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ELECTRONIC VOTING MACHINE USING ARDUINO

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ABSTRCT

The primary aim of this paper is to design and implement an Electronic Voting Machine (EVM) that utilizes a fingerprint sensor for authentication. The system is built on an Arduino Mega 2560 microcontroller and includes a fingerprint sensor to scan voters' fingerprints before casting their votes. It features a 2.4” TFT LCD screen for displaying instructions and voter information, a buzzer for alerts, and an SD card reader. The database within the system stores the password IDs and fingerprints of all voters in the microcontroller for comparison and verification during the polling process. If a voter attempts to access the EVM after already casting a vote, the buzzer will notify the master user. This proposed EVM is designed to enhance efficiency, offering reliability, ease of use, and quick responses. At the conclusion of voting, results are saved in E SamanvithaE Samanvithaflash memory, allowing the master user to access and review them. When developing an electronic voting system, it is crucial to address various factors, particularly the privacy of voters, the accuracy of the voting process, and data security. This research aims to deliver a secure and dependable voting solution.

I. INTRODUCTION

Voting systems have undergone significant transformation, moving from early hand-counting methods to sophisticated electronic systems that utilize various materials and technologies, including paper ballots and punch cards. With advancements in technology, the integration of scanning machines has become commonplace [1]. The primary purpose of voting is to empower individuals to express their preferences on diverse matters [2]. Electronic voting systems offer advantages over traditional methods, such as enhanced user-friendliness, improved accuracy, streamlined navigation, and greater flexibility [1]. Different types of voting machines exist, including Direct Recording Electronic (DRE) systems, Electronic Voting Machines (EVMs) with Voter Verifiable Paper Audit Trails (VVPAT), and EVMs utilizing paper ballots [3]. Most electronic voting systems globally follow a series of critical steps: voter identification, authentication, results storage, vote counting, and result publication. These steps are designed to assist voters in casting their votes while facilitating the overall voting process under supervision [2, 4].

A crucial aspect of developing Electronic Voting Machines (EVMs) is security. It is

essential to create secure EVMs to prevent issues like vote duplication and unauthorized voting. Our proposed system aims to enhance EVM security by incorporating fingerprint verification to confirm voter identities. The fingerprint data and unique user IDs are stored in a secure EVM database, thus facilitating voting and ensuring more accurate results.

II. RELATED WORK

Pal et al. [5] designed an EVM that combines RFID technology with a fingerprint sensor. This system stores voter information, including fingerprint data and personal details, in a database. Each voter is assigned a unique RFID tag, which is validated against the database via a microcontroller. Once the fingerprint is verified, the voter is permitted to cast their vote, with feedback displayed on an LCD screen. If the information is not recognized, an "Access denied" message is shown, and an alarm alerts polling officials.

Sudhakar and Sai [6] developed a web-based EVM known as FP-EVM that utilizes Ethernet for local networking. This system saves voter details such as fingerprints and voter ID on a remote server. Additionally, it employs a photo of the voter to bolster security. The FP-EVM uses a biometric method for identification and is built around an ARM9 microcontroller, featuring various user interfaces to display voter information and results.

Satheeswari et al. [1] created a mobile-based voting system that allows users to vote via a dedicated application. Voters must provide fingerprint verification through their mobile devices; if unavailable, designated voting booths are set up. After voting, the information is transmitted to a server for recording.

A. Hardware Components

This section outlines the hardware components necessary for the implementation of our proposed EVM.

B. Arduino Mega 2560

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It includes 54 digital input/output pins (15 of which can function as PWM outputs), 16 analog inputs, and 4 UARTs (hardware serial ports). The board operates at a 16 MHz clock speed and offers various connectivity options. Its compatibility with numerous shields enhances its versatility in microcontroller applications [7][8].

C. Fingerprint Sensor

Fingerprint sensors provide a reliable method for user authentication, eliminating the need for passwords. These sensors capture and verify fingerprints effectively and can store numerous fingerprint templates in onboard memory. A built-in LED indicates the operational status of the sensor, making it user-friendly [6].

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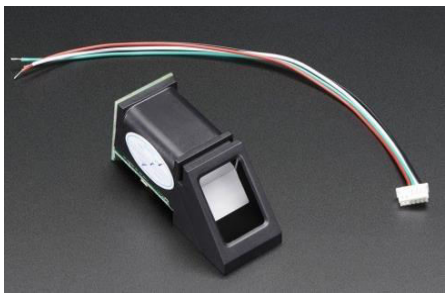

D. 2.4" TFT LCD

The 2.4-inch TFT touch screen LCD module offers vibrant colors and a resolution of 240×320 pixels. This display enhances user interaction by providing clear visual feedback and is particularly advantageous for displaying complex data in an easily understandable format [10][11].

E. Buzzer

Buzzers are crucial for providing audio feedback in electronic systems. Active buzzers emit a constant tone when powered, while passive buzzers require a signal to produce sound. The YL-44 model, which operates in the audible frequency range, is commonly used in applications where sound alerts are necessary [12].

F. SD Card Reader

The SD card reader is a user-friendly component that allows for seamless data storage and retrieval. It enables easy reading and writing operations when interfaced with Arduino, serving as a compatible sensor shield module [13]. This functionality is particularly useful for storing voting data and results securely. The SD card reader facilitates efficient data management, ensuring that the system can access and log information as needed.

III. PROPOSED SYSTEM

The Electronic Voting Machine (EVM) is designed with several essential components: the Arduino Mega 2560 microcontroller, a fingerprint sensor, a buzzer, a 320 x 240 color graphics LCD screen, and an SD card reader. All components are interconnected using appropriate wiring on a printed circuit board (PCB). The fingerprint sensor connects to the Arduino via the Serial 1 ports (18 "TX" and 19 "RX"). The graphic display and memory card are linked to specific pins according to their libraries, while the buzzer is connected to a randomly selected pin that does not interfere with other components. The main activities of the EVM are organized in a flow chart, which outlines the sequential steps involved in the voting process. This flow chart details how the system interacts with voters, guiding them from identification through to vote recording.This integrated system ensures a smooth and secure voting experience,

leveraging the capabilities of each component to facilitate accurate and efficient election processes.

IV. DISCUSSION

In this section, we discuss the results obtained from the experimental evaluation of the Electronic Voting Machine (EVM). The data collected during the voting process was saved in a Notepad file stored on the SD card. The database summary provides an overview of the voting results. The first column of the summary indicates the number of voters, while the second column contains binary values: "1" denotes that the voter has cast their vote, and "0" indicates that they have not yet voted. Further analysis of the database reveals additional details, including the password ID for each voter in the first column, the corresponding voter number in the second column, and the choice made by each voter in the third column. The voting results illustrate the number of available voting options along with the votes received for each option. At the end of the file, the final results of the voting process are displayed. Notably, the maximum number of voters participating in this experiment was 150, showcasing the system's capacity for handling multiple votes effectively.

V. CONCLUSION

This paper aimed to enhance the security and reliability of Electronic Voting Machines (EVMs) by integrating fingerprint sensors for user authentication. All voter information was securely stored in a microcontroller database, with the ability to display this information on an LCD screen. The EVM demonstrates several key features: it provides clear and user-friendly interfaces for voters, is portable, has a short response time, and offers flexibility in its operation. Overall, the proposed EVM not only improves the voting experience but also strengthens the integrity of the electoral process by ensuring that only authenticated users can cast their votes. This innovation paves the way for more secure and efficient voting systems in the future.

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