensitivity.
- 3- Use at least one number.
- 4- and use at least one special character.

Type	Example
Uppercase letters	A , B , C ...
Lowercase letters	a , b , c ...
Numbers	1 , 2 , 3 ...
Symbols (special character)	! , @ , # ...

Table 2.1:Strong password content

Applications should prohibit weak passwords. For example, they should not be publicly identifiable, such as date of birth, child's name, favorite player name or the same username.

And these are some examples of weak passwords;

1. 123456
2. Password
3. Qwerty
4. admin

And this is an example of the strongest type of password combination;

1. WoS4-m46o-4oEw-Ptm4

2- Password authentication

Password authentication only does not meet the security requirement. Multifactor authentication has been proposed, and with the rapid growth of multifactor authentication, various methods have emerged: personal question, mail verification, SMS verification, face ID, fingerprint, etc.

The popular ways of multi-factor authentication: **SMS Two-Factor & Fingerprint.**

SMS Two-Factor: Many use SMS two-factor authentication to protect their accounts from hacking. You have probably seen SMS 2FA in action.

Mark Risher says, Google director of product management for counter-abuse and identity services. “Any form of 2FA improves user security over a password alone; however, not all 2FA provides equal protection. Sophisticated attacks can work around some methods of 2FA” (Risher, 2019). Risher cites SMS-based phishing attacks as one such method. “Despite this, adding a phone number for two-step verification is still recommended if you cannot use any other options” (Risher, 2019).

We found it an effective method but it is not perfect. It has many disadvantages such as your phone must be in good condition if it is not with you or is down, you will not receive the message, may not get the message if there is a problem in your sim card company, see figure 2.1 below.



Figure 2.1: Working of SMS 2FA

Fingerprint: Many methods have been used to confirm human identity, some of these: face, iris, fingerprint, hand geometry, and voice. Fingerprint is the popular and most used recognition system.

Compared to other ways it is good and does not take time like checking messages on email or SMS, but it has problems also, this too will be on your own devices, you cannot be used on devices in public places, and not all devices provide a fingerprint service. So still now we cannot consider it a perfect solution. See figure 2.1 below

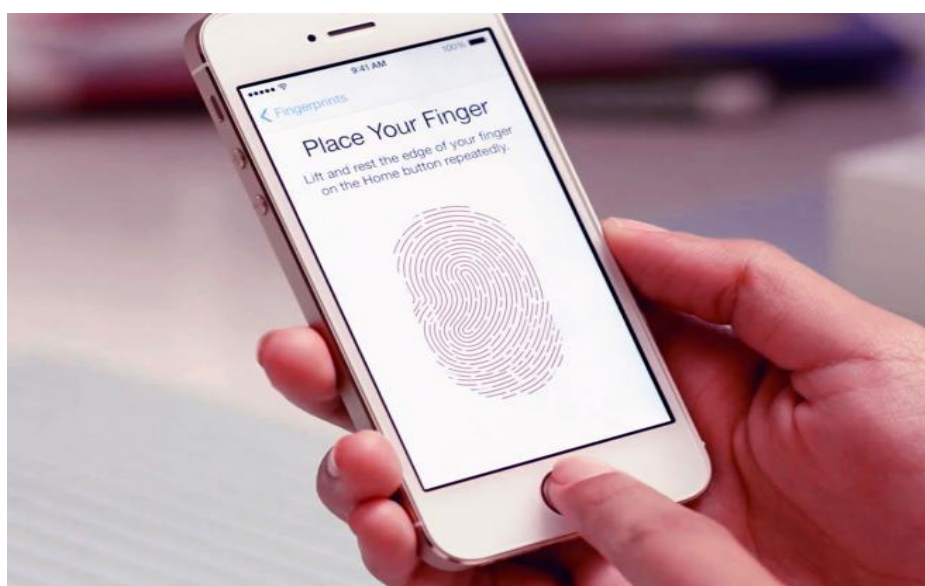


Figure 2.2: How to apply a fingerprint

And there are a lot of methods to multi-factor authentication each has its advantages and disadvantages, we will focus on these disadvantages so that we do not fall into them to get a good method with the least number of problems.

2.4- Network security

Overview

When a device connects to another device, it opens up a lot of possibilities, such as sending data over the network, communicating with others, or keeping it in a cloud, with this connection we have facilitated our lives, on the other hand, this connection may expose our data to hacking or sabotage.

Network security is one of the most important things in the world of technology and we will talk about the most important topics about network security, which are of interest to our research.

Social Engineering Attacks

First what is Social Engineering?

Social Engineering is gathering of information from victims and relies on confidence and psychological approach and physical procedures.

Psychological Approaches: Is to persuade the victim to give information or do a certain thing, and he does that by persuasion, flattery and beautiful talk. Sometimes he asks for simple information, and when he wants to take an action the request will be believable. And there are three types:

- **Impersonation:** It deludes you as someone else, like helping you with something as an expert or convincing you that it is technical support.

- **Phishing:** Is sending an email that it is from a company and giving him personal information for the victim to trust him.

- **physical procedures:** Attacks are used to take advantage of user actions to be a security vulnerability, and there is to of them dumpster diving and tailgating.

Network Attack

Nowadays people rely on the internet for many personal, social and professional things however, in recent years, network attacks have increased as hackers try to control and destroy organizations for political or material reasons and also violate our privacy. Therefore, the topic of network security has become one of the most important topics in the field of computer.

Now we will see types of Network Attack.

1) Denial of service (DoS)

“An attack that attempts to prevent a system from performing its normal functions by overwhelming the system with requests” (CIAMPA, 2015).

2) Interception

a) Man-in-the-middle:

An attack on two people or servers connected to the network, the attacker captures the data sent for modification, theft or surveillance. See figure 2.3 below

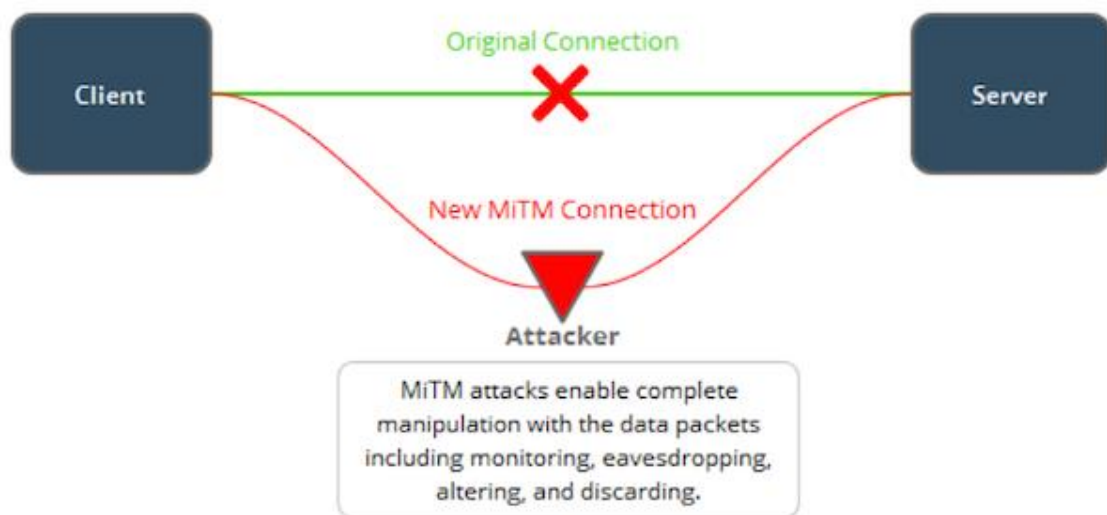


Figure 2.3: Man in the middle attack (taken from teskalabs, 2019)

3) Poisoning

“Poisoning is the act of introducing a substance that harms or destroys a functional living organism. Two types of attacks inject “poison” into a normal network process to facilitate an attack. These are ARP poisoning and DNS poisoning” (CIAMPA, 2015). see Figure 2.4, 2.5 and 2.6

Device	IP and MAC address	ARP cache before attack	ARP cache after attack
Attacker	192.146.118.2 & 00-AA-BB-CC-DD-02	192.146.118.3=>00-AA-BB-CC-DD-03 192.146.118.4=>00-AA-BB-CC-DD-04	192.146.118.3=>00-AA-BB-CC-DD-03 192.146.118.4=>00-AA-BB-CC-DD-04
Victim 1	192.146.118.3& 00-AA-BB-CC-DD-03	192.146.118.2=>00-AA-BB-CC-DD-02 192.146.118.4=>00-AA-BB-CC-DD-04	192.146.118.2=>00-AA-BB-CC-DD-02 192.146.118.4=>00-AA-BB-CC-DD-02
Victim 2	192.146.118.4 & 00-AA-BB-CC-DD-04	192.146.118.2=>00-AA-BB-CC-DD-02 192.146.118.3=>00-AA-BB-CC-DD-03	192.146.118.2=>00-AA-BB-CC-DD-02 192.146.118.3=>00-AA-BB-CC-DD-02

Figure 2.4: ARP poisoning attack (taken from CIAMPA, 2015)

Attack	Description
Steal data	An attacker could substitute their own MAC address and steal data intended for another device
Prevent Internet access	An attacker could substitute an invalid MAC address for the network gateway so that no users could access external networks
Man-in-the-middle	A man-in-the-middle device could be set to receive all communications by substituting that MAC address
DoS attack	The valid IP address of the DoS target could be substituted with an invalid MAC address, causing all traffic destined for the target to fail

Figure 2.5: Attacks from ARP poisoning (taken from CIAMPA, 2015)

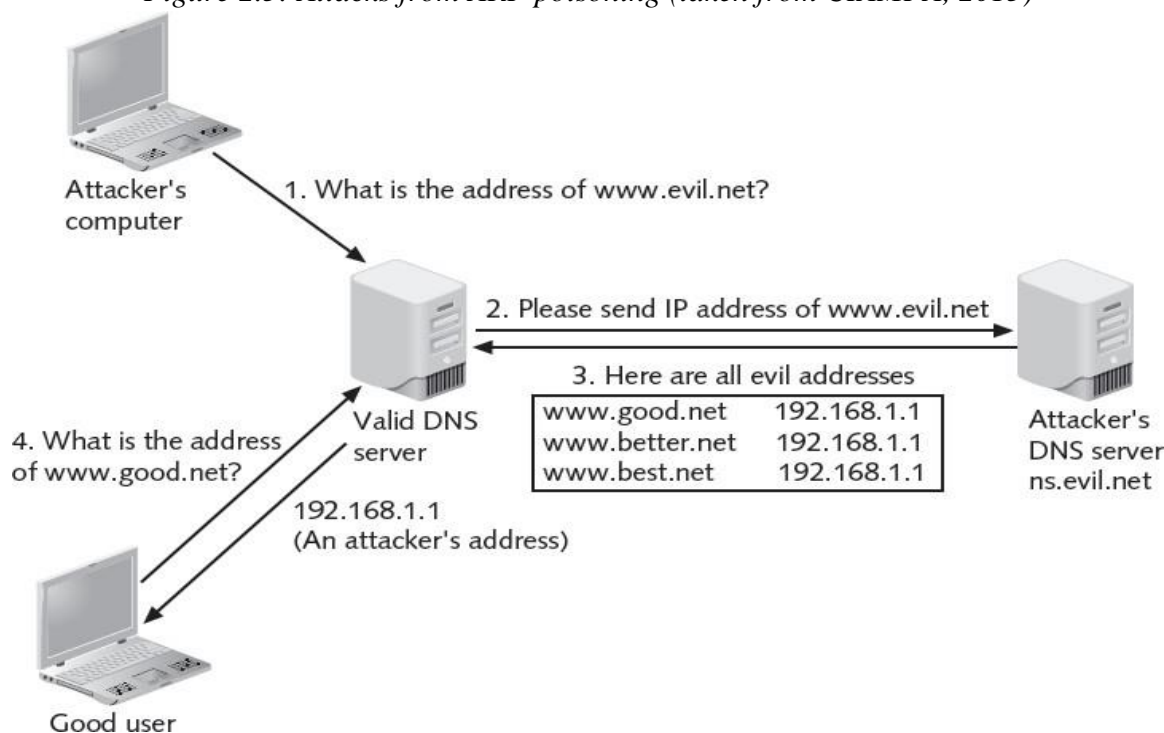


Figure 2.6: DNS poisoning (taken from CLAMPA, 2015)

These are methods for a person to get login details.

2.5- Login System

Overview

One of the most prominent ways to log into a system, is to use the name of the ID and password of the user, to give the right to access our personal files or secret files, and the user may deliberately password easy to remember, which makes it easier for the attacker to guess and connect, when the password is difficult to remember requires special conditions to new word that is easy to forget and not to be able to reach our own files.

One solution is to use biometrics as a method for user authentication. Such as the use of a fingerprint although there are a number of devices supporting this feature, but it is not available in all devices and additional costs are required to support it.

Another biometric and suitable for accessing the computer system is the dynamic of the keyboard, that many computer systems today support mechanical or touch keyboard way.

2.6- Related Work

Our research is unique and it is difficult to get topics similar or close to it, so when we search in the books and google scholar, we did not find topics related to our research we only found an idea close to it and we will discuss it here:

A Login System Using Mouse Dynamics

Their research is about a login system using mouse dynamics, using a task with its mouse pointer, from which the user is verified in granting access to the computer or not. The system can be an alternative or additional regular username and password. (Patrick & Christopher, 2009)

One of the advantages of a system that uses biometrics is that people cannot forget it. The system has the added advantage of not requiring additional devices unlike systems using fingerprints.

The research depends on the user's computer identification based on how the mouse pointer is used. One of the advantages of mouse dynamics is that it can be used not only to log in to the user in the computer system but also to detect user change during the open session. The mouse dynamics uses a continuous credibility feature, where user behavior and deviations are followed in normal behavior and in the event of a difference this will indicate the potential for user change.

One of the actions that can be done using the mouse is to move it using the mouse wheel and use the left and right buttons to click and double click.

The disadvantage of their work is that you must use the mouse cursor, not all systems have a mouse and also not all systems have the same sensitivity of the mouse. And also requires their system to an external device.

Our project outperforms them because it does not require an external device and also in the previous search it is difficult to memorize the behavior of the user because its behavior may differ from time to time or from one device to another unlike our project as it only requires keeping the time of clicking the buttons.

The Experiment of Mouse Dynamics

In the experiment, they performed a task called (follow the maze) for each participant to participate, moving the mouse pointer between two lines from start to finish. As in Figure 2.7, the maze is the actual path between two lines. Each participant performed this task 5 times per session, 6 sessions in total. Twenty-eight people, both ordinary and experienced in mouse use, participated in this experiment.

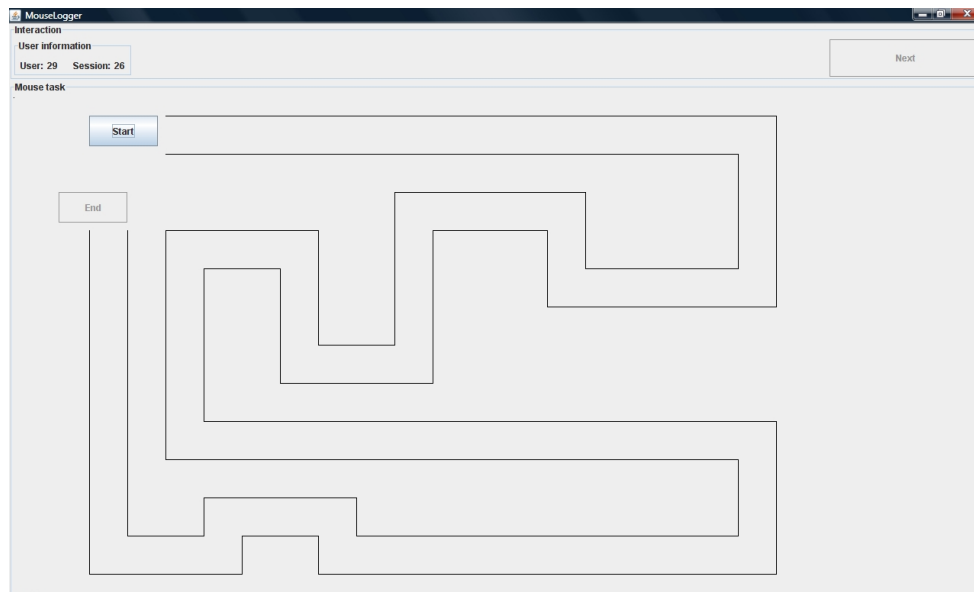


Figure 2.7: GUI of the maze

They created a program that captures mouse movements x and y for the mouse pointer to take an average of 100 samples per second, the results gave a clear view of the task completed, see Figure 2.8.

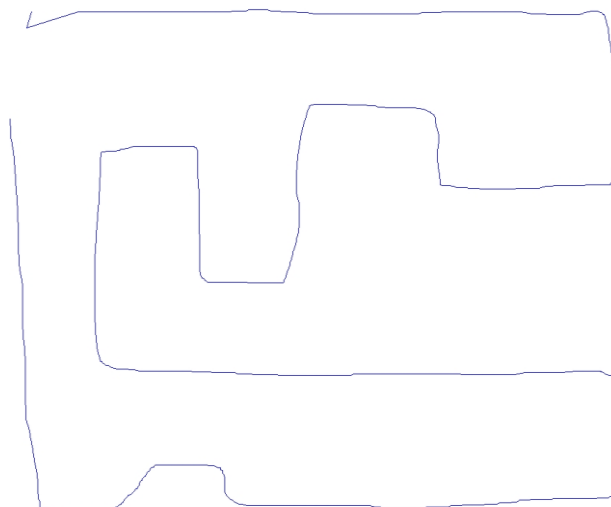


Figure 2.8 : Example plot of user data

In this figure, we can see the way of storing the user data, this is how the mouse dynamics work.

2.7- Conclusions

In this chapter, we introduced you the Literature Review of our research and we talked about computer security and how computer security is useful in our research specifically password, how we know if our password weak or strong, and we saw 2-step verification, methods, advantages and disadvantages, and last thing is the fingerprint.

After that we talked about network security and explained the most important attacks on the network, which we focus on to help us in this project, then we talked in general about the logon system, and finally, we show you the related work of our project. Now we will talk about chapter 3, which talks about System Analysis.

Chapter 3

System Analysis

3.1- Introduction

In this chapter we will describe the work of our project, Functional and Non-Functional Requirements then we will see the processes between the user and the login system. This is by using graphs that will enable us to analyze and design our system, as well as to show us the requirements for the system and the processes that occur in the system.

3.2- Requirements specification

Functional requirements

No.	Functional Requirements Description
1	User should be able to register.
2	User should be able to login.
3	Every member using the system shall have uniquely identified by his timing in writing the password.
4	Easy to user.

Table 3. 1: Functional Requirements

Non-functional requirements

No.	Non- Functional Requirements Description
Organizational requirement	User of the system shall have authenticate themselves using their timing in writing the password.
Usability requirements	The system should be clear and easy to use.
Reliability requirement	The system will refuse entry if the error rate at the time of the password is more than 15%.
Security requirement	The system will provide high security in password registration

Table 3. 2: Non- Functional Requirements

User requirements

Unified Modeling Language (UML):

UML stands for Unified Modeling Language (UML) is a unified modeling language with many purposes; generally, it is specialized in software engineering. Use this language to make diagrams to describe computer programs. UML is not limited to software engineering, but download them in systems engineering, and represent organizational structures. Unified Modeling Language (UML) can create forms and can be done by drawing (drawing) by generating initial program code. See Figure 3.1 below for examples.

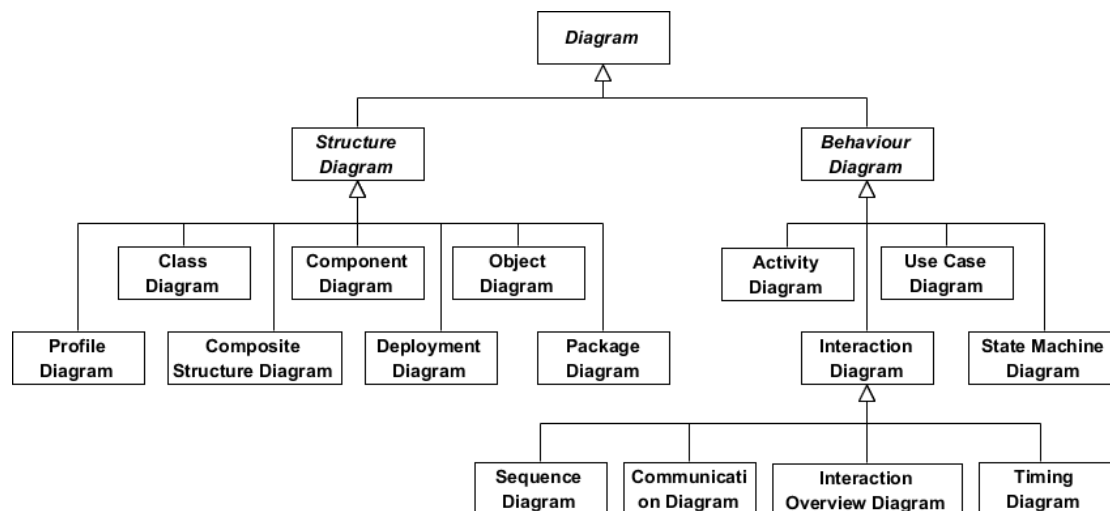


Figure 3.1: UML diagrams

Use Case Diagram:

In software engineering, systems engineering is a description of the steps between the user and the software system that leads the user to perform the required operation. A user or actor can be a person or something such as an external programming system or a manual process. Use Cases is a language modeling technique that helps software developers define features to execute and solve errors safely. In Figure 3.2 below, it describes how users login by Use-Case Diagram.

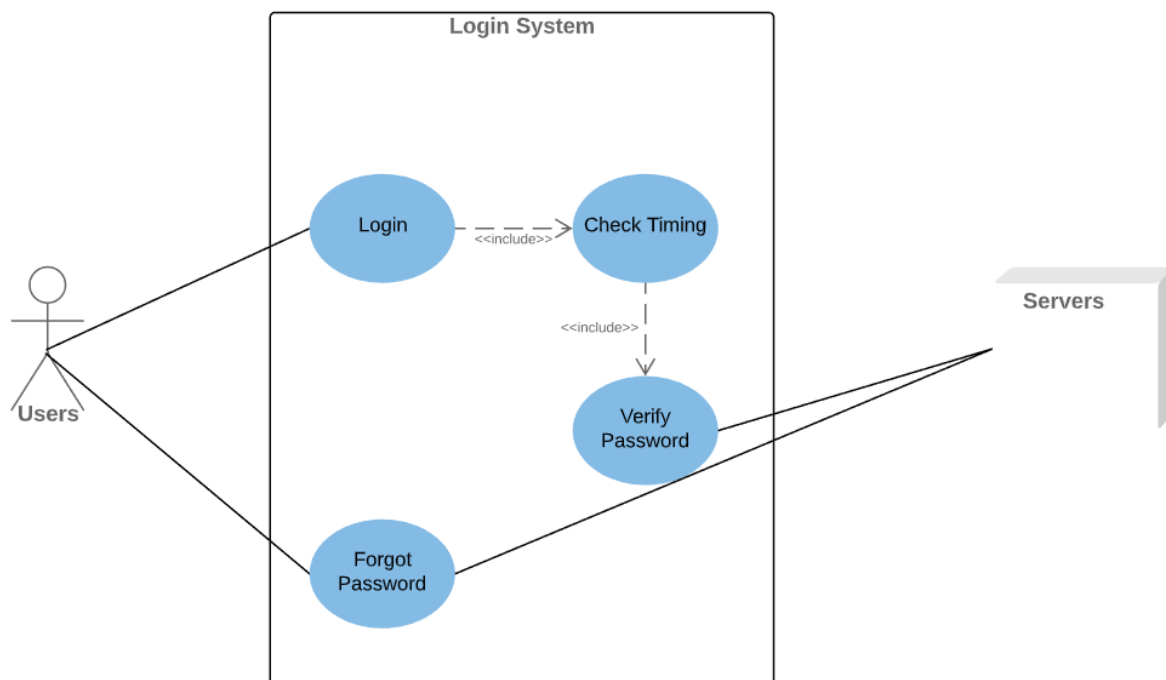


Figure 3.2: Use Case Diagram

Sequence Diagram:

A sequence diagram explains the behavior of objects in case of use and describe objects and messages passed between them. Charts are read from left to right and descending. In Figure 3.3 below, it describes how users login by Sequence Diagram.

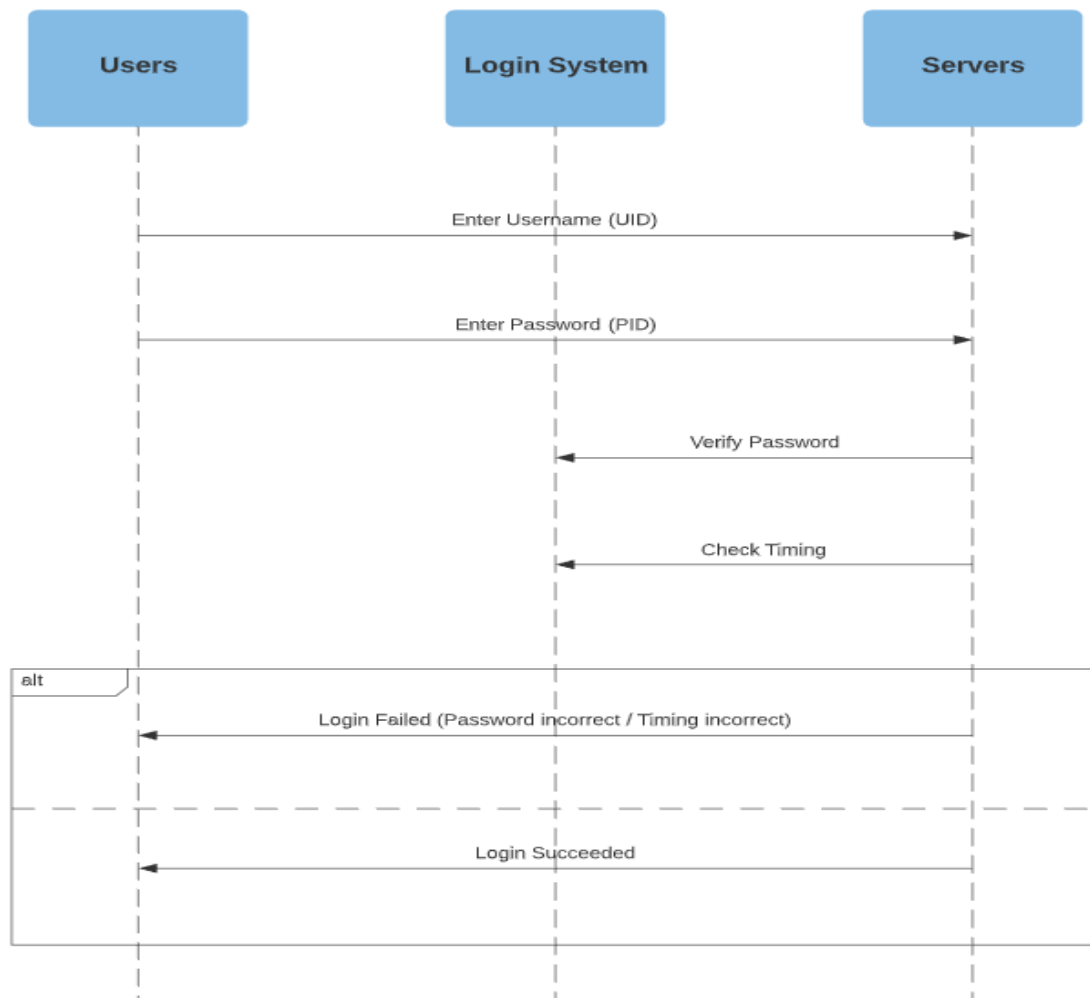


Figure 3.3: Sequence Diagram

Activity Diagram:

The activity diagram is a simple way to tailor the system's workflow, using graphs of activities and how they work step-by-step until they reach the goal. In Figure 3.4 below, it describes how users login by Activity Diagram.

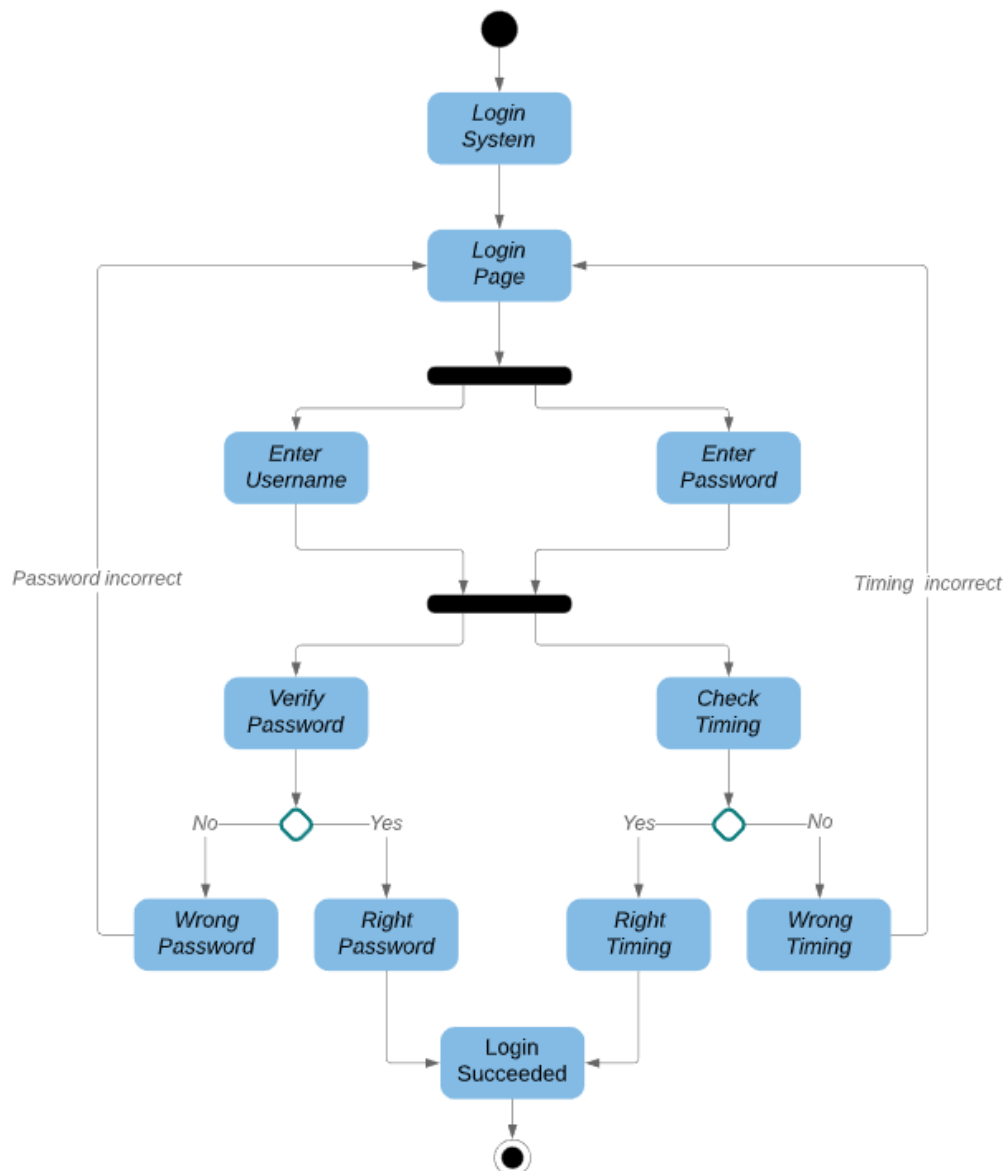


Figure 3.4: Activity Diagram

Chapter 4

Implementation and Testing

4.1- Introduction

In this section, we will outline our proposed research methodology in order to elicit the primary data required to answer the research question. The first quantitative method selected is experiments. The second qualitative method of our evaluation is surveys to explain the effectiveness of our approach to check the ability to identify the person from the password.

4.2- Technical Study

Hardware Environment

Initially, we need a web server for hosting our site on the internet. There are many aspects of the web server, we will talk about the hardware side and the software side and they working together:

From the hardware aspect, it is mean a web server is a computer that acts as storage of web server software and a website's component files. It is supported physical data exchange with different devices connected to the web through its connected to the Internet. From the software aspect, it is means a web server contains various parts that control the access of users to hosted files, at a minimum an HTTP server. The HTTP "Hyper Text Transfer Protocol" it is shown the webpages by using the browser and implementation of that protocol in a piece of Software that understand the web URL addresses. As well, it can show the webpages through the domain names of websites that its stores. Therefore, if the user asks the browser to display a webpage, the browser requests a file from the web server that hosted that file via HTTP. As long the

request arrives to the correct web server (Hardware aspect), HTTP server it sends a confirmation that it is ready to process a request (Software aspect) then sent the requested file to a browser, through HTTP too. As a result, the browser displays the file on the computer screen. Otherwise (like wrong web server) then a 404 response is returned.

Before publishing our site, must we decide which web server need static or dynamic, the difference between them is a static web server are sends its hosted file without update to the browser and it only consists of computer (which is referred to Hardware) and HTTP server (which is referred to the Software). With regard to dynamic web server consist of static web and extra software which is commonly being an application server and a database. The application server wills prior update of sending a host files to the browser via the HTTP server.

There is no official minimum for the hardware requirements to host the site that is because change of hardware specifications under the influence of different factors. To know the hardware specifications should know:

- The site is a High-traffic or low-traffic
- Number of users per day and month
- Size of the database

Cross-Platform Testing

In this age, there are a lot of devices types around, that related also with operating systems which may different as result of this. There is no limit of platforms that end user use to access the web sites.

Therefore, to achieve the goal of our project " A Test Bed for Novel Login Behavior " that was the be able to use the system anytime as well as any place, must we test a number of platforms to identify problems or issues with most of it. We should take into an account which type of devices is used. Nevertheless, we will do platform test for laptops and tablets to ensure the comfort of users with that devices have a big screen especially they need to focus their eyes on screen for a while. See Figure 4.1 below.

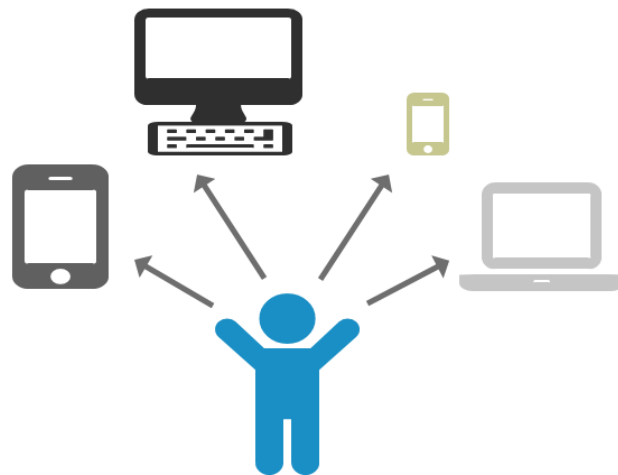


Figure 4.1: Types of devices

Software Environment

Programming Tool:

We will develop a web-based interactive login system via Flask. Flask is a micro web framework written in Python. It is classified as a microframework because it does not require particular tools or libraries. It allows you to build websites and web apps quite rapidly. The reasons of using Flask are useful in:

- control keystrokes through a system of micro-programs built with python.
- Easy to connect to libraries and databases

PostgreSQL:

PostgreSQL is most advance relational database, open source and it been active in development for about 30 years, it's very popular reliable and lot of startups do use PostgreSQL instead of using some other database engines such as Oracle because they don't have to pay for a license.

PgAdmin:

PgAdmin is GUI client it's make easier to connect to database and view the data with UI elements that allows to see database in much easier way.

Tkinter:

Tkinter is module built in with Python that allows you to create graphical user interfaces easy and very quickly.

Git:

Git is Version Control that help us mange our project's file, by tracks every change we make to our project, if we need to revert changes or if we want to look back and see how a file has evolved over the past with we can git history, and another reason to use git is collaboration, git makes collaboration very

easy and it allows you to be more productive when working in a team if two member make change in the code and then merge ever one changes, one of most helpful Software we use with git is SourceTree.

SourceTree:

SourceTree is git GUI client that help you simplifies how you interact your git repositories, See Figure 4.2 below.

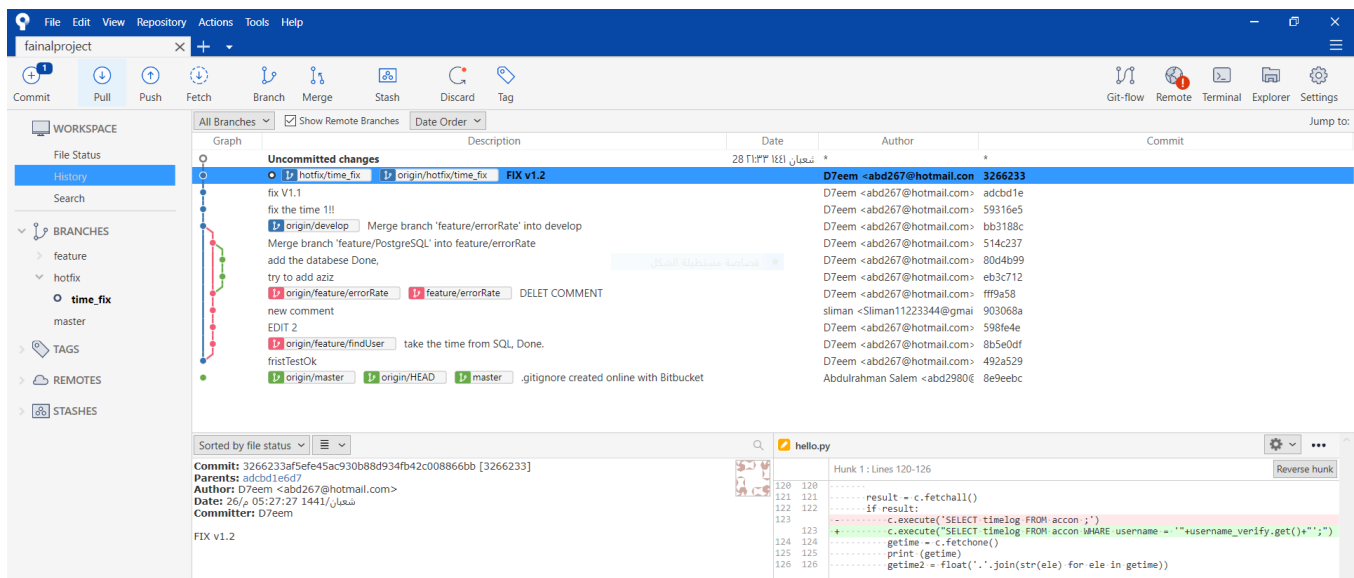


Figure 4. 2: SourceTree program

4.3- Implementation

Technical architecture of the application:

Registration Page

The software will contain two pages, one for registration and the other for login. We will explain each of them in the flowchart below, See Figure 4.3below.

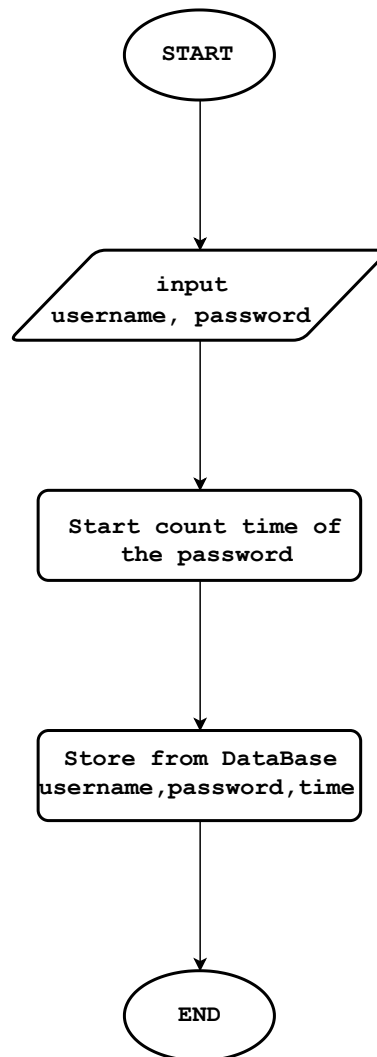


Figure 4.3: flowchart of Registration Page

In this chart we will see how to register the new user, at the beginning the user will enter his name, then he will start writing the password, but he must pay attention to the time in writing the password from the beginning to the end, the time between each letter to another will be calculated to be recorded in the database.

Login page

On this page, the user will be logged in. Initially, he will enter the username, then he will start entering the password, considering the time between each number in the password. See Figure 4.4 below.

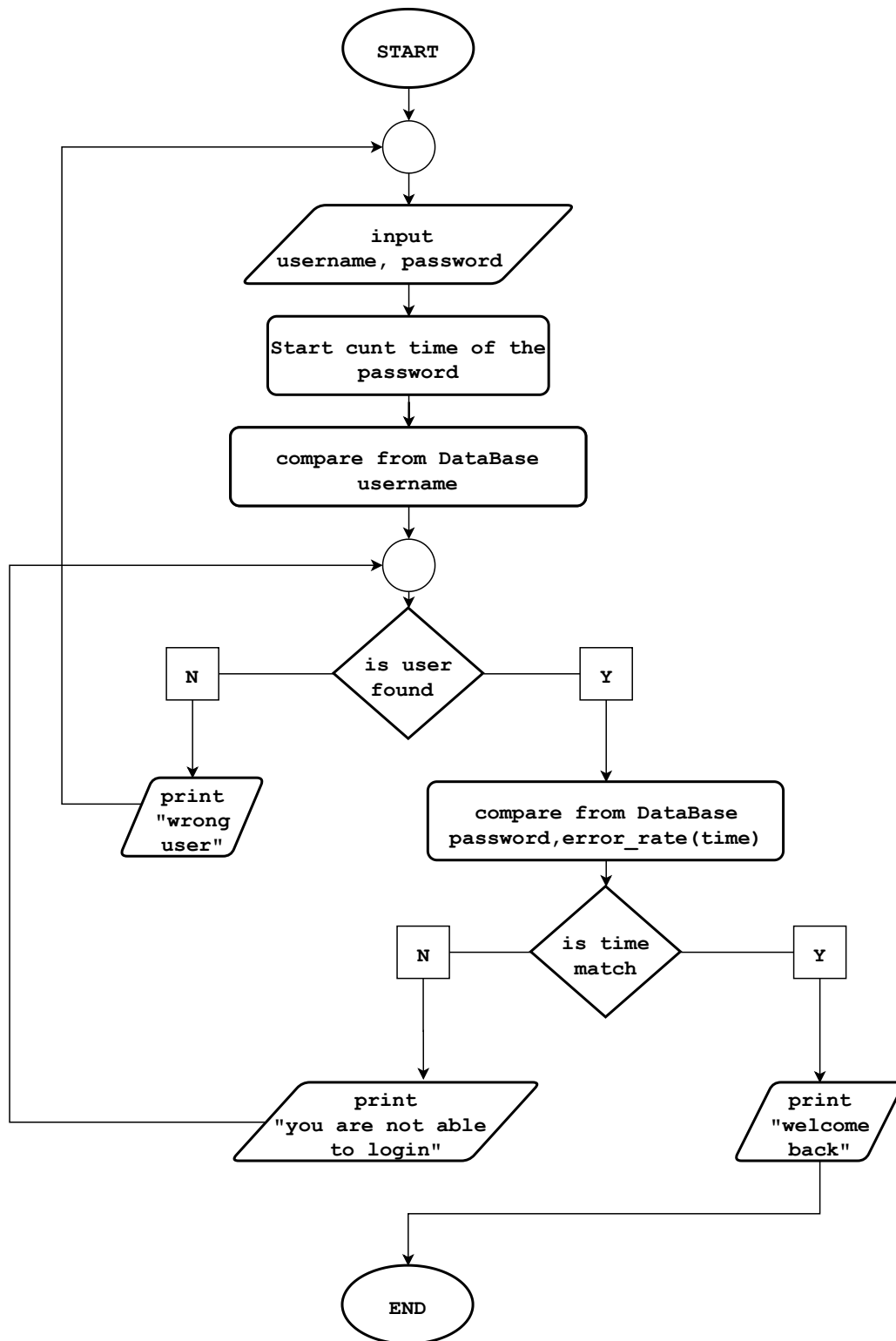


Figure 4.4 : flowchart of login Page

Interfaces of The Application

The following figures present the initial design of the main page of our website interface. As the figures show, our website will be flexible to use in the smart phones, tablets and PCs.

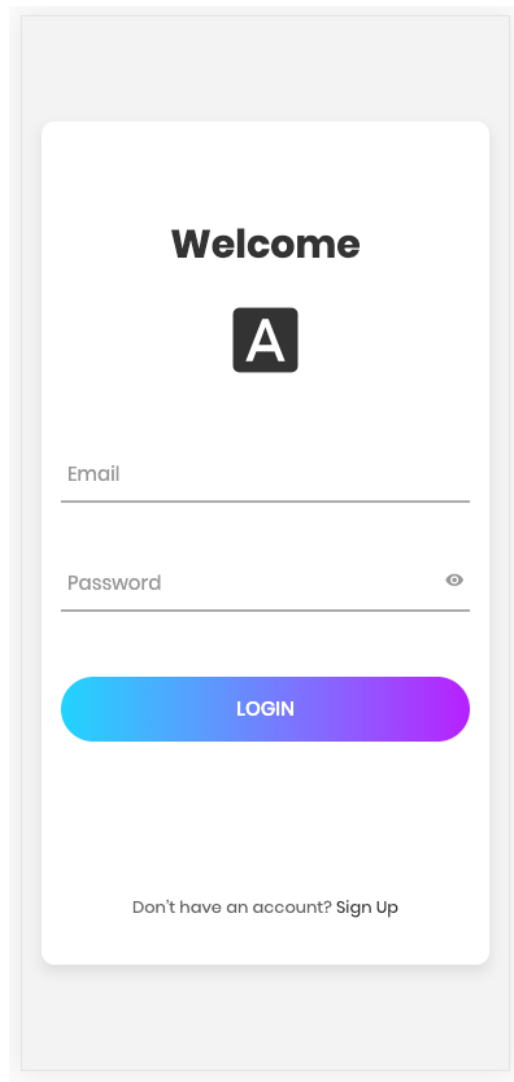


Figure 4. 5: on smart phone

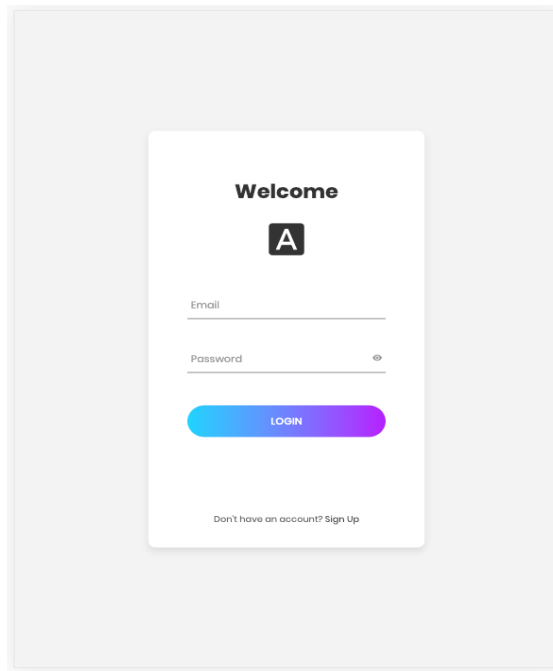


Figure 4. 6: on Tablet

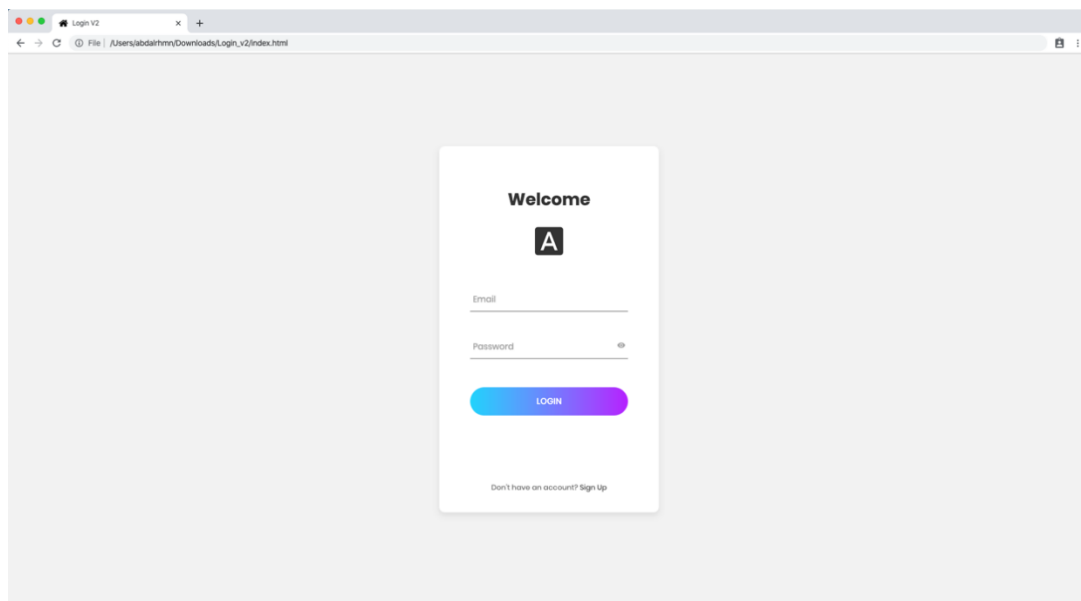


Figure 4. 7: on PCs

In the figure we will show you how to create the database, See Figure 4.8 below.

```
1 cur =conn.cursor()
2 cur.execute("CREATE TABLE IF NOT EXISTS user (username TEXT NOT NULL ,password TEXT
  NOT NULL, timelog FLOAT NOT NULL);")
3 #cur.execute("INSERT INTO test (username, password) VALUES (%s, %s)","test",
  "passwd"))
4 print("coins")
5 conn.commit()
6 cur.close()
7 conn.close()
```

Figure 4. 8: create a database

And this is how the database is linked with the program, See Figure 4.9 below.

```
try:
    db = psycopg2.connect(database="name of database", user="user name ", password="the password ",
    host="the host name ")
    print("connected for test")
except:
    print ("I am unable to connect to the database")
```

Figure 4. 9: linking the DB with the program

4.4- Testing Method

Testing Strategy

An experiment is the most suitable research method that can indeed test if our system effective or not. There are numerous types of preceding academic research exists related to protecting your personal account and even dynamic pressing the keys, but it does not exist. So, our experience will be applied to the login system on websites that make up the Web.

Initially we will take a group of 5 students and let each person register on the graduation project web page with a username, password and choose the appropriate timing for it.

After this we ask each user to try to access his account five times and record the results ...

Now after seeing and record the login results by the user himself we move to the most important part, which is whether the account will be hacked by a hacker who knows the password beforehand but he does not know the time used in the password.

We will take the test on the same ten students by randomly switching accounts between students so that each person gets an account from his primary account with knowledge of the user name and password and we ask them to try to enter five times and record the results after this.

Error rate:

- Number of times for correct entry.
- Number of times for the wrong entry.
- Allowing rate for error.
- Expected time.

Results

Initially here in the testing table we ask each user to register the test page and try to enter five times with the data he registered from a user name and password and timing and then we will record the successful entry times from the five attempts for each user, then we will distribute the accounts among the five users with each user giving a username and password to another user without knowing the timing used to log in and we ask each person to try to login five times to hack the account and the number of attempts that were logged in or not is recorded.

These are the data used to log in the given user name, the password specified by the user, and the time specified.

Username	Password	The timing used
test0	11111	13.55
test1	19833	5.08
test2	Ss055	8.51
test3	11223	2.73
test4	Mss96	6.85
test10	canyou	?*

Table 4. 1: data for testing table

*Can you access to this user “test10”? try it in the program.

Users Records

Users and Hackers		Was logged in? (Y/N)				
		First attempt	Second attempt	Third attempt	Fourth attempt	Fifth attempt
1	User 1	Y	Y	Y	Y	Y
	Hacker 1	N	N	N	N	N
2	User 2	Y	Y	Y	Y	Y
	Hacker 2	N	N	N	N	N
3	User 3	Y	Y	Y	Y	Y
	Hacker 3	N	N	N	N	N
4	User 4	N	Y	Y	Y	Y
	Hacker 4	N	N	Y	Y	N
5	User 5	Y	Y	Y	Y	Y
	Hacker 5	N	N	N	N	N

Table 4. 2: testing table

Register data in the table after the users have been notified with his user name and choose the appropriate password for him and the time specified by the user. Each user is attempted to enter his account five times in a row and we record the results and then give each user an account different from his account and ask him to register after giving it Username and password without knowing the timing used. After recording the results, we conclude from the user's attempts that he was successful at 96%, so that among 25 attempts 5 of each user, there was only a failed attempt. After recording the results, we conclude from the hacker's attempts that the method was successful at 92%, so that among the 25 attempts 5 for each hacker, there were only two attempts at which the hacker was able to enter.

The problems that were apparent to us are in the fourth user. The password was 11223. I think the reason for the ease of penetration depends on that in this user, use a simple password and close numbers, and he did not care about the timing factor after writing the password, he directly login.

Therefore, we should suggest that users try to choose a more difficult password with attention to the main aspect of the project idea, which is choosing an appropriate timing.

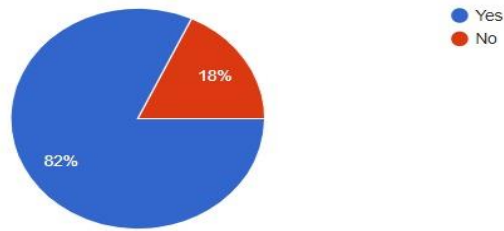
Survey

This survey of 183 people we asked them some questions and these results. We concluded from them that people liked the project idea and should develop in the future.



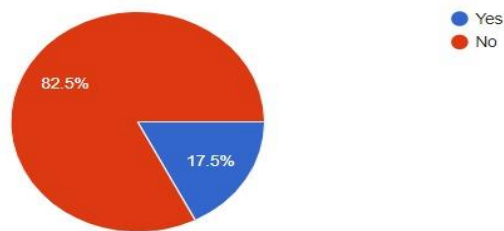
Is this way faster than 2-step verification (text message ... etc) (هل هذه الطريقة أسرع من التحقق بخطوتين) (رسالة نصية... إلخ)

183 ردًا



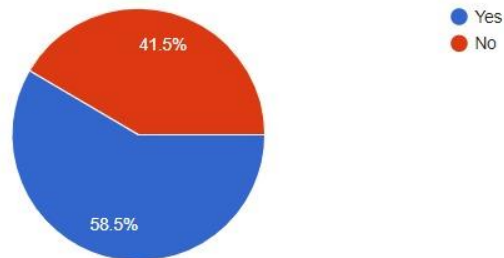
Have you ever been hacked (هل سبق وأن تعرضت للاختراق؟)

183 ردًا



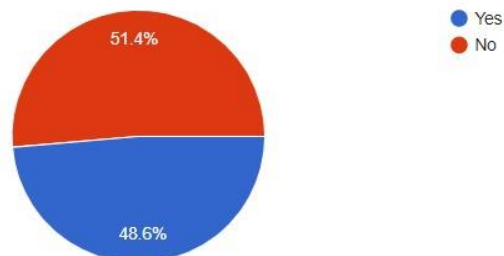
Did you have to change your password because someone saw you typing it (هل توجب عليك تغيير كلمة المرور بسبب مشاهدة شخص لك أثناء كتابتها؟)

183 ردًا



Have you ever had problems with 2-step verification (هل سبق أن واجهت مشاكل بسبب التحقق بخطوتين؟)

183 ردًا



Chapter 5

General Conclusions & Future Work

5.1- Conclusion

In this research, it aims to understanding user login behavior, how the user enters his password? Is he write it faster or slower? One hand or two hands? And solving some problems of the login system in terms of remembering or security. In addition, this system will save time and effort in logging in. The system ensures that the account remains confidential even if it is compromised, thus providing an additional layer of protection. Our research seeks to strengthen security in operating systems and it is intended to be available in all devices.

In this project, we first discussed an introduction about the project, we talked about the problem that is the basis of our project and also the objectives of our project that we aspired to achieve. In Literature Review we talked about computer security, network security, the difference between them, login system and finally related work. In the third chapter, we talked about the system and its requirements, user, Functional and Non-Functional Requirements. Then the fourth chapter comes and talks about the implementation and testing of your project, and we talked about the hardware and software environment, and at the end of the chapter we create a Survey to see our project in order to see what people think about our project. No this is the last chapter we are writing a general conclusion for the project, and a future work.

Finally, this is our Research Question now we can answer them:

- Can we write a program to accurately record a user's login (User name & Password) in terms of keystrokes and timing?
Yes, we writing a program that can record keystrokes and timing.
- Can a user login use the same timings on different devices?
Yes, user can login use the same timings on different devices.
- What is an acceptable error rate for system that allows user flexibility but does not compromise security?
We make the error rate 15%, it is flexibility but does not compromise security as we see in testing table.

5.2- Future Work

In future work, we will solve some problems that we could not solve due to lack of time and current conditions narrowed our sources to search for a solution, from the problems that we faced is that we could not create a code that records the time in the password between the numbers. For this reason, we are satisfied with recording the time for the full password, but we will solve this problem in the future. Also, one of the actions that we will be doing in the future is developing the program to be professional.

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Appendices

copies of all supervisor meeting reports

Graduation Project#2 Team Meeting Minutes	Your team number: 1
	Meeting date: 27 January 2020

Attendance

Team Member Name	Present?	Method
Sulaiman AL-Dubaykhi	Y	Lab
Abdurhman AL-Shuhetan	Y	Lab
Abduaziz Al-Tassan	Y	Lab

Meeting Location

Lab 5

Meeting Start

Scheduled start: 10:00 AM

Actual start: 10:05 AM

Recorder: 2:00 PM

Agenda

1. Introduction for CS499.
2. Discuss about timeline and tasks.

Meeting End

Scheduled end: 10:50 AM

Post-Meeting Action Items

Action	Assigned To	Deadline
Create a web page	supervisor	3-Feb
Create a database	supervisor	3-Feb

Decisions Made

1. Create a web page and database.

Next Meeting

Location: Online

Scheduled date: not specific

Scheduled time: not specific

Graduation Project#2 Team Meeting Minutes	Your team number: 1
	Meeting date: 3 February 2020

Attendance

Team Member Name	Present?	Method
Sulaiman AL-Dubaykhi	Y	Online
Abdurhman AL-Shuhetan	Y	Online
Abduaziz AL-Tassan	Y	Online

Meeting Location

WhatsApp

Meeting Start

Scheduled start: 11:00 AM To 2:00 PM

Actual start: 11:05 AM

Recorder: 2:00 PM

Agenda

1. Discuss our last meeting and what we do after meeting-1.
2. Send everything we have done.
3. Discuss about database and the algorithm.

Meeting End

Scheduled end: not specific

Actual end: 10:47 pm

Post-Meeting Action Items

Action	Assigned To	Deadline
Create an algorithm for our project.	supervisor	10-Feb

Decisions Made

1. Create an algorithm

Next Meeting

Location: online

Scheduled date: not specific

Scheduled time: not specific

Graduation Project#1 Team Meeting Minutes	Your team number: 1
	Meeting date: 10 February 2020

Attendance

Team Member Name	Present?	Method
Sulaiman AL-Dubaykhi	Y	Lap
Abdurhman AL-Shuhetan	N	-
Abduaziz AL-Tassan	Y	Lap

Meeting Location

Lap 5

Meeting Start

Scheduled start: 10:00 AM

Actual start: 10:10 AM

Recorder: 1:00 PM

Agenda

1. Everyone works so far.

Meeting End

Scheduled end: 11:30 AM

Actual end: 11:30 AM

Post-Meeting Action Items

Action	Assigned To	Deadline
Editing in the algorithm v1.0	supervisor	16-Feb
Editing in the database	supervisor	16-Feb

Decisions Made:

1. Do some editing in the algorithm v1.1
2. Editing in the database.
3. New idea for the algorithm.

Next Meeting

Location: Online

Scheduled date: not specific

Scheduled time: not specific

Graduation Project#1 Team Meeting Minutes	Your team number: 1
	Meeting date: 16 February 2020

Attendance

Team Member Name	Present?	Method
Sulaiman AL-Dubaykhi	Y	Online
Abdurhman AL-Shuhetan	Y	Online
Abduaziz Al-Tassan	Y	Online

Meeting Location

WhatsApp

Meeting Start

Scheduled start: 10:00 AM

Actual start: 10:20 AM

Recorder: 1:00 AM

Agenda

1. Everyone works so far.
2. Discuss about database and the algorithm v2.0.
3. Prepper for testing.

Meeting End

Scheduled end: -

Actual end: 1:00 PM

Post-Meeting Action Items

Action	Assigned To	Deadline
Editing in the algorithm v2.0	supervisor	23-Feb

Decisions Made:

- 1- Editing in the algorithm v2.0

Next Meeting

Location: lap 5

Scheduled date: 23-FEB

Scheduled time: 10:00 AM

Graduation Project#1 Team Meeting Minutes	Your team number: 1
	Meeting date: 23 February 2020

Attendance

Team Member Name	Present?	Method
Sulaiman AL-Dubaykhi	Y	Lab
Abdurhman AL-Shuhetan	Y	Lab
Abduaziz Al-Tassan	Y	Lab

Meeting Location

Lab 2

Meeting Start

Scheduled start: 9:30 AM

Actual start: 9:40 AM

Recorder: 12:00 PM

Agenda

1. Discuss the work that we have done so far.
2. Review what has been done in the past weeks.
3. What we will doing next.
4. Deadline.

Meeting End

Scheduled end: 10:20 AM

Actual end: 10:10 PM

Post-Meeting Action Items

Action	Assigned To	Deadline
Working in the code.	supervisor	29-Mar

Decisions Made:

1. Everyone keeps going on his work.
2. More work in the code.

Next Meeting

Location: online

Scheduled date: -

Scheduled time: -

Graduation Project#1 Team Meeting Minutes	Your team number: 1
	Meeting date: 3 March 2020

Attendance

Team Member Name	Present?	Method
Sulaiman AL-Dubaykhi	Y	online
Abdurhman AL-Shuhetan	Y	online
Abduaziz Al-Tassan	Y	online

Meeting Location

WhatsApp

Meeting Start

Scheduled start: 10:00 AM

Actual start: 11:07 AM

Recorder: 1:00 PM

Agenda

1. Discuss the work that we have done so far.

Meeting End

Scheduled end: 12:00 pm

Actual end: 11:40 AM

Post-Meeting Action Items

Action	Assigned To	Deadline
Editing in the code	supervisor	-

Decisions Made:

1. Solving code problems

Next Meeting

Location: office

Scheduled date: 8 April

Scheduled time: 10:00 AM

Graduation Project#1 Team Meeting Minutes	Your team number: 1
	Meeting date: 8 April 2020

Attendance

Team Member Name	Present?	Method
Sulaiman AL-Dubaykhi	Y	office
Abdurhman AL-Shuhetan	Y	office
Abduaziz Al-Tassan	Y	office

Meeting Location

office

Meeting Start

Scheduled start: 10:15 AM

Actual start: 10:20 AM

Recorder: 3:00 pm

Agenda

1-Review what has been done in the past weeks.

2-Test the code.

Meeting End

Scheduled end: 10:40 AM

Actual end: 10:35 AM

Post-Meeting Action Items

Action	Assigned To	Deadline
Editing in the code v2.0	supervisor	-

Decisions Made:

1. Do some editing on the code.

Next Meeting

Location: blackboard

Scheduled date: 18 March 2020

Scheduled time: 12:00 pm

Graduation Project#1 Team Meeting Minutes	Your team number: 1
	Meeting date: 18 March 2020

Attendance

Team Member Name	Present?	Method
Sulaiman AL-Dubaykhi	Y	blackboard
Abdurhman AL-Shuhetan	Y	blackboard
Abduaziz Al-Tassan	Y	blackboard

Meeting Location

blackboard

Meeting Start

Scheduled start: 12:00 PM

Actual start: 12:10 PM

Recorder: 2:00 PM

Agenda

1. Database was created and linked to the login page.
2. Review the code to Count from the first letter to the last letter max 5.

Meeting End

Scheduled end: 12:50 PM

Actual end: 12:45 PM

Post-Meeting Action Items

Action	Assigned To	Deadline
Editing in the code v3.0	supervisor	-

Decisions Made:

1. Do some editing on the code v3.0.

Next Meeting

Location: blackboard

Scheduled date: 29 March 2020

Scheduled time: 7:00 PM

Graduation Project#1 Team Meeting Minutes	Your team number: 1
	Meeting date: 29 March 2020

Attendance

Team Member Name	Present?	Method
Sulaiman AL-Dubaykhi	Y	blackboard
Abdurhman AL-Shuhetan	Y	blackboard
Abduaziz Al-Tassan	Y	blackboard

Meeting Location

blackboard

Meeting Start

Scheduled start: 12:00 pm

Actual start: 12:15 pm

Recorder: 2:00 pm

Agenda

1. Review the hole code.
2. Update the report and make some changes.

Meeting End

Scheduled end: 12:50 PM

Actual end: 12:44 PM

Post-Meeting Action Items

Action	Assigned To	Deadline
Update the report	supervisor	16 - Abril
Editing in the code v4.0	supervisor	16 - Abril
10-minute video of a demonstration	supervisor	18 - Abril

Decisions Made:

1. Update the report.
2. Editing in the code v4.0.

Graduation Project#1 Team Meeting Minutes	Your team number: 1
	Meeting date: 11 April 2020

Attendance

Team Member Name	Present?	Method
Sulaiman AL-Dubaykhi	Y	blackboard
Abdurhman AL-Shuhetan	Y	blackboard
Abduaziz Al-Tassan	Y	blackboard

Meeting Location

blackboard

Meeting Start

Scheduled start: 7:00 pm

Actual start: 7:15 pm

Recorder: 8:00 pm

Agenda

1. Fix the bugs and test the code.
2. Update the report and make some changes.
3. Presentation video.

Meeting End

Scheduled end: 7:50 PM

Actual end: 7:44 PM

Post-Meeting Action Items

Action	Assigned To	Deadline
Update the report	supervisor	16 - Abril
Editing in the code v5.0	supervisor	16 - Abril
Testing the code	supervisor	16 - Abril
10-minute video of a demonstration	supervisor	18 - Abril

Decisions Made:

1. Update the report.
2. Editing in the code v4.0.
3. Testing the code.
4. 10-minute video of a demonstration.