

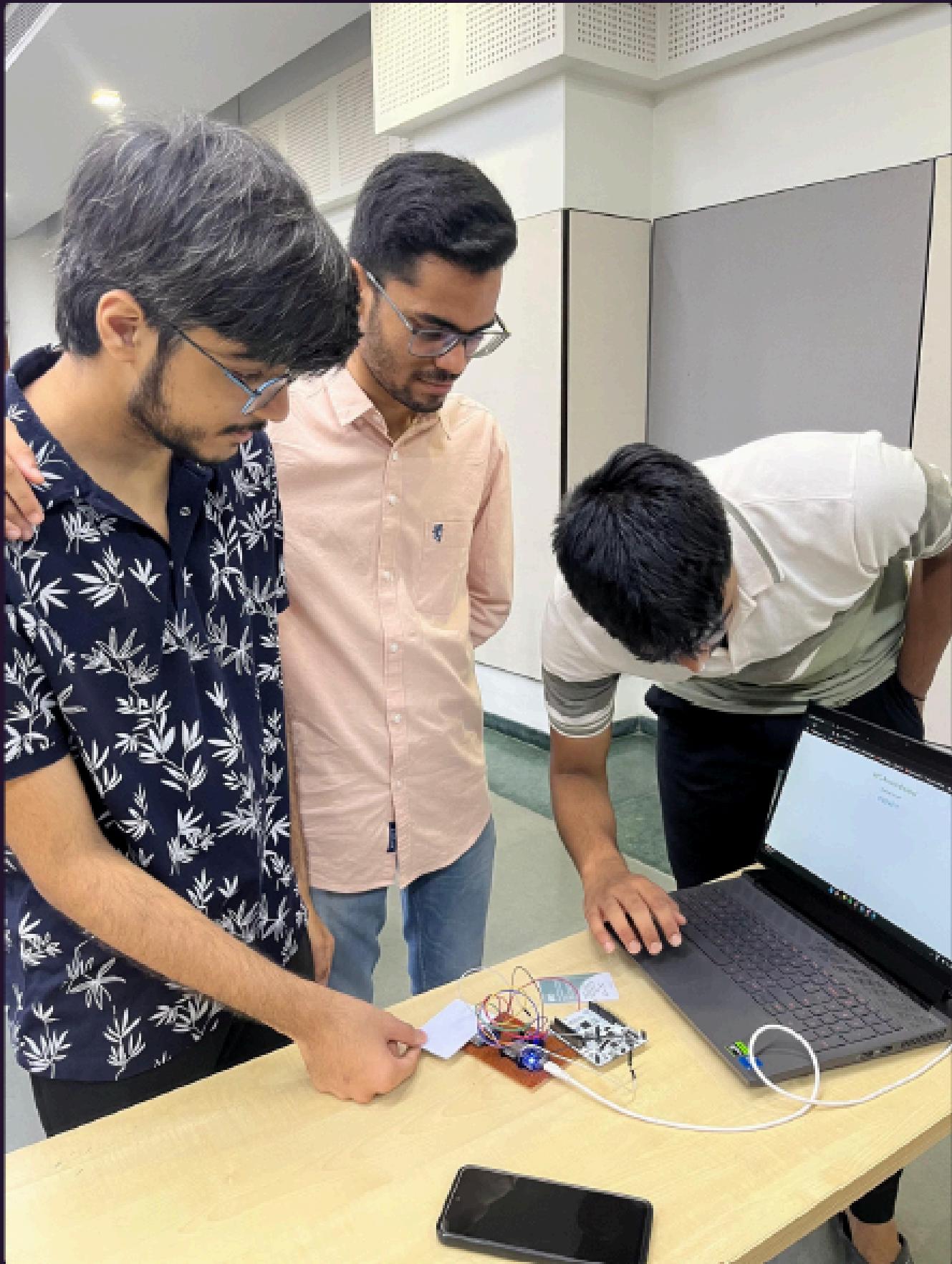
# NFC Authentication System with ESP8266

This project implements secure access control using NFC cards with an ESP8266 and a local Node.js server.

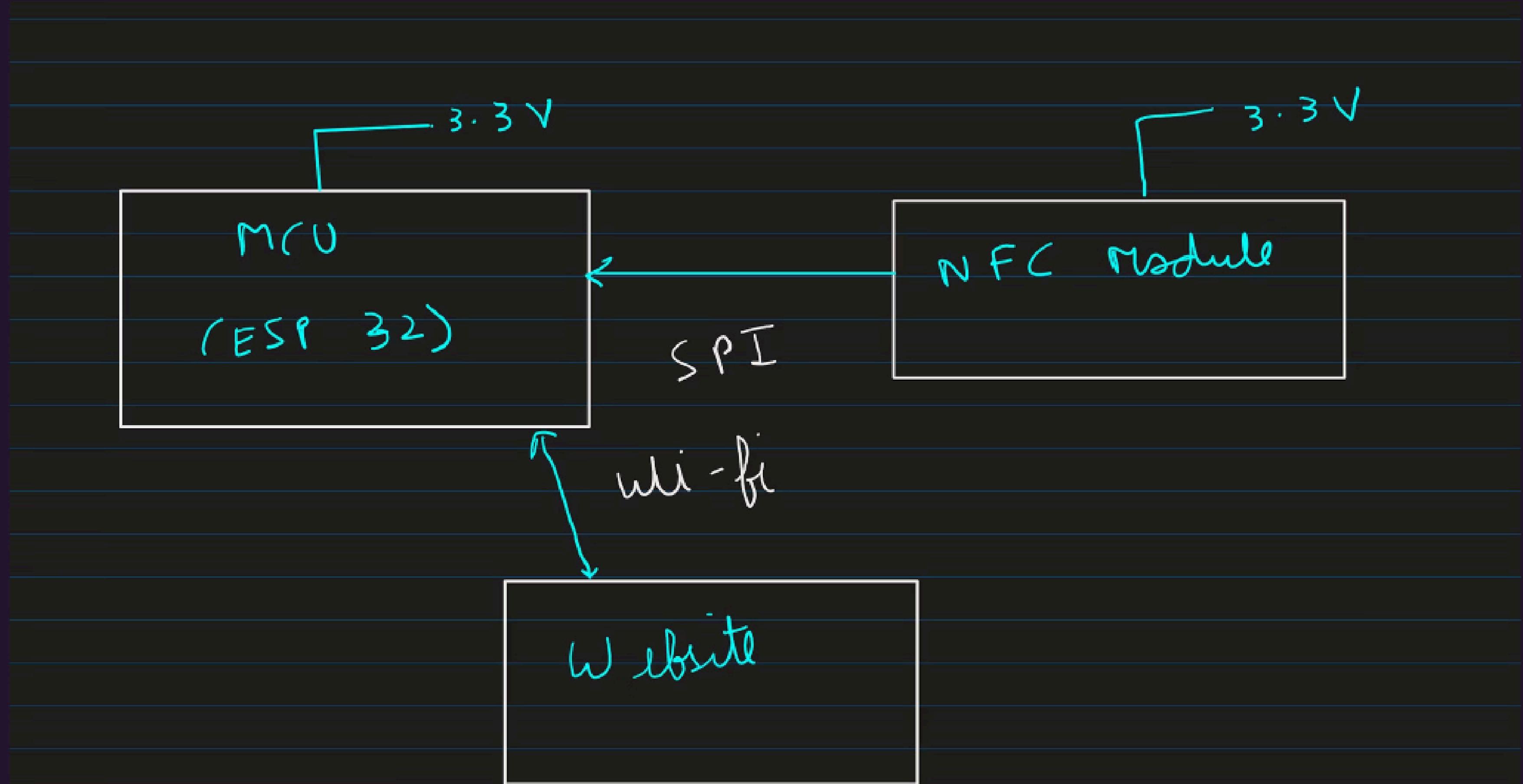
TEAM LOCK

VIPUL MADAN(2023600) , PRADYUT MISHRA(2023378), PIYUSH SINGH(2023377)

# Group and Project Photos



# Block Diagram



# Hardware Components

## ESP8266 Microcontroller

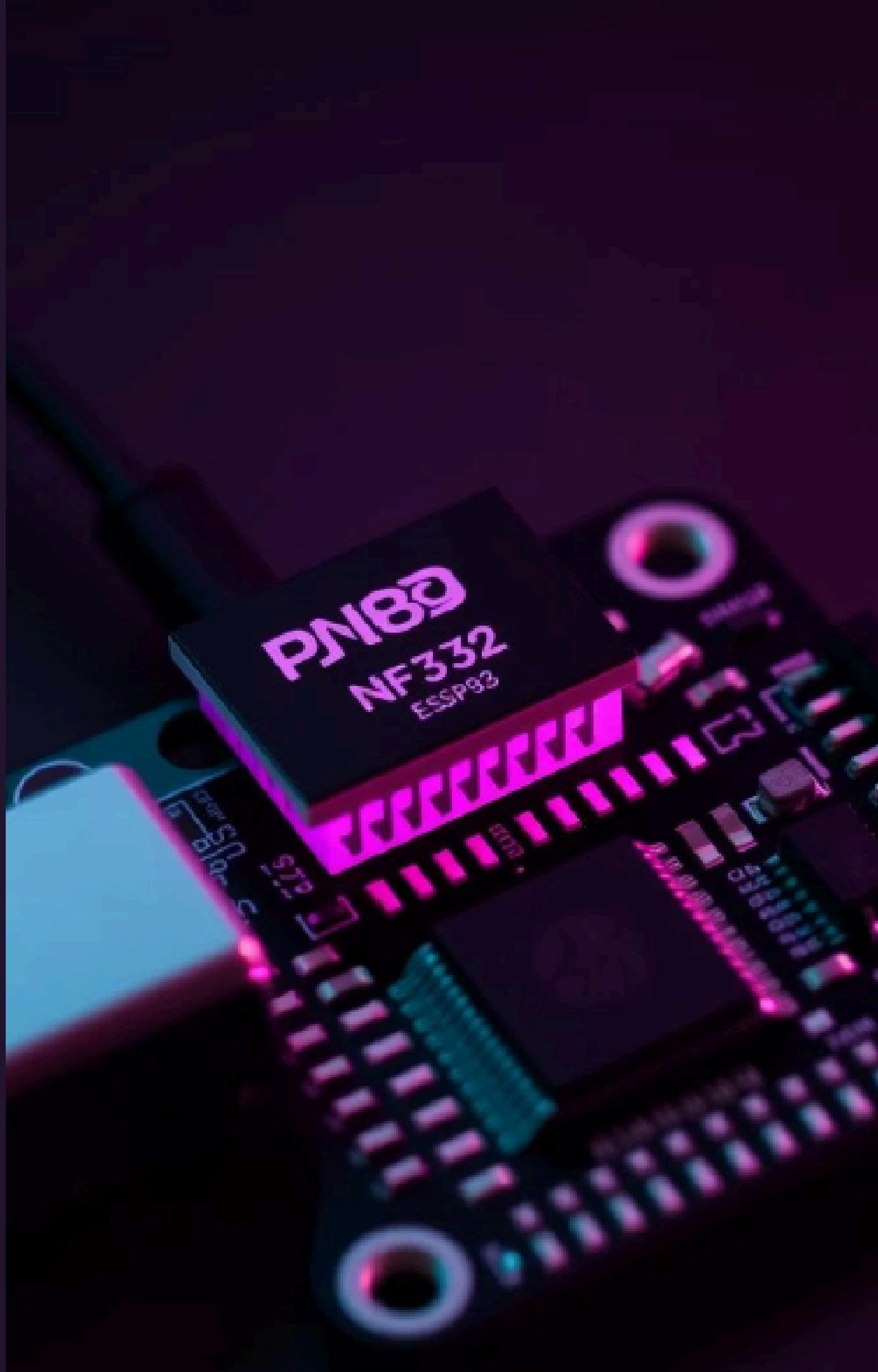
Handles processing and Wi-Fi connectivity for the system.

## PN532 NFC Module

Reads NFC card UIDs to identify authorized users.

## NFC Cards

Provide secure access credentials to the system.



# Progress Report

Updated twice via email on 16 March and 18 April. Also presented Progress Report in the classroom on 25 March.

Submission of Block Diagram and BOM for ESD Project

Vipul Madan <vipul23600@iitd.ac.in>  
to akumar, Pradyut, Piyush

Respected Sir,  
As per your instructions, we are sharing the block diagram and Bill of Materials (BOM) for our ESD project. Our project involves designing an NFC-based smart lock system that operates with both NFC cards and mobile phones.

Thanking you  
Regards  
Vipul Madan, Pradyut Kumar Mishra, Piyush Singh

2 Attachments • Scanned by Gmail



Subject : ESD Project Progress( Team Vault)

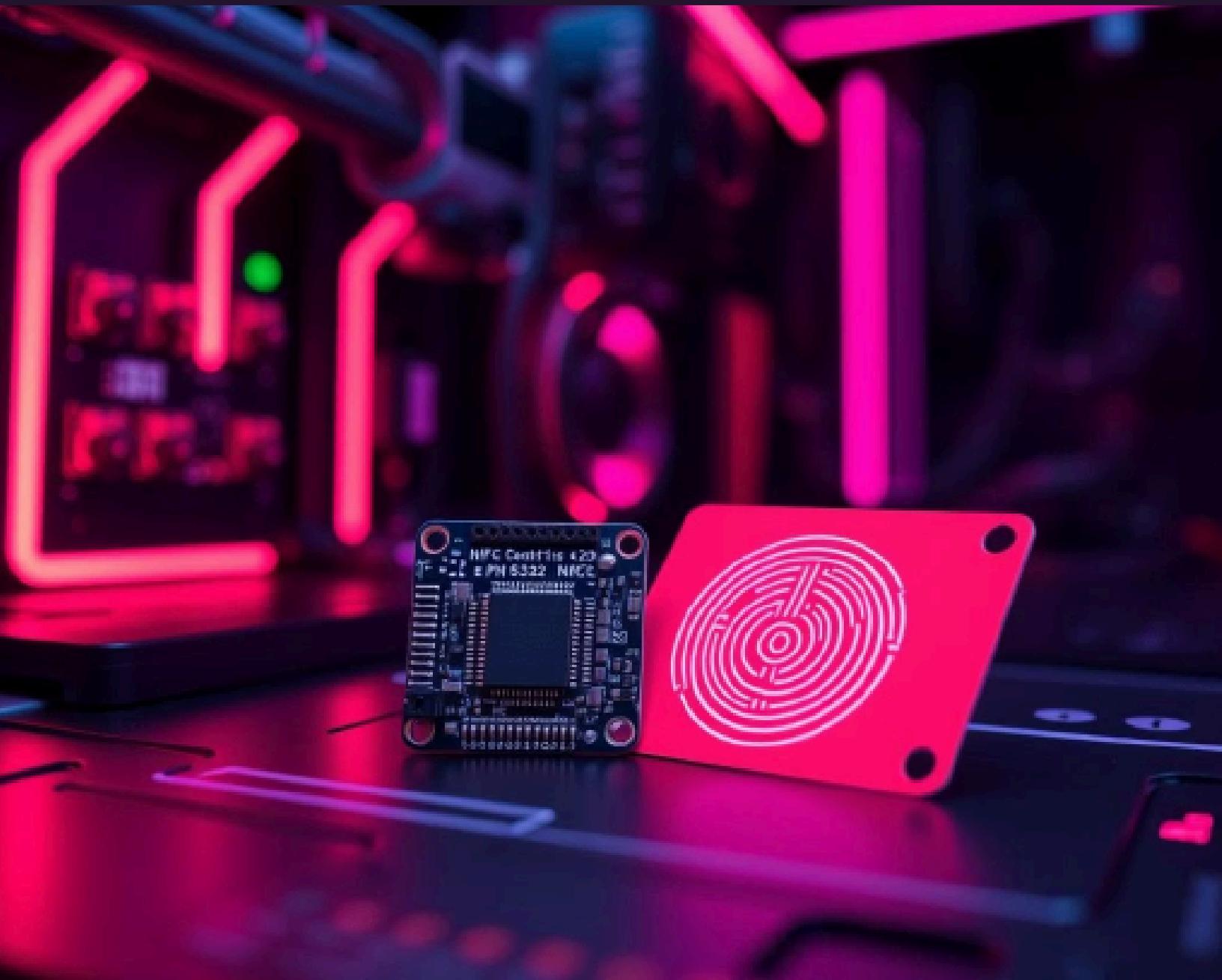
Piyush Singh <piyush23377@iitd.ac.in>  
to akumar, Pradyut, Vipul

Respected Sir,  
As you might remember, We are making a project on NFC based smart lock. As of today, we have gathered all the components required, and are ready with the final implementation plan. We are also partially done with the hardware part of the project. We are looking to complete the project in the next few days.  
Thank you  
Regards  
Team Vault

# NFC Authentication Flow

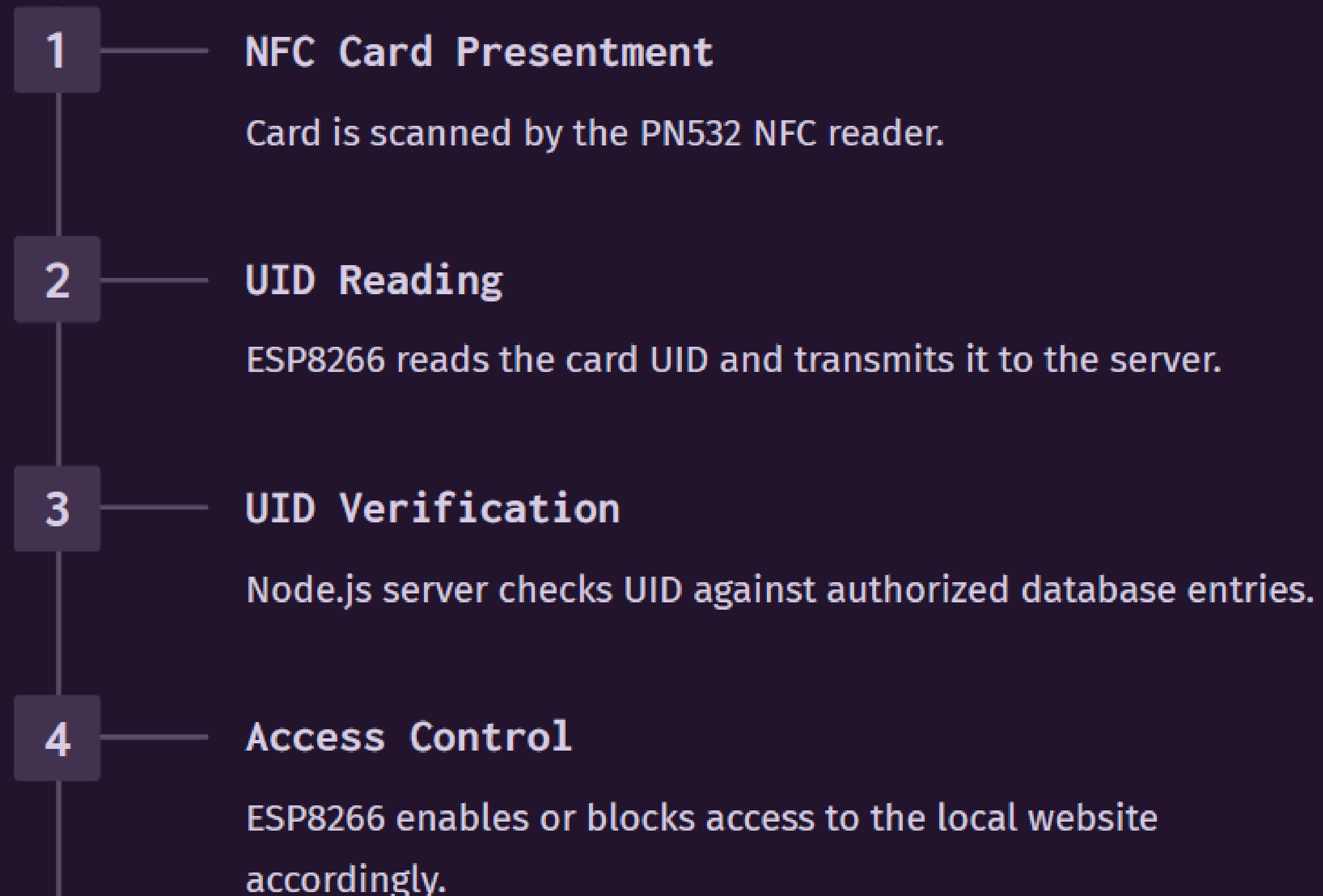
The ESP8266 microcontroller reads the NFC card UID via the PN532 module when a card is tapped. If the UID matches an authorized card, the ESP32 grants access by enabling the local Node.js web server services.

Communication between the ESP8266 and the web server is carried out over Wi-Fi, allowing seamless interaction and control. Unauthorized NFC cards are detected and denied access, ensuring secure system protection.





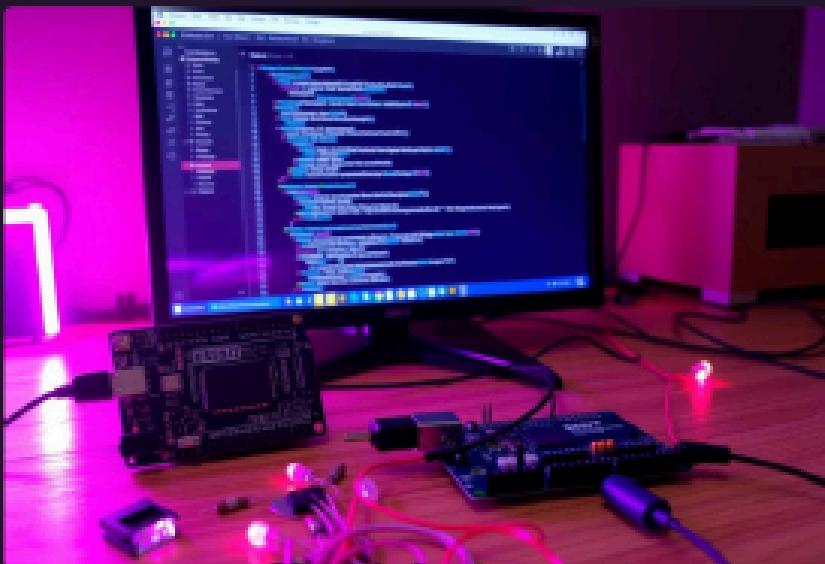
# Authentication Flow



# Software Stack

## ESP8266 Firmware

Written in C/C++ using Arduino IDE for hardware control.



## Node.js Server

Built with JavaScript and Express.js to handle authorization.



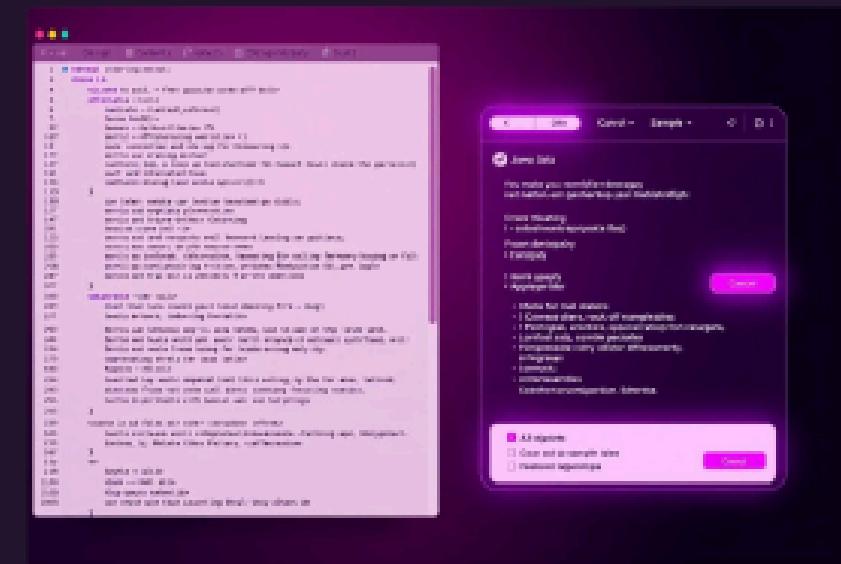
## Database

Optional store for authorized UIDs, e.g., MongoDB for flexibility.



## Client Website

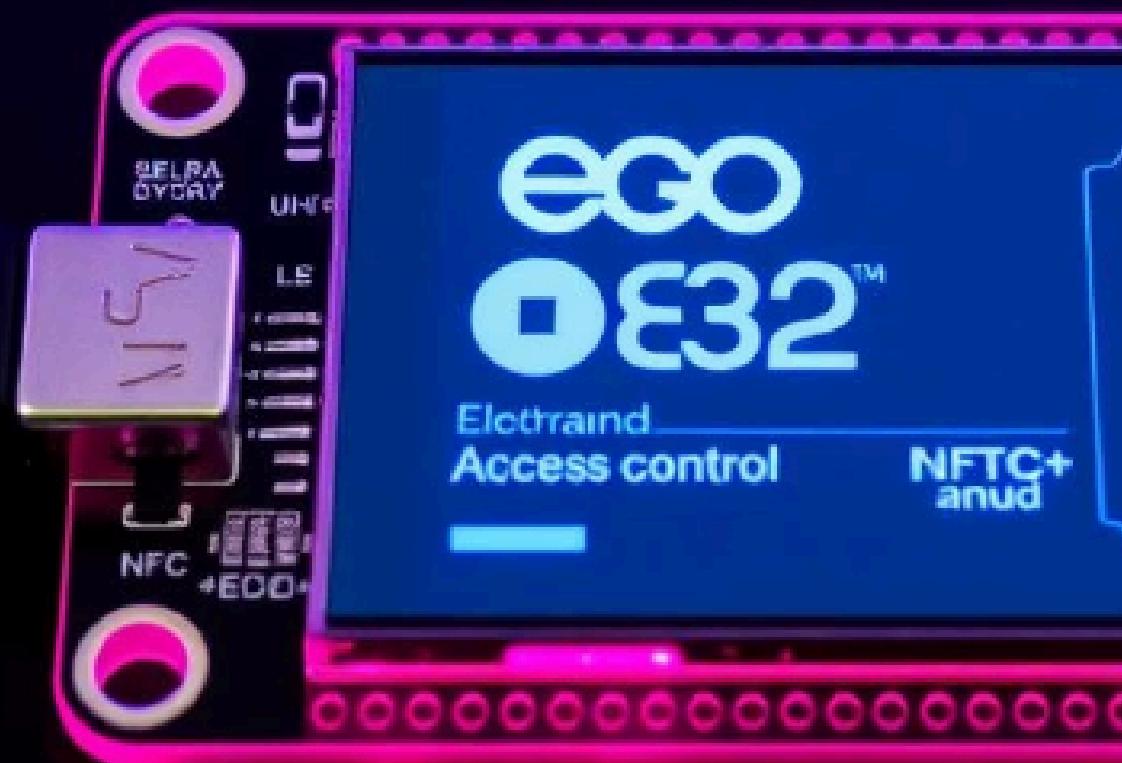
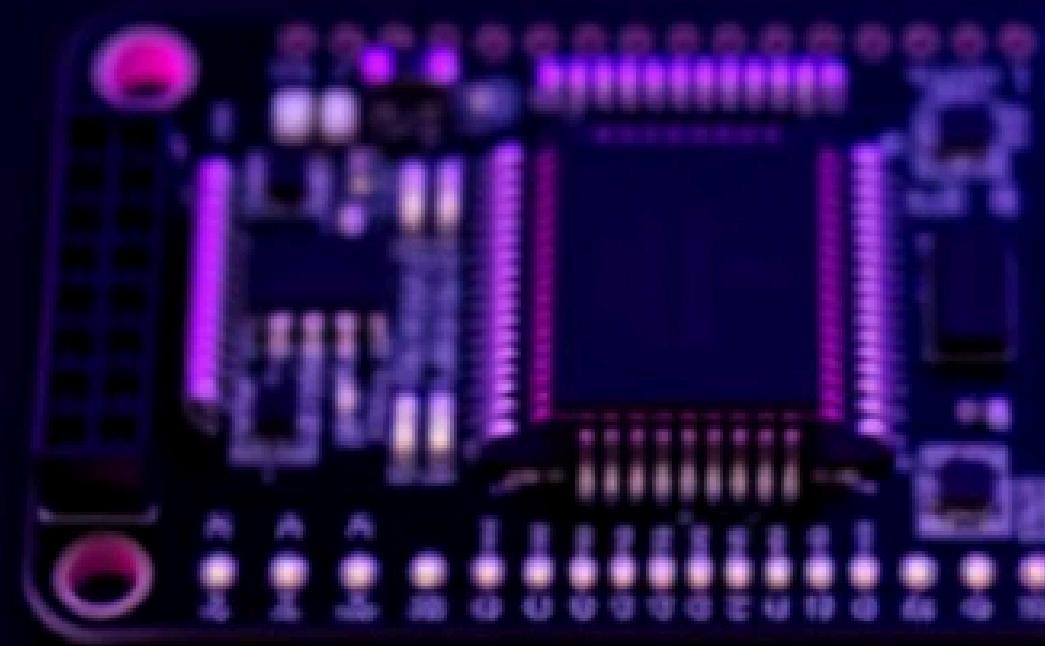
HTML, CSS, and JavaScript create the user interface for access control.



# Design Details

The ESP8266 acts as an access controller by scanning NFC cards and matching their unique identifiers (UIDs) with a pre-saved authorized list.

Upon successful UID verification, the ESP8266 grants the client device, such as a phone or laptop, access to the local website.





# Implementation Details

## ESP8266 Firmware

Integrates PN532 libraries, configures Wi-Fi, performs API calls.

## Node.js Server

Manages Express.js routes, validates UIDs, handles sessions.

## Client-Side Website

Uses access status to control website availability to users.

# Security Considerations



## Data Protection

Encrypt NFC data and securely store authorized UIDs.



## Attack Prevention

Use timestamps and nonces to prevent replay attacks.



## Secure Communication

Implement HTTPS between ESP32 and Node.js server.



## Physical Security

Protect hardware devices from tampering or theft.

# Smarter and Faster Access Control

We introduced a smarter and faster way to control access by replacing the traditional username and password system with contactless NFC authentication, making it more convenient and secure.

The entire system is lightweight, low-cost, and responds quickly, making it suitable for real-time applications.



# Technical Challenges :

**NFC Lock Power Issues:** Initially, we worked with an NFC-controlled electric lock. However, managing power distribution across the various components proved difficult, so this approach was ultimately abandoned.

**Website-MCU Integration:** We faced issues when trying to process GET requests. After several hours of troubleshooting, we realized the problem was caused by a missing "http" prefix in the URL, which was preventing successful communication between the website and the MCU.

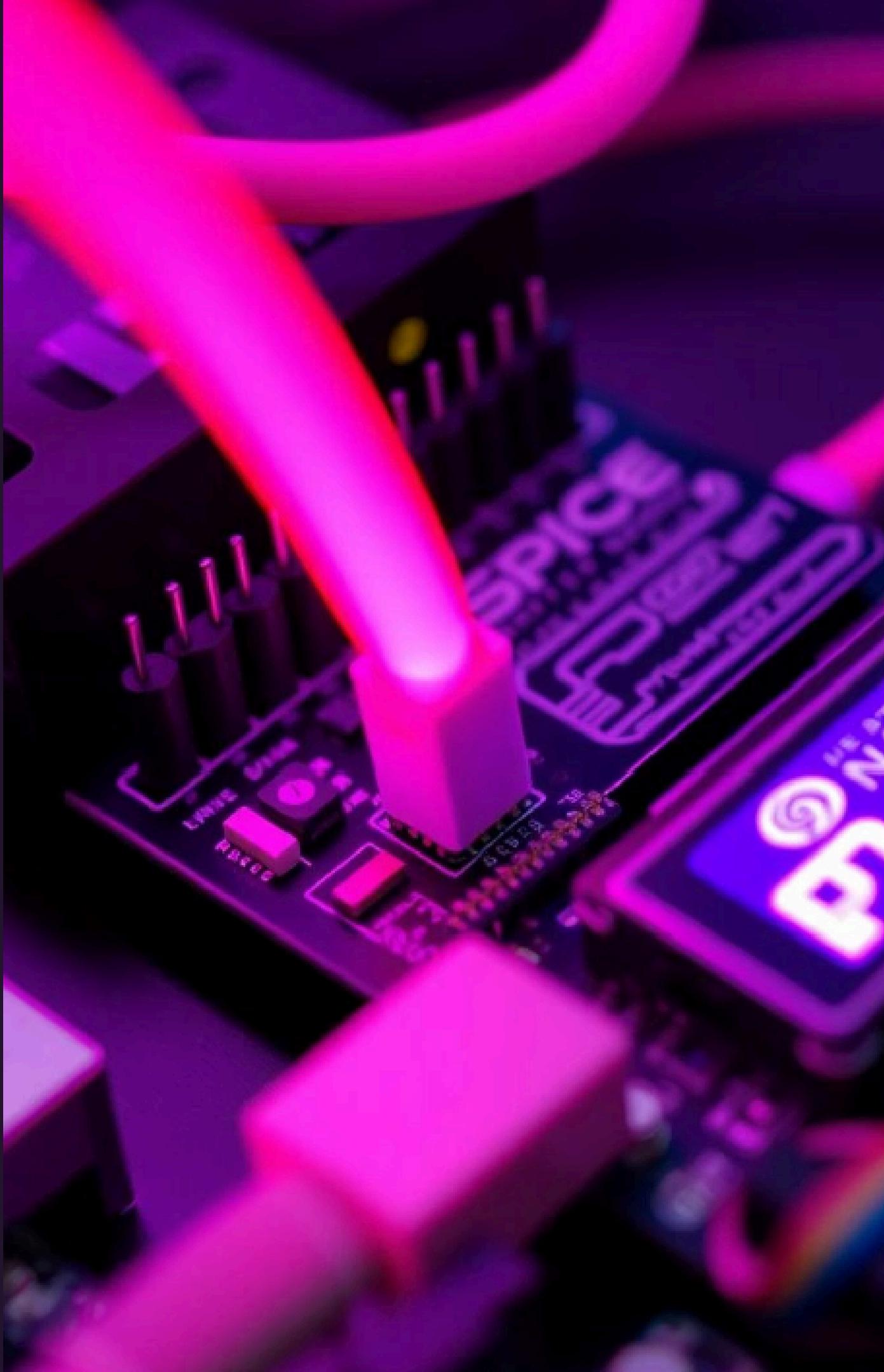
**Wi-Fi Hosting Problems:** College Wi-Fi didn't work. Switching to a local hotspot enabled the ESP module to connect and use data successfully.

**Demo Day Setback:** On the day of the demo, the hosting phone crashed. We had to quickly update the Wi-Fi SSID and password in the code to restore functionality.

# Project Summary and Learnings

Through this project, we gained hands-on experience in hosting a website on a microcontroller unit (MCU), specifically the ESP8266. We successfully set up NFC communication using the PN532 module and learned how to integrate it with the ESP8266 environment.

Additionally, we explored an easy and efficient method for authenticating users and controlling access using NFC technology, enhancing the security and convenience of embedded web applications.



# THANK YOU

Thank You!

We appreciate your attention and interest in our NFC Authentication System.