

# **CMPE 331 SOFTWARE PROJECT FINAL REPORT**

**Bachelor of Science**

## **FINGERPRINT VOTING SYSTEM**

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## **Introduction**

Democratic governments in the world today rely on electronic voting as the foremost means of providing credible, transparent and fair elections for the electorate. There is a need for developed electronic voting systems to be security enhanced to ensure the authenticity of the developed system.

Traditional paper balloting systems suffer from vote tampering, multiple voting and illegal voting by unregistered voters. They are also susceptible to underaged voting due to the difficulty in authenticating the identity of prospective voters. Manual collation and publication of vote results also leads to slow response times and inaccuracies in published results. [2] Fingerprint applications are the healthiest method of this because human fingerprints are detailed, nearly unique, difficult to alter, and durable over the life of an individual, making them suitable as long-term markers of human identity.

## **Aim of the Project**

Fingerprints are the only thing that distinct people from others. Every fingerprint is unique and cannot be copied by anyone else. In this project the goal is to make a voting system based on fingerprints.

## **Importance**

This project will make the voting system improve in security, expenses and reliability.

## **Hardware**

**Arduino UNO:**

Arduino UNO is the main part of the hardware. It will be used to connect the fingerprint sensor to the computer. It will also store the code of the fingerprint sensor inside it.



## **Fingerprint Sensor:**

We will connect the sensor to Arduino and with proper code, it will be connected to the website.



## **Software**

### **Html (Bootstrap Framework), CSS and JScript**

Html, CSS and JScript were used to make the website.

### **MySQL Database**

MySQL Database was created to hold the data of the voters' input and transfer it to the website itself.

### **Php**

Php was used to pull the Arduino data from pc and to connect the database to website.

## PuTTY

PuTTY was used to pull the outputs of the Arduino code to a text file so that php can pull it.

## Arduino

Arduino code was used to check the fingerprint and compare it with the first check.

## Requirement List

<b>REQ1</b>	Program should be able to take input.
<b>REQ2</b>	The user should use fingerprint scan.
<b>REQ3</b>	The code should be understandable and clean

## Timeline

<b>Week 1</b>	The price for fingerprint devices will be searched and the fingerprint device will be bought. The software that is not familiar will be studied.
<b>Week 2</b>	The Arduino and fingerprint device will be checked if it is working properly. If it is not

	working properly, will ask the teacher for further instructions.
<b>Week 3</b>	Arduino developers will start working on the Arduino and its code. Front-end developers will focus on making the website. The back-end developer will work on the database. This took around 3-4 weeks to finish.
<b>Week 7</b>	This week the part above was complete, so the focus turned to the tests and fixing errors.
<b>Week 8</b>	The demo of the project was recorded, and presentation preparation was complete.

## The Design of the Project

### 1-Arduino

In the Arduino code, Adafruit library is used for exemplary code templates. Then, the code has been changed according to the project itself. In the 2<sup>nd</sup> picture, the “Stored!” Print is added for a reason which’ll be explained in puTTY.

```

|
#include <Adafruit_Fingerprint.h>

#if (defined(__AVR__) || defined(ESP8266)) && !defined(__AVR_ATmega2560__)

SoftwareSerial mySerial(2, 3);

#define mySerial Serial1

#endif

Adafruit_Fingerprint finger = Adafruit_Fingerprint(&mySerial);

int id;

void setup()
{
  Serial.begin(9600);
  while (!Serial); // For Yun/Leo/Micro/Zero/...

  Serial.println("\n\nAdafruit Fingerprint sensor enrollment");

  finger.begin(57600);

  if (finger.verifyPassword()) {
    Serial.println("Found fingerprint sensor!");
  } else {
    Serial.println("Did not find fingerprint sensor :(");
    while (1) { delay(1); }
  }

  Serial.println(F("Reading sensor parameters"));
  finger.getParameters();
  Serial.print(F("Status: 0x")); Serial.println(finger.status_reg, HEX);
  Serial.print(F("Sys ID: 0x")); Serial.println(finger.system_id, HEX);
  Serial.print(F("Capacity: ")); Serial.println(finger.capacity);
  Serial.print(F("Security level: ")); Serial.println(finger.security_level);
}

```

---

```

p = finger.storeModel(id);
if (p == FINGERPRINT_OK) {
    id=id+1;
    Serial.println("Stored!" + String(id));
} else if (p == FINGERPRINT_PACKETRECEIVEERR) {
    Serial.println("Communication error");
    return p;
} else if (p == FINGERPRINT_BADLOCATION) {
    Serial.println("Could not store in that location");
    return p;
} else if (p == FINGERPRINT_FLASHERR) {
    Serial.println("Error writing to flash");
    return p;
} else {
    Serial.println("Unknown error");
    return p;
}

return true;
}

```

## 2-puTTY

Since there were problems with connecting the Arduino to the internet, puTTY is used to get the output of the Arduino code and save it in a text file. Stored! Part is important since php code will check if there's any "Stored!" in the text file.



```

Adafruit Fingerprint sensor enrollment
Found fingerprint sensor!
Reading sensor parameters
Status: 0x0
Sys ID: 0x0
Capacity: 300
Security level: 3
Device address: FFFFFFFF
Packet len: 128
Baud rate: 57600
Enrolling ID #16
Waiting for valid finger to enroll as #16
....
  Image taken
Image converted
Remove finger
ID 16
Place same finger again
.....
  Image taken
Image converted
Creating model for #16
Prints matched!
ID 16
Stored!
Enrolling ID #17
Waiting for valid finger to enroll as #17
....
  Image taken
Image converted
Remove finger
ID 17
Place same finger again
.....
  Image taken
Image converted
Creating model for #17
Fingerprints did not match
Enrolling ID #17
Waiting for valid finger to enroll as #17
.....
  Image taken

```

## 3-HTML

### Import bootstrap to html

```

<!-- Bootstrap core JS-->
<script src="https://cdnjs.cloudflare.com/ajax/libs/jquery/3.5.1/jquery.min.js"></script>
<script src="https://cdn.jsdelivr.net/npm/bootstrap@4.5.3/dist/js/bootstrap.bundle.min.js"></script>

```

### The login page html

```

<section class="page-section" id="contact">
  <div class="container">
    <div class="text-center">
      <h2 class="section-heading text-uppercase mt-3">Login</h2>
      <h3 class="section-subheading text-muted">Please Vote.</h3>
    </div>
    <form id="contactForm" name="sendMessage" novalidate="novalidate" action="login2.php" method="post">
      <div class="row align-items-stretch mb-5">
        <div class="col-md-6">
          <div class="form-group mb-md-0">
            <input class="form-control" name="id" id="id number" type="num" placeholder="Your id number *" required="required" data-validation-required-message="Please enter your id number." />
            <p class="help-block text-danger"></p>
          </div>
          <div class="col-md-6">
            <div class="form-group form-group-textarea mb-md-0">
              <input class="form-control" name="vote" id="vote" placeholder="Your Vote *" required="required" data-validation-required-message="Please enter your vote."></textare>
              <p class="help-block text-danger"></p>
            </div>
          </div>
        </div>
        <div class="text-center">
          <div id="success"></div>
          <button class="btn btn-primary btn-xl text-uppercase" id="VoteButton" type="submit">Vote</button>
        </div>
      </div>
    </form>
  </div>
</section>

```

The front page of the website

```

5      <!-- Masthead-->
6      <header class="masthead">
7          <div class="container">
8              <div class="masthead-subheading" style= "color:black">Welcome to Fingerprint Voting System!</div>
9              <link href="css/styles.css" rel="stylesheet" />
10
11
12      </div>
13          <a class="btn btn-primary btn-xl text-uppercase js-scroll-trigger" href="login.php">Click Here The Vote </a>
14      </div>
15  </header>

```

Fingerprint accept page

```

<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta http-equiv="X-UA-Compatible" content="IE=edge">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Fingerprint scan</title>
</head>
<body>

  <header class="masthead">
    <div class="container">
      <link href="css/styles.css" rel="stylesheet" />
    </div>
    <a href=?php echo $path; ?> class="btn btn-primary btn-xl text-uppercase js-scroll-trigger"><?php echo $message; ?></a>
  </div>
</header>

</body>

</html>

```

## Candidate profile picture and name

```
<section class="page-section bg-light " id="profiles">
  <div class="container">
    <div class="text-center">
      <h2 class="section-heading text-uppercase mt-3">Candidate Profiles</h2>
      <h3 class="section-subheading text-muted">About Candidates</h3>
    </div>
    <div class="row">
      <div class="col-lg-4 col-sm-6 mb-4">
        <div class="portfolio-item">
          <a class="portfolio-link" data-toggle="modal" href="#portfolioModal1">
            <div class="portfolio-hover">
              <div class="portfolio-hover-content"><i class="fas fa-plus fa-3x"></i></div>
            </div>
            
          </a>
          <div class="portfolio-caption">
            <div class="portfolio-caption-heading">Hillary Clinton</div>
            <div class="portfolio-caption-subheading text-muted">Biography</div>
          </div>
        </div>
      </div>
    </div>
  </div>
```

## Candidate Information Section

```
<!-- Profile Modals-->
<!-- Modal 1-->
<div class="portfolio-modal modal fade" id="portfolioModal1" tabindex="-1" role="dialog" aria-hidden="true">
  <div class="modal-dialog">
    <div class="modal-content">
      <div class="close-modal" data-dismiss="modal"></div>
      <div class="container">
        <div class="row justify-content-center">
          <div class="col-lg-8">
            <div class="modal-body">
              <!-- Project Details Go Here-->
              <h2 class="text-uppercase">Biography</h2>

              
              <p>Hillary Diane Rodham Clinton is an American politician, the 67th Secretary of State of the United States. Hillary Rodham Clinton, married to the 42nd President of the United States.</p>
              <ul class="list-inline">
                <li>Party: Democratic Party</li>
                <li>Date of birth: 26 Ekin 1947</li>
                <li>Education: Yale Law School</li>
              </ul>
              <button class="btn btn-primary" data-dismiss="modal" type="button">
                <i class="fas fa-times mr-1"></i>
                Close Biography
              </button>
            </div>
          </div>
        </div>
      </div>
    </div>
  </div>
</div>
```

## The about page start

```

<!-- About-->
<section class="page-section" id="about">
  <div class="container">
    <div class="text-center">
      <h2 class="section-heading text-uppercase mt-3">About</h2>
      <h3 class="section-subheading text-muted">Fingerprint is an online voting system, developed just for your convinience!
    </h3>
    </div>
    <ul class="timeline">
      <li>
        <div class="timeline-image"></div>
        <div class="timeline-panel">
          <div class="timeline-heading">
            <h4 class="subheading">Introduction</h4>
          </div>
          <div class="timeline-body"><p class="text-muted">Democratic government in the world today rely on electronic voting as the fore- most means of providing credible, transparent and fair elect
        </p></div>
      </li>
      <li class="timeline-inverted">
        <div class="timeline-image"></div>
        <div class="timeline-panel">
          <div class="timeline-heading">

```

The about page end

```

      <h4 class="subheading">Motivation</h4>
    </div>
    <div class="timeline-body"><p class="text-muted">In our website, we've used a voting panel that will let the user vote and can only be accepted with the user's fingerprint since every voter
  </div>
</li>
<li>
  <div class="timeline-image">
    <div class="timeline-heading">
      <h4 class="subheading">Timeline</h4>
    </div>
    <div class="timeline-body"><p class="text-muted">We did the hardware part of the website in 3 weeks.
  </p></div>
  </li>
  <li class="timeline-inverted">
    <div class="timeline-image"></div>
    <div class="timeline-panel">
      <div class="timeline-heading">
        <h4 class="subheading">Conclusion</h4>
      </div>
      <div class="timeline-body"><p class="text-muted">
        Our project is about making a more efficient, reliable , fast and cleaner way of voting. We have seen how the traditional voting system work and made the assumption that we have a better solution for this event that p
      </div>
    </li>
    <li class="timeline-inverted">
      <div class="timeline-image">
        <h4>
          Be Part
        <br />
          Of Our
        <br />
          Story!
        </h4>

```

## 4-JScript

Open-source pie chart import code

```

<style>
#chartdiv {
  width: 100%;
  height: 500px;
  margin-top: 200px;
}
</style>

<!-- Resources -->
<script src="https://cdn.amcharts.com/lib/5/index.js"></script>
<script src="https://cdn.amcharts.com/lib/5/percent.js"></script>
<script src="https://cdn.amcharts.com/lib/5/themes/Animated.js"></script>

<!-- Chart code -->
<script>

am5.ready(function() {

  // Create root element
  // https://www.amcharts.com/docs/v5/getting-started/#Root\_element
  var root = am5.Root.new("chartdiv");

```

Inserting values for the pie chart

```

// Create chart
// https://www.amcharts.com/docs/v5/charts/percent-charts/pie-chart/
var chart = root.container.children.push(
  am5percent.PieChart.new(root, {
    endAngle: 270
  })
);

// Create series
// https://www.amcharts.com/docs/v5/charts/percent-charts/pie-chart/#Series
var series = chart.series.push(
  am5percent.PieSeries.new(root, {
    valueField: "value",
    categoryField: "category",
    endAngle: 270
  })
);

series.states.create("hidden", {
  endAngle: -90
});

// Set data
// https://www.amcharts.com/docs/v5/charts/percent-charts/pie-chart/#Setting_data
series.data.setAll([
  {
    category: "Hillary Clinton",
    value: 501.9
  }, {
    category: "Bill Clinton",
    value: 301.9
  }, {
    category: "Donald Trump",
    value: 201.1
  }, {
    category: "John F. Kennedy",
    value: 165.8
  }, {
    category: "Barack Obama",
    value: 139.9
  }, {
    category: "George Bush",
    value: 128.3
  }
]);

```

## 5-Php

Inserting the voters' information and the candidates that the voter's going to vote for to MySQL

```

<?php

$dbhost = "localhost";
$dbuser = "root";
$dbpass = "";
$dbname = "fvs";

if(!($con = mysqli_connect($dbhost,$dbuser,$dbpass,$dbname))){
    echo '<script>alert("Failed to connect")</script>';
    include("login.php");
}

$name = $_POST["name"];
$id = $_POST["id"];
$vote = $_POST["vote"];

$change_vote_query = "UPDATE `users` SET `vote` = '$vote' WHERE `users`.`id` = $id";
mysqli_query($con,$change_vote_query);

$query = "select * from users where id=$id";
$result = mysqli_query($con,$query);
$data = mysqli_fetch_assoc($result);

if($id == $data["id"] && $vote < 7 && $vote > 0){
    header("location:fingerprint.php");
}else{
    echo '<script>alert("Your information does not match.")</script>';
    include("login.php");
}

```

The Regex code to get the data from the text file

```

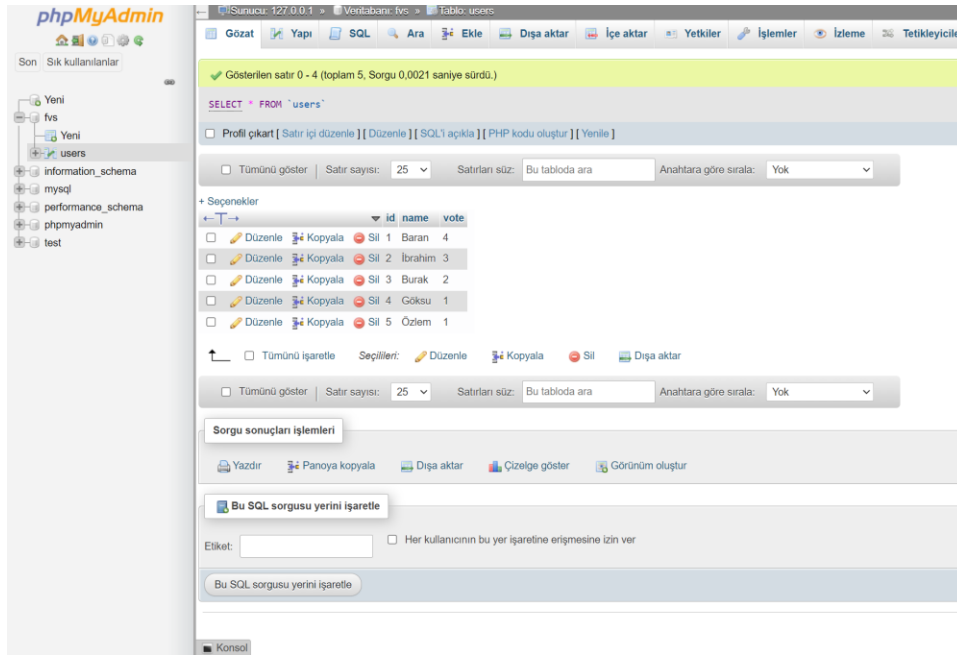
include("inc/head.php");
$message = "hello!! please scan your finger.";
$path = "fingerprint.php";

$myfile = fopen("putty.log","r");
$filecontent = fread($myfile,filesize("putty.log"));
fclose($myfile);
if(preg_match("/Stored!/", $filecontent)){
    $message = "You can click here to see the results";
    $path = "statistics.php";
}

```

## 6-MySQL

Exemplary MySQL database was made to show how the system works. Normally the database would contain the people who will vote.



## Test Cases

Possible situations	Expected outcomes
Candidate id does not match any other candidate id.	Website gives an error and refreshes the page.
Voter wrote the id(ssn) that did not match the database.	Website gives an error and refreshes the page.
Initial fingerprint and confirmation fingerprint does not match.	The fingerprint will not be accepted, and it will request a fingerprint again.

## Future Works

FW1	Adding a system where it compares the fingerprint data to all the other fingerprints
FW2	Adding other languages to the system.
FW3	Transferring the system from local to network.



## References

1:<https://www.ijert.org/research/a-finger-print-based-voting-system-IJERTV4IS050948.pdf>

2:<https://en.wikipedia.org/wiki/Fingerprint>

3:[https://www.researchgate.net/publication/331511027\\_Development\\_of\\_A\\_Fingerprint\\_Biometric\\_Authentication\\_System\\_For\\_Secure\\_Electronic\\_Voting\\_Machines](https://www.researchgate.net/publication/331511027_Development_of_A_Fingerprint_Biometric_Authentication_System_For_Secure_Electronic_Voting_Machines)