RFID & RF Based E-Voting System

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CONTENTS

➢Aim and Objectives

➢Abstract

➢Literature Review

➢Introduction

➢Block Diagram

➢Circuit Diagram

➢Results

➢References

AIM

- To develop an electronic voting system using RFID and RF modules for secure and contactless voting.

- To utilize the ESP32 microcontroller for processing and WiFi-based connectivity.

- To design a portable and compact hardware prototype integrated with buttons, LCD display, LEDs, and a buzzer.

- To store voting data in real-time to **Google Sheets** via Apps Script Web App.

- To eliminate manual errors, fake votes, and duplicate entries through RFID-based identification.

- To enhance transparency, reliability, and efficiency in small-scale organizational elections.

OBJECTIVES

- To uniquely identify each voter using **RFID cards or tags**, ensuring secure and authorized access.

- To interface the **RFID module (RC522)** with **ESP32** for card scanning and UID detection.

- To integrate **buttons** representing different political parties (BJP, INC, AAP, NOTA) for casting votes.

- To provide **real-time feedback** to voters using **LEDs, buzzer, and a 16x2 I2C LCD** display.

- To enable **vote casting timeout** and **invalid card handling** using custom logic in Arduino code.

- To implement **master/admin RFID card** functionality for ending voting and displaying the result.

- To display **vote summary and winner** on both the **LCD** and send it to a **Google Sheet** via WiFi.

- To prevent **multiple voting** from the same card by tracking already-voted users.

- To improve user-friendliness with **LCD instructions, countdowns, and error handling**.

- To demonstrate a **functional prototype** simulating real-time secure voting suitable for small-scale organizations.

ABSTRACT

- In today's digital era, ensuring transparency and security in the electoral process has become increasingly important. This project presents an **RFID & RF Based E-Voting System** that aims to enhance voting reliability and eliminate the possibilities of fraud and repetition. The system uses **RFID cards/tags** to uniquely identify each voter and only allows authorized users to cast their vote.

- The core of the system is based on an **ESP32 microcontroller**, interfaced with components like an **RC522 RFID scanner**, **push buttons** for party selection, **LED indicators**, a **buzzer**, and a **16x2 I2C LCD** for live feedback. Upon scanning, the system verifies voter identity, enables one-time voting through buttons, and sends the **vote data in real-time to a linked Google Sheet** via WiFi using HTTP requests.

- To enhance administrative control, a special **Master RFID Card** is used to **end the voting session and display the final vote summary** with the declared winner. The system also includes **invalid card detection**, **already voted warning**, **auto timeout on inactivity**, and visual feedback for each action.

- This project serves as a working prototype for secure, efficient, and tamper-free electronic voting — ideal for institutions, clubs, or internal organizational elections.

LITERATURE REVIEW

S.N.	Year	Title	Methodology
1	2017	RFID-Based Electronic Voting Machine with Secure Access	Proposed a secure voting system using RFID cards to authenticate voters and restrict duplicate voting.
2	2019	IoT-Enabled E-Voting System Using ESP32 and Cloud Integration	Integrated ESP32 with RFID and Google Sheets to store votes in real time and visualize data.
3	2020	Multi-Level Authentication E-Voting System Using RFID & Biometrics	Combined fingerprint recognition with RFID card scanning to ensure high-level identity validation.
4	2021	Secure RFID Voting System with Blockchain-Based Result Storage	Used blockchain ledger to store votes submitted via RFID-based validation, ensuring tamper-proof results.
5	2023	Real-Time IoT-Based Voting with LCD Feedback and Remote Monitoring	Enabled live feedback via LCD and remote result monitoring using WiFi and cloud-based spreadsheets.

INTRODUCTION

- In today's digital era, the need for modernization of conventional voting systems is crucial. Traditional methods involve manual registration, paper-based ballots, and physical counting, which are often time-consuming, error-prone, and susceptible to manipulation or malpractices. These limitations highlight the importance of building a secure, automated, and efficient voting mechanism.

- The **RFID & RF Based E-Voting System** is designed to address these challenges by leveraging RFID technology for voter authentication and ESP32 with WiFi connectivity to transmit and store votes in real-time to a Google Sheet. Each voter is issued an RFID tag, which when scanned, verifies their identity. Once verified, the voter casts their vote using dedicated buttons for each party. The system ensures that every user votes only once and prevents duplication through backend verification. Moreover, administrators can access real-time vote summaries and winner announcements, making the system transparent and auditable.

- This smart system enhances reliability, reduces manual labor, eliminates the need for paper, and offers cloud-based storage — making it ideal for institutions, organizations, or small-scale elections.

INTRODUCTION

»» Why ?

- To **eliminate manual errors** and improve the accuracy of vote recording.
- To **prevent fraudulent voting**, such as double voting or unauthorized access.
- To **enable real-time data logging** and winner calculation on Google Sheets.
- To provide a **cost-effective and portable solution** for small-scale voting needs.
- To provide a **cost-effective and portable solution** for small-scale voting needs.
- To familiarize students with **practical applications of RFID, IoT, and embedded systems**.
- To introduce a **modern voting system** that is secure, fast, and eco-friendly.
- To demonstrate how **technology can enhance transparency and trust** in the election process.
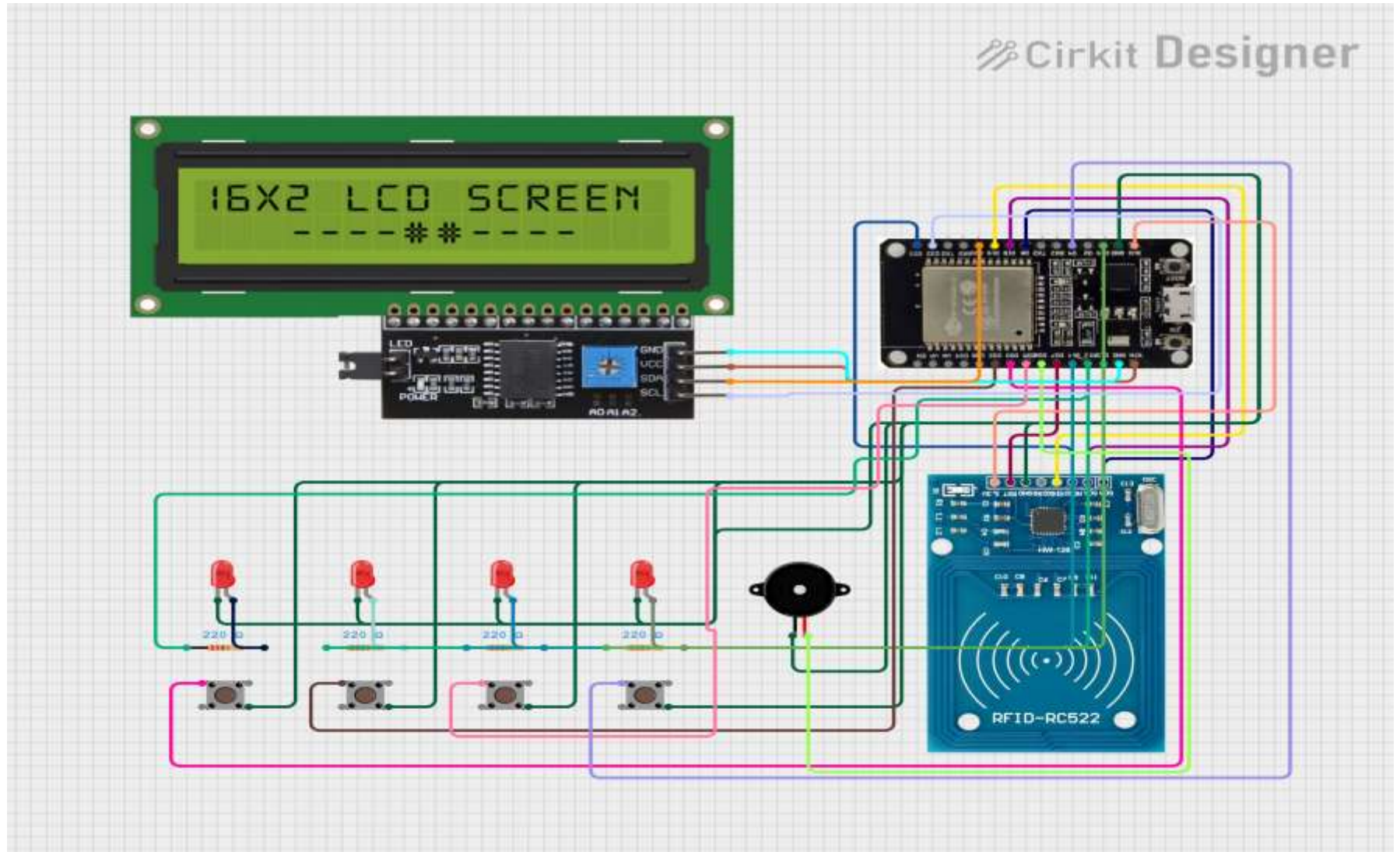
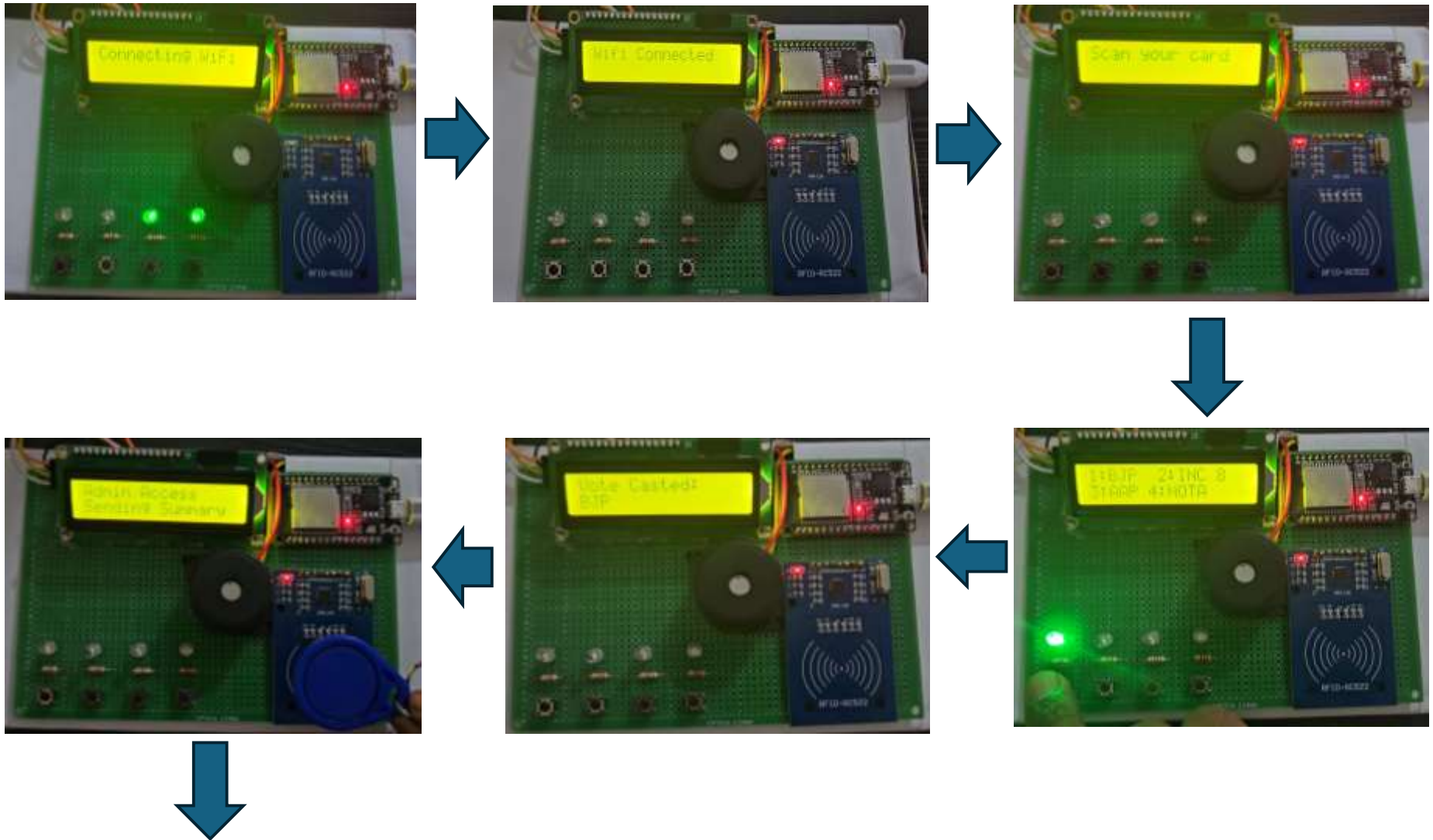# BLOCK DIAGRAM
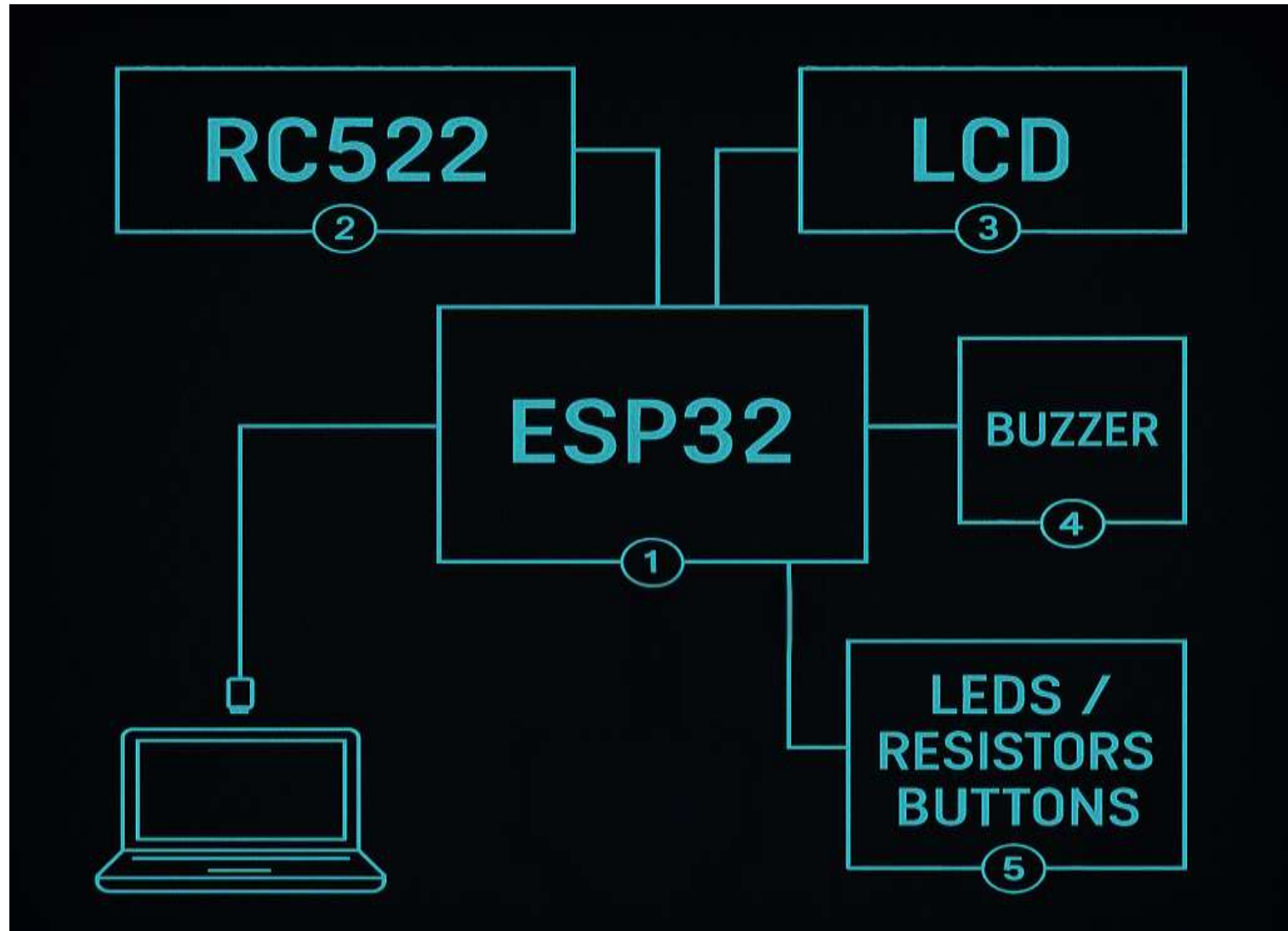
BLOCK DIAGRAM

- Explanation / Table

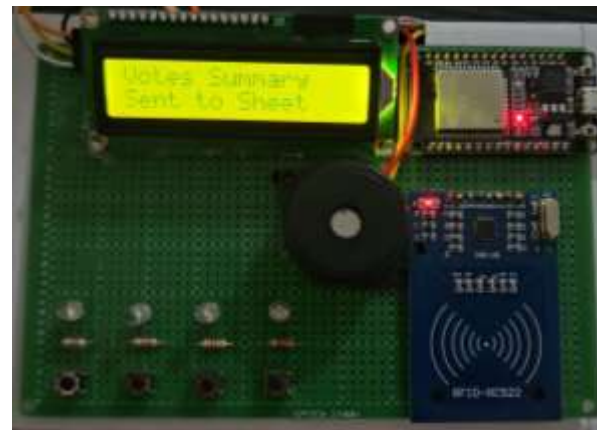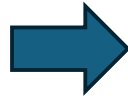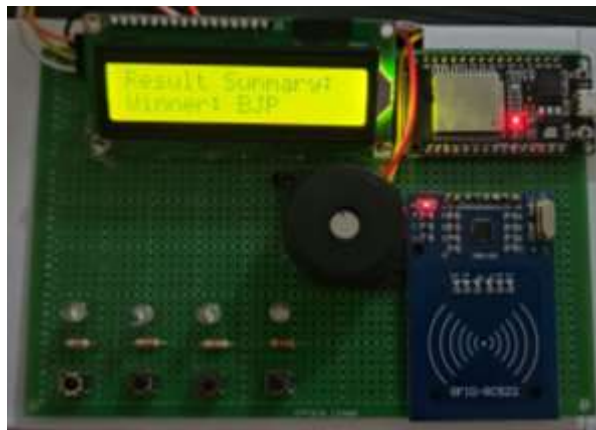| Block Name	Description
Power Supply	Provides 5V regulated power to the ESP32, RFID module, LCD, and other components.
ESP32 Microcontroller	The brain of the system that controls all operations, processes RFID input, handles vote logic, LCD display, WiFi connection, and data transmission to Google Sheets.
RFID Module (RC522)	Detects and reads RFID cards/tags to identify and authenticate voters.
RFID Cards	Assigned to individual voters; each card has a unique UID used for identification.
Push Buttons (4)	Represent vote options: BJP, INC, AAP, and NOTA. Voter presses one to cast their vote.
LED Indicators (4)	Each LED corresponds to a voting button and blinks to indicate a successful vote.
Buzzer	Gives audible feedback for actions like card scan, successful vote, invalid entry, etc.
16x2 I2C LCD Display	Displays system messages, instructions, voter names, vote confirmation, winner info, etc.
WiFi Module (built-in ESP32)	Connects to internet using hotspot and sends data to Google Sheets in real-time.
Google Apps Script Web App	Acts as a backend to receive and log voting data securely into a Google Sheet.
Google Sheet (Log)	Stores all voting records, UID, status, vote counts, winner summary, etc.

CIRCUIT DIAGRAM

RESULTS

- Working Images :

Github : https://github.com/TejasK-02/RFID-RF-Based-E-Voting-System
Youtube : https://youtube.com/shorts/w2tXMks05K4?si=k-z5knKSpe7Tq8rl
Drive : https://drive.google.com/drive/folders/1dlD695RuSaaR76-CfT7QR9z3M7TtpGgr

CONCLUSION

- The RFID & RF Based E-Voting System successfully provides a secure, transparent, and tamper-proof voting mechanism.

- Voters are authenticated using RFID cards, ensuring only registered users can cast their votes.

- The system ensures **one person, one vote**, by maintaining a record of voters who have already voted.

- Voting data, including party-wise vote count and voter details, are automatically updated to a **Google Sheet** for transparent logging.

- A **master RFID card** allows administrators to view results, including total votes and winner, directly on the LCD and also logs it on the sheet.

- The system handles edge cases like **tie conditions**, **no votes cast**, and **invalid/unregistered RFID cards** gracefully.

- Voting is time-limited with a **10-second countdown**, ensuring smooth flow and avoiding system hang-ups.

- Visual (LEDs) and auditory (buzzer) feedback enhances **user interaction and confirmation**.

- The system can be extended further with features like **biometric authentication** or **IoT dashboard integration**.

- Overall, the project demonstrates how microcontrollers and real-time databases can be used to create **smart, user-friendly, and efficient voting solutions**.

REFERENCES

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- MFRC522 RFID Module Datasheet by NXP Semiconductors.

- Espressif Systems, "ESP32 Technical Reference Manual," Version 4.0.

- LiquidCrystal_I2C Library Documentation (Arduino.cc).

- Google Apps Script Documentation (script.google.com).

- *Wireless Communications & Networks* by William Stallings.

- Arduino.cc Community Forums and Official Library Repositories.

- IEEE Xplore Digital Library for papers on secure RFID-based systems.