

# Ahsanullah University of Science & Technology

Department of Computer Science & Engineering

Semester Fall 2022



**CSE 3118**

## Microprocessors and Microcontroller Lab

### Project Report

Project Name: Bank Vault System

#### Submitted To

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**Section: C(C1)**

## Objectives:

The objective of this project is to design, develop, and implement a secure Bank Vault Management System utilizing microcontrollers and microprocessor components. The system aims to enhance the overall security and operational efficiency of bank vaults by integrating advanced access control mechanisms, real-time monitoring, and centralized management through the seamless integration of various sensors and hardware components. The Bank Vault Management System seeks to establish a robust and tamper-resistant solution. The project further aims to provide a scalable and user-friendly interface for secure access, monitoring, and emergency response, ensuring compliance with industry standards and regulations. Ultimately, this system aims to set a new standard for the security and management of bank vaults, offering a reliable and technologically advanced solution to safeguard valuable assets and sensitive information.

## Social Values:

The Bank Vault Management System project embodies social values by fortifying trust through advanced security measures and respecting privacy with advanced access control mechanisms. User-friendly interfaces and multiple authentication layers promote inclusivity, enhancing accessibility for diverse users. The detailed access logs and audit trails contribute to societal values of accountability and ethical conduct, ensuring compliance with regulatory standards. Overall, the project aligns with the growing emphasis on data security, workplace efficiency, and responsible financial management, making a positive impact on the societal fabric within the financial sector.

## Required Components:

These following parts and tools are required for building this project:

- Arduino Mega 2650
- Servo Motor SG-90
- Piezo-Buzzer
- 3.7 Volt Battery
- Infrared (IR) Sensor
- 4X4 Keypad
- 16X2 LCD Display
- LED
- Resistance
- Wire
- Bread Board
- Card Board

## Working Procedure:

As we all know bank vault is placed in a restricted room. Here, no unauthorized employee will be allowed to enter. If an intruder tries to enter into the vault, this system can automatically capture the intruder through the trap.

### First case:

Assume an official authorized employee is entering into the room. Firstly, he will stand before the room door and in front of the room there will be a display, which shows "Restricted Area" to the people outside the vault and the IR sensor in front of the door will get triggered and the entrance door will automatically get opened. The employee will go inside and the entrance door will get locked. Now the employee will go stand before the vault and the display beside the vault will show "Welcome to Shalimar". The employee will try to put password on the Keypad and the Vault room be locked and the display beside the vault will show "Shalimar is Locked". Now the employee will continue entering the password. The employee will get three chances to put the right password. For example, if he accurately put the right password, the vault will get opened and he can do the work in peace. But if unfortunately, he gives the wrong password firstly, the display will show "Attempt 1 Failed" and the LED placed in the room will be turned on. As, it is a very normal thing that a human can input wrong password. But if the employee gives wrong password for the second time, the display will show "Attempt 2 Failed" and the light of the room is already on and additionally, the Peizo-Buzzer placed in the room will start to make alarming sound. As a skilled dutiful employee, he must have to be smart enough to open the vault on the first attempt. Unfortunately, if he gives wrong input, he will get two more chances. But if the give wrong inputs on the third attempt, he may face the consequences of being an intruder. after doing the work in the vault room, he will go before the entrance door and put the actual password on the keypad to leave the room. If he doesn't know the password, he will not get to leave the room. Ultimately, he will get trapped.

### Second case:

Let's assume an intruder is trying to get entry into the vault room. The entrance get will get opened for everyone. After entering into the room, he will get locked as if someone wants to get out of the room, he has to put the accurate password in the keypad. If he doesn't know the password, The display outside the room will show "Vault at Risk! Suspicious Activity" and he will get trapped inside the room until someone else comes to check. Now, if he enters the wrong password for three times, the trap door in front the vault will get opened and the intruder will get trapped. The LED and the buzzer will be on. The Display outside the room will show "Intruder detected". This is how an intruder will get caught in out bank vault system.

**Estimated budget (First One):**

<b>Equipment</b>	<b>Quantity</b>	<b>Budget(Tk)</b>
Arduino Mega 2650	1	1800
Servo Motor SG-90	4	700
Piezo-Buzzer	3	150
12 Volt Battery	3	400
IR Sensor	1	90
4X4 Keypad	1	75
16X2 LCD Display	1	300
LED	10	20
Resistance	10	10
wire	As required	200

Breadboard	1	150
Card Board	As required	200
Sonar Sensor (HC-SR04)	1	100
Soldering Iron	1	200
Total	-----	4895 Tk

### Final budget (Last One):

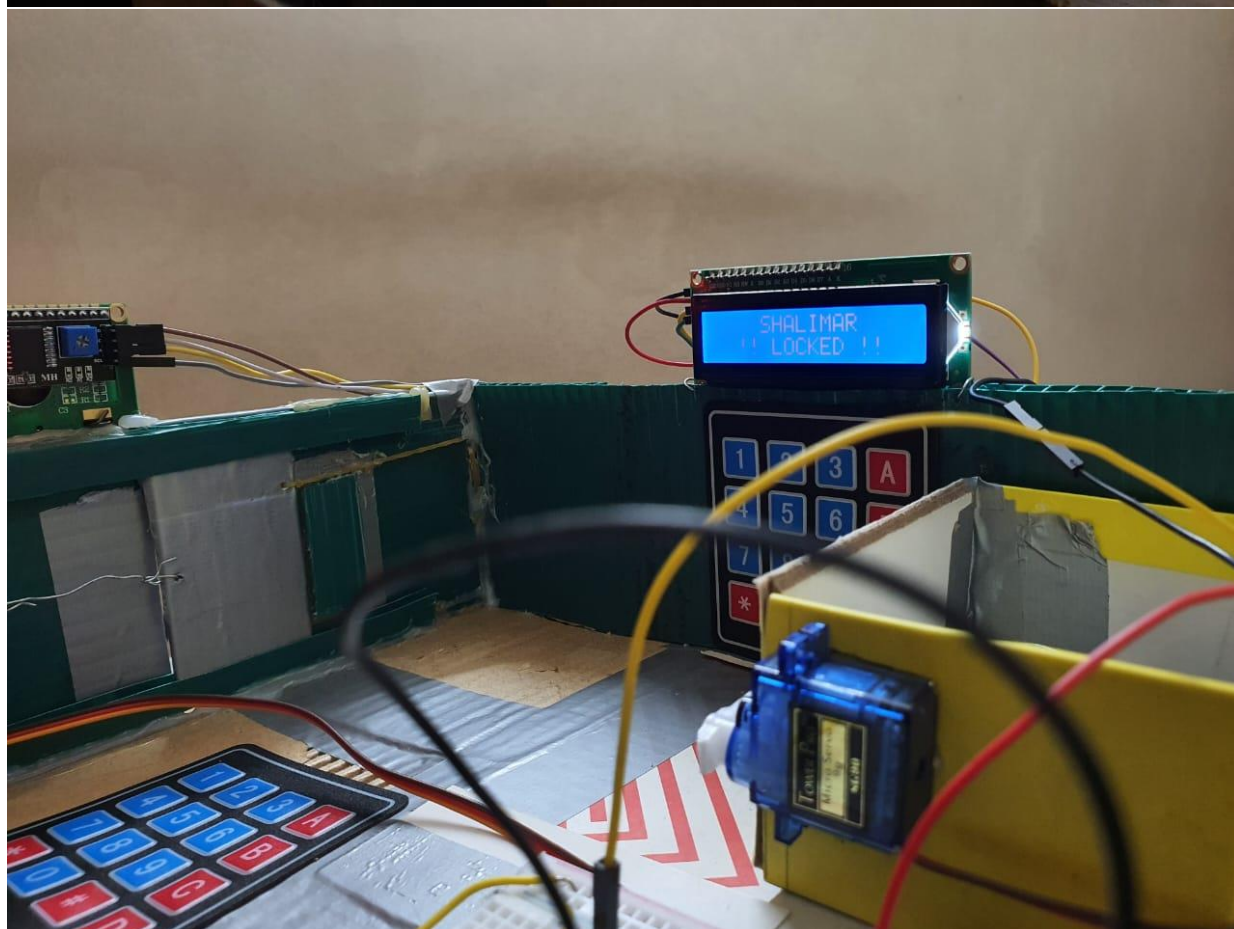
Equipment	Quantity	Budget (Tk)
Arduino Mega 2650	1	2150
Servo Motor SG-90	1	520
Piezo-Buzzer	3	90

3.7 Volt Battery	3	540
IR Sensor	1	50
4X4 Keypad	2	160
16X2 LCD Display	2	640
LED	5	10
Resistance	15	15
wire	2 set	300
Breadboard	1	150
Card Board	1	300
Soldering Iron	1	200
Battery Case	1	55
Battery Charger	1	120
Glue Stick	1	20
Hard Wire	1 set	10
DC jack	1	10

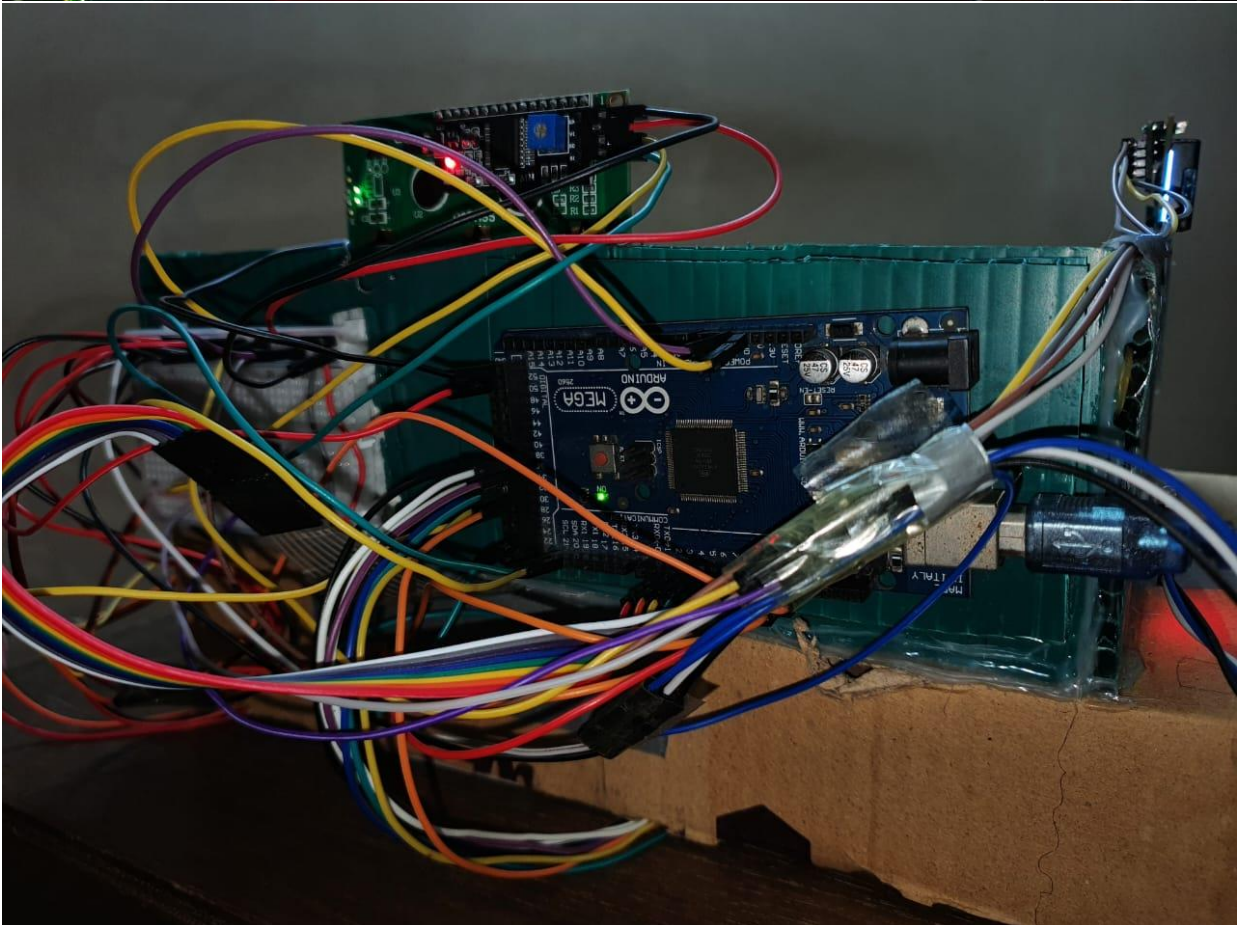
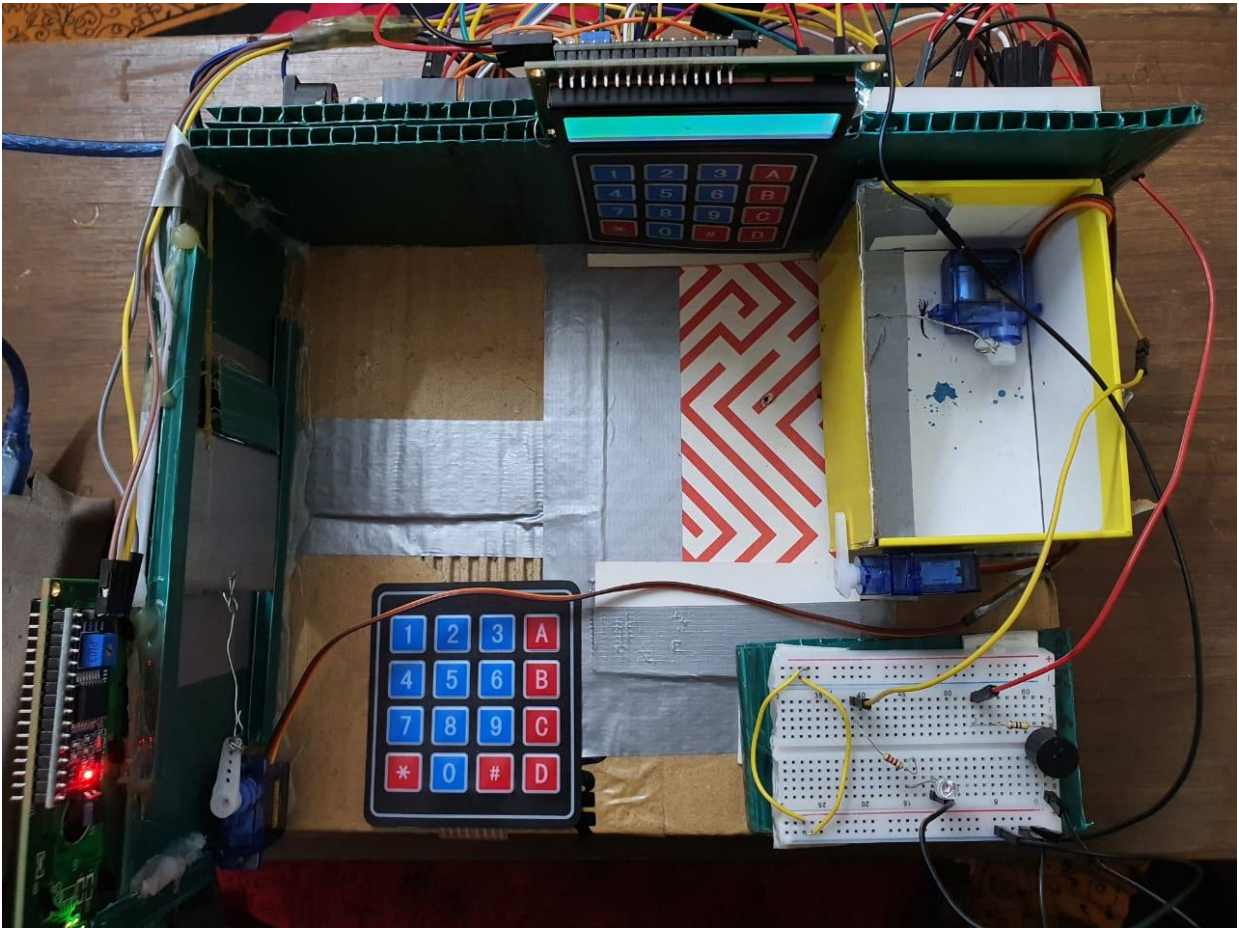
Gaffer Tape	1	150
Scotch tape	1	50
Transportation		500
Total	-----	6040 Tk

### Final Outlook of The Project:







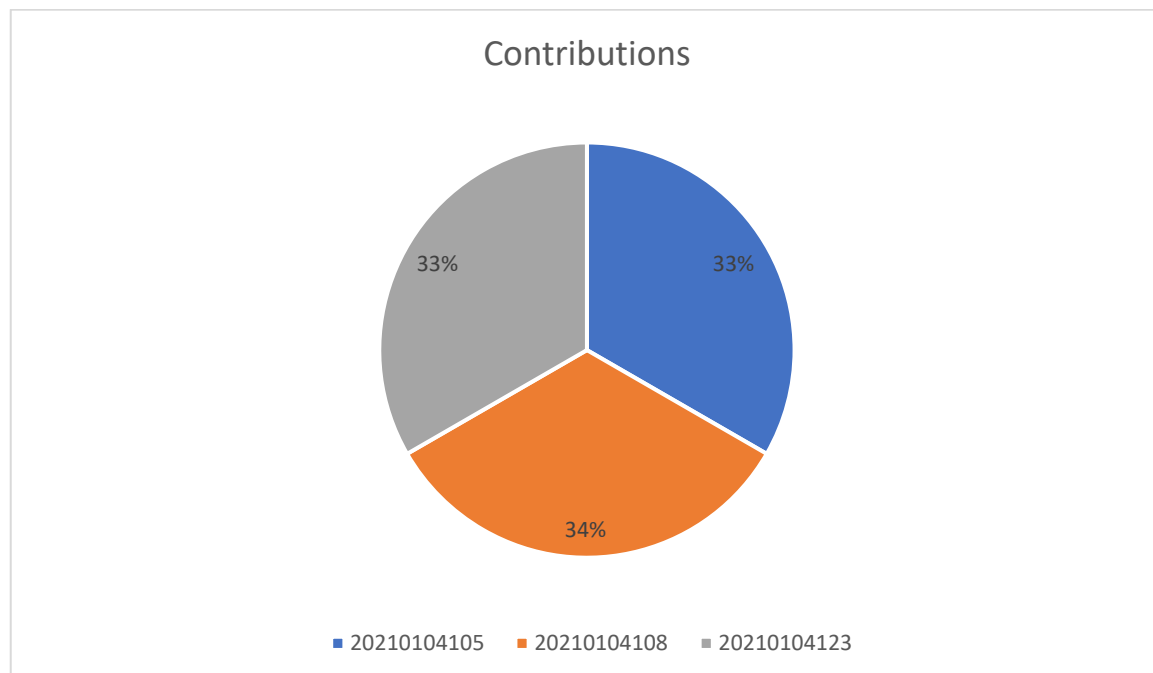


## Contribution of Team Mates:

**20200204105 (30%):** Circuit connection, Idea generating, Error handling on the implemented code.

**20200204108 (40%):** Concept generating, Circuit connection, implementing the codes on the platform named Arduino IDE.

**20200204123 (30%):** Designing the Outlook, Circuit connection, solving bugs in the system.



## Multidisciplinary Contribution:

Bank vault management system involves various stakeholders due to its diverse nature.

- Technical Experts
- Security Professionals
- UX Designer
- Financial Experts
- Maintenance and Support Teams

## Safety norm:

In microprocessor and microcontroller projects, prioritizing safety is crucial. Adhere to electrical safety standards, like IEC 60950, for voltage control and protection. Implement efficient heat dissipation and temperature monitoring to prevent overheating. Consider environmental resilience (IEC 60068), EMC compliance, and functional safety standards (ISO 26262, IEC 61508) for critical applications. Enforce robust software practices, comprehensive documentation, and user guidelines to ensure secure operations. These measures collectively establish a safety framework, fostering reliability in microprocessor and microcontroller projects.

## **Environmental Impact:**

We have used Arduino Mega in which CMOS is used which is current efficient. Also, we are using led lights which are also current efficient. We will try to use component which will be made from recycled plastic for the safety of the environment.

## **Conflicting Requirements:**

- Comprehensive Functionality vs. Power Efficiency
- Security and Accessibility

## **Addressing the Conflict:**

- Optimized Functionalities
- Balanced Security and Accessibility

## **Unfamiliar Territory:**

- Microprocessors and Electrical Equipment
- Embedded Programming Challenges

## **Limitations of our project:**

- We tried to use GSM Module to send notification to the bank manager about the system condition. But we couldn't complete it.
- We tried to place a camera in the room, but we failed to afford that.
- we tried to use Flame sensor to avoid any kind of tragic incident, but we couldn't use it.

## **Steps to overcome these Limitations:**

- More time to spend on this project.

- More funding to implement some component which is too expensive to bear for a student.

## Challenges of the project:

1. Using Mechanics concept and placing servo motors in a perfect place to obtain desired output.
2. Controlling Voltage. We were facing difficulties, because our components weren't getting enough voltage to hold the system well.
3. Display connection. As, our target was to use 2 separate display to show two separate texts on the screen. So, we soldered the I2C Module's address port and made both display work perfectly.
4. Adding keypad on the project. As, Keypad takes one character as input each time. So, we had taken a string to solve this problem.
5. Setting all the code for Arduino Mega was a little bit difficult. As, Arduino Mega can't work on all command at a time.

## Conclusion:

In summary, the bank vault management system, driven by microprocessor and microcontroller components, is a groundbreaking hardware project. Designed to fortify security measures, it revolutionizes access control, monitoring, and management within bank vaults. Through the integration of cutting-edge microprocessor technology, the system ensures real time data processing, optimizing responsiveness and reliability. The microcontroller components enable the implementation of precise and adaptable security protocols, tailored to individual bank requirements. This innovative project signifies a harmonious blend of advanced hardware solutions and heightened security demands, providing a sophisticated and responsive system for the evolving landscape of bank vault management.

## References:

[Happy New Year \(2014\) - IMDb](#) Here, in this Movie there was a vault system. A group of people was trying to steal some valuable thing from the vault named "Shalimar". This movie Basically inspired us to make a vault system having automated security system.