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ELECTRONIC VOTING MACHINE WITH FACE RECOGONIZATION SYSTEM

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Abstract: Voting is a rigorous process in India which is very important as it helps to decide the future leader of India. Most of the time parties often complain about the true nature of the electronic voting machine and how truthful it is. This paper presents the simple yet very efficient electronic voting system using Arduino with face detection system using python. It will help in preventing the malfunction which usually takes place in rural and deserted areas. This is easy and very secure in comparison to the traditional electronic voting machine. The proposed "Electronic Voting Machine with Face Detection System" implemented using python aims to improve voter authentication, ensuring that only registered voters can cast their ballots, thus preventing voter fraud and impersonation. By employing facial recognition, the system captures a voter's facial features, matches them with a pre-stored database, and grants access to the voting process only upon successful verification. The design is intended to be user-friendly, with a focus on maintaining the privacy and confidentiality of the voters. Additionally, the system supports real-time identification, reducing manual errors and speeding up the voting process. We evaluate the system's accuracy, security, and robustness in comparison to traditional voter authentication methods, and provide insights into potential challenges such as scalability, ethical concerns, and data privacy. The proposed system represents a step forward in modernizing the voting process, contributing to transparent and secure elections.

Keywords: **Electronic Voting Machines, Face Detection System, I2C converter, Python, Arduino Uno, LCD Display.**

1. Introduction:

The electronic voting machine (EVM) is a critical tool in modern day elections, designed to replace traditional paper-based voting systems with an efficient and error-free process. In recent years, the development of small-scale voting machines using micro-controllers like Arduino has gained popularity due to their simplicity, affordability, and scalability. One such implementation integrates the use of an Arduino with an I2C (Inter-Integrated Circuit) converter, which allows for more streamlined communication between various components of the machine, such as LCD displays and other sensors.Electronic voting machines are designed to digitize the process of recording, counting, and displaying votes. In most cases, such a system includes input devices (buttons or keypads for voter selection), a micro controller for processing and storing the votes, and an output device such as an LCD screen to display the results. Arduino, being a popular microcontroller platform, is often chosen for educational or small-scale projects because of its ease programming, flexibility, and integration capabilities.

2. Literature Review:

This project is based on the electronic voting machine as it is cost effective and affordable than traditional method. It is automated voting process with speed and accurate result. Putting in place an automated voting system has a number of clear functional benefits. First and foremost, it automates the entire voting process, which removes the need for human supervision and involvement and speeds the process. It also makes real-time vote counting possible, providing prompt and accurate results tracking as they happen. By facilitating communication between different parts of the machine, an I2C converter [1] coupled with an Electronic Voting Machine (EVM) can improve the operation of the system.Data from non-I2C devices can be seamlessly transmitted throughout the system which acts as a bridge and transforms the data into the I2C protocol.This feature also makes it possible for results to be displayed very instantly, reducing the wait times usually connected with vote tallying. Significantly lowering human error—a problem that often occurs with manual vote counting methods—is another important advantage that improves the election's overall accuracy and dependability. Furthermore, the system supports voter identity verification, guaranteeing that every vote is valid and confirmed correctly. it greatly improves voter identification security and accuracy by offering biometric verification, which aids in preventing impersonation and guarantees that only voters who are registered may cast ballots. By lowering the possibility of electoral fraud, this sophisticated verification technique improves the voting process's integrity. In addition, it simplifies the voter authentication procedure, which makes it quicker and more effective than with conventional techniques like manual identity checks. This effectiveness can shorten wait times at polling places and expedite the voting process in

general. Furthermore, All things considered, this technology not only increases election security In sum, the deployment of an automated voting system not only improves efficiency but also strengthens the integrity of the electoral process, providing a more streamlined, accurate, and secure method of vote management. Overall, this technology not only elevates the security of elections but also improves the user experience by making the process more seamless and secure.V.K Priya explained that the fundamental concept behind this project is to develop an electronic voting machine designed to eliminate fraud inherent in manual voting systems as well as previous iterations of electronic voting methods. This study delves into and proposes a system fortified with multiple layers of verification mechanisms to enhance the reliability and integrity of the device. One critical feature is the integration of a biometric fingerprint sensor, which ensures that each voter is authenticated against an existing database of registered voters before being allowed to participate. Upon successful fingerprint verification, the voter can proceed to select their preferred candidate from a panel of buttons. For transparency and voter assurance, the selected vote is displayed on an LCD screen for confirmation. Furthermore, the proposed system operates autonomously, maintaining its functionality without external interference. This project showcases a model that not only ensures the transparency of the electoral process but also enhances security and reliability through advanced verification procedures.[2] L Li X et al., explained that the facial recognition technology is a sophisticated biometric methodology predicated on the discernment of distinctive facial attributes. The system acquires facial images, which are subsequently processed automatically by recognition software. The paper explores diverse research trajectories in facial recognition, elucidating its evolutionary phases and associated technological advancements. It delves into studies focusing on real-world scenarios, alongside a discussion of standard evaluation protocols and widely utilized databases in this field. A prospective analysis is presented, underscoring the burgeoning potential and the broad spectrum of future applications for facial recognition, which is poised to be a pivotal frontier in technological innovation.[3] Dr A.V Nikam rationalized that the rapid evolution of information technology (IT) has significantly influenced various facets of human life, including the electoral process. In our democracy, which comprises three tiers—Loksabha, Vidhan Sabha, and Sthanik Swarajya Sanshta—IT plays a pivotal role in compiling voter lists, facilitating efficient voting procedures, and even predicting election outcomes. To enhance voter services, a dedicated software application, "Too Voter," has been developed. This app enables citizens to easily verify their registration status, locate their polling station, and access other election-related information. It also provides transparency by allowing users to monitor election expenses. The application benefits a wide range of stakeholders, including voters, election officials, political parties, media, and political analysts. A crucial component of the election process is the actual voting through Electronic Voting Machines (EVMs). Initially, there were concerns about their usability among both literate and illiterate voters,

but it has been observed that all demographic groups have successfully adapted. The inclusion of the "None of the Above" (NOTA) option has also sparked discussions. EVMs have enabled rapid and accurate vote counting, minimized misconduct, and enhanced the dissemination of candidate information through platforms like Facebook and Twitter, where public opinions and candidate images can be shared and analyzed.[4]Dr A Kumar el.al stated that an Electronic Voting Machine (EVM) is a streamlined electronic apparatus designed to record votes, replacing the traditional ballot papers and boxes utilized in conventional voting systems. The fundamental right to vote underpins the very essence of democracy. Historically, during both state and national elections, voters would select their preferred candidate by stamping next to their name on a ballot paper, then meticulously folding it before placing it in the ballot box—a lengthy, error-prone procedure. This method prevailed until the advent of the EVM revolutionized the voting process, eliminating the need for ballot papers, boxes, and stamping, consolidating everything into a compact unit known as the ballot unit of the EVM. Biometric identifiers, being resistant to loss, forgery, or unauthorized use, are deemed more reliable for identity verification compared to conventional token or knowledge-based methods. Consequently, the electronic voting system necessitates enhancement through integration with modern technologies such as biometric systems. This article provides a comprehensive analysis of voting devices, explores pertinent issues, and compares various voting methodologies, including biometric EVMs.[5]G Singh stated that the the context of individual identification, the face serves as the most defining attribute, as it uniquely represents one's identity. Consequently, facial recognition facilitates the verification of a person's identity by analyzing distinct personal features. This authentication process is bifurcated into two main stages: initially, face detection is executed swiftly, except in cases where the subject is considerably distant. Subsequently, the second phase commences, wherein the detected face is matched to a specific individual. This iterative process underpins the development of facial recognition models, which are considered among the most extensively studied biometric technologies. Currently, two primary methodologies are predominant in facial recognition: the Eigenface method and the Fisher face method. The Eigenface technique employs Principal Component Analysis (PCA) to reduce the dimensionality of facial features, thereby optimizing recognition performance. This paper focuses on leveraging digital image processing techniques to construct an effective facial recognition system.[6]The primary aim of this paper is to design and implement an Electronic Voting Machine (EVM) that utilizes fingerprint sensors for voter authentication. The system is built around the Arduino Mega 2560 microcontroller, which coordinates various components including a fingerprint sensor for voter verification, a "2.4" TFT LCD screen to display instructions and voter details, a buzzer, and an SD card reader for data storage. The system’s database, containing both voter password IDs and fingerprints, is stored in the microcontroller for real-time comparison during the voting process. If a voter attempts to cast

a second vote, the buzzer alerts the system administrator. This proposed EVM offers significant time and effort savings for voters due to its reliability, user-friendly interface, and rapid response. Upon the conclusion of the voting process, the results are stored in flash memory, allowing the system administrator to easily retrieve and review them. In developing an electronic voting system, essential considerations include voter privacy, voting accuracy, and data security. This research presents a secure and dependable solution that addresses these critical aspects effectively.[7]

3. Design and Simulation:

One of the main components in the project is ardino uno. The Arduino Uno is one of the most popular and widely used microcontroller boards in the Arduino family. It is an open-source, easy-to-use platform designed for building interactive projects. The Uno is an excellent starting point for beginners, while also being powerful enough for more advanced users and projects. The Arduino Uno is based on the ATmega328P microcontroller, which is a small chip that controls inputs and outputs, processes data, and runs the program you upload to it.The Uno has 14 digital input/output pins, which can be used to control LEDs, motors, or other devices, and read signals from buttons, sensors, etc. It also has 6 analog input pins, which can read varying signals from devices like temperature sensors or potentiometers.It operates at 5V, making it compatible with most standard electronic components and sensors. The Arduino Uno with an I2C converter is a powerful combination used for simplifying communication between the Arduino and various peripheral devices, such as LCD displays, sensors, or other micro-controllers. The I2C (Inter-Integrated Circuit) protocol is a two-wire communication standard that allows multiple devices to communicate over just two pins, significantly reducing the number of connections needed. This is especially useful when connecting devices like LCD displays that typically require many wires to communicate with the Arduino. An I2C converter is a module that allows devices, such as an LCD display, to use the I2C communication protocol instead of parallel communication. It simplifies the wiring by reducing the number of pins needed to control a device. The main part of the project involves the face detection system using python which contribute to lesser many social problems.it can be implemented with the help of the OpenCV library, which is a popular library for computer vision tasks. Face detection involves identifying and locating faces within an image or video feed. This technology is widely used in security, surveillance, photo tagging, and facial recognition systems.

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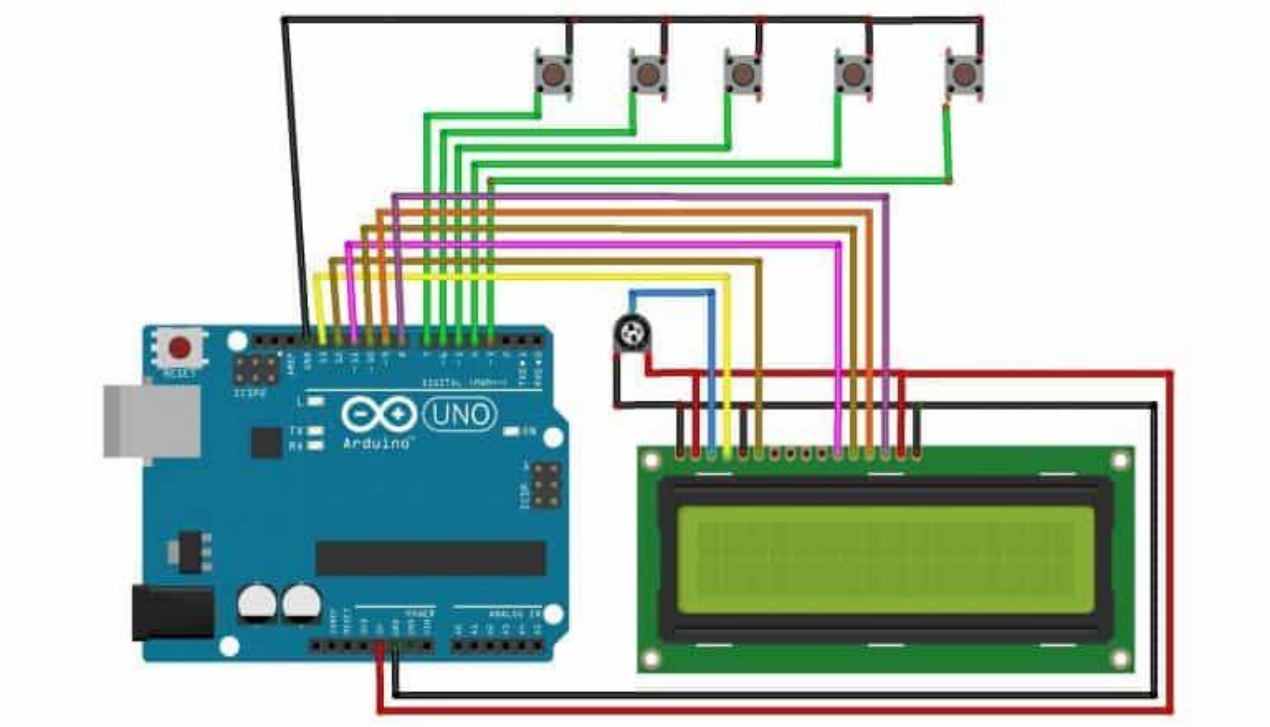

Figure:1 Simulation of an electronic voting machine

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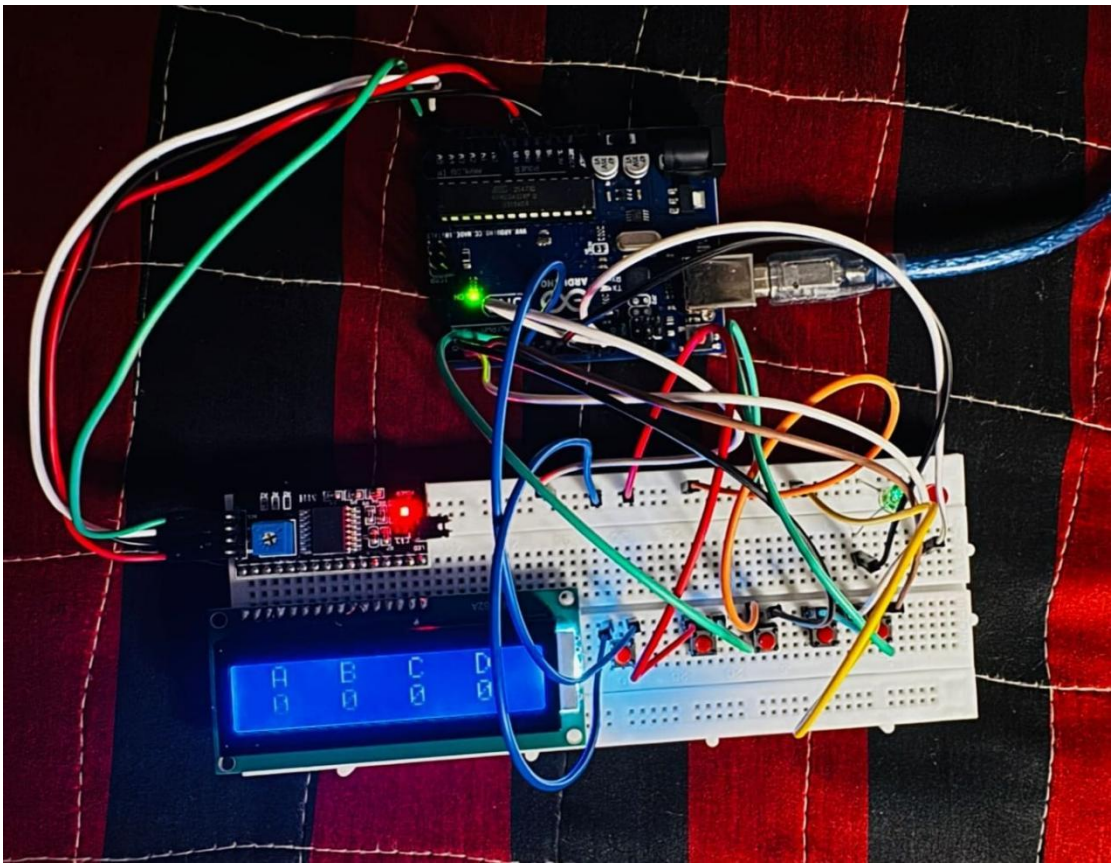

Figure:2 Design of various components

4. Simulation Parameter:

To specify a number of elements that are pertinent to the simulation procedure. The device uses these parameters based on the desired outcome. Achieving the intended performance is facilitated by giving these parameters and the features that enable the sensor to deliver precise temperature readings across the designated range and under different operational circumstances. The various parameters for the device are below:

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Table 1: Components used

SL. NO	COMPONENTS	SPECIFICATION
1.	ARDUINO UNO	R4/R3
2.	LCD DISPLAY	Red
3.	I2C CONVERTOR	ADC/DAC
4.	SWITCH	TACTILE PUSH BUTTON
5.	CONNECTING CABLES	5 PIN OR 7PIN
6.	BREADBOARD	SOLDERLESS

5. Result Analysis:

The system is initialized, resetting all vote counts to zero. A voter presses a button corresponding to their candidate. The Arduino registers the vote, increments the vote count for that candidate, and gives feedback (e.g., an LED or buzzer). After voting, the system resets for the next voter. In an electronic voting machine, integrating an I2C converter simplifies the communication between the Arduino and various components, particularly the LCD screen. Without an I2C converter, interfacing with a standard 16x2 LCD display would require several digital pins (up to six or more) for data transmission. However, with the I2C converter, the communication can be done using only two wires: SDA (Serial Data Line) and SCL (Serial Clock Line). This reduction in wiring not only simplifies the hardware design but also frees up more pins on the Arduino for additional features like adding more candidate buttons, sensors, or other input/output devices. The machine allows voters to select a candidate using push buttons or a keypad. Each candidate is assigned a button, and the voter presses the corresponding button to cast their vote. Once the voter presses the button, the

Arduino registers the vote and counts it for the respective candidate. The system also includes a voter authentication system such as face detection system which help each voter to only vote once, preventing fraud. The face detection system is done by using python libraries. The Arduino receives the input from the buttons and processes it, incrementing the vote count for the selected candidate. The vote counting is done in real-time, meaning the system continuously updates the count as each vote is cast. To ensure that no double voting occurs, a simple debouncing logic is applied to the buttons to ensure that each press is counted only once. The I2C protocol is employed to communicate the results to the output device (LCD display). This reduces the complexity of wiring and simplifies data transmission between the Arduino and the display. After all votes have been cast, the machine processes the results. The vote count for each candidate is displayed on a 16x2 LCD screen, which is connected to the Arduino via the I2C protocol. The LCD, with the help of the I2C converter, receives data from the Arduino and displays the vote counts for each candidate in real-time. This makes it easy to instantly display results at the end of the election process.

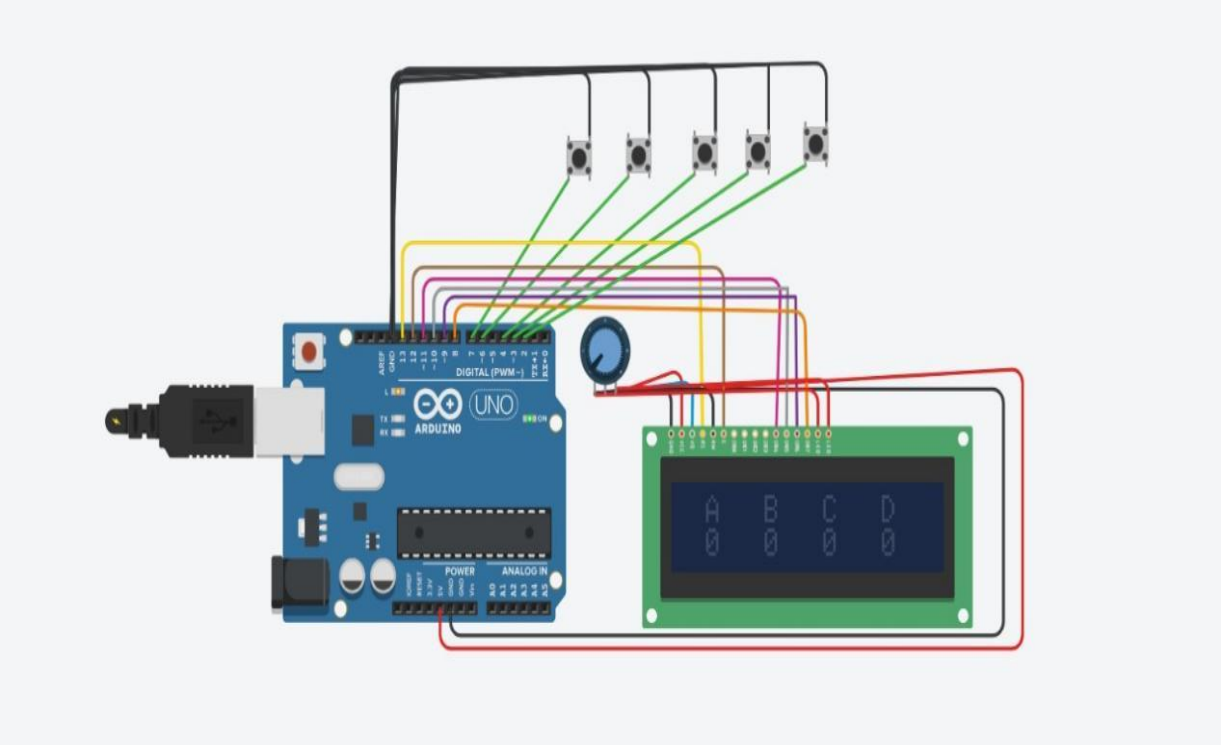

Figure 3: Result of an electronic voting machine

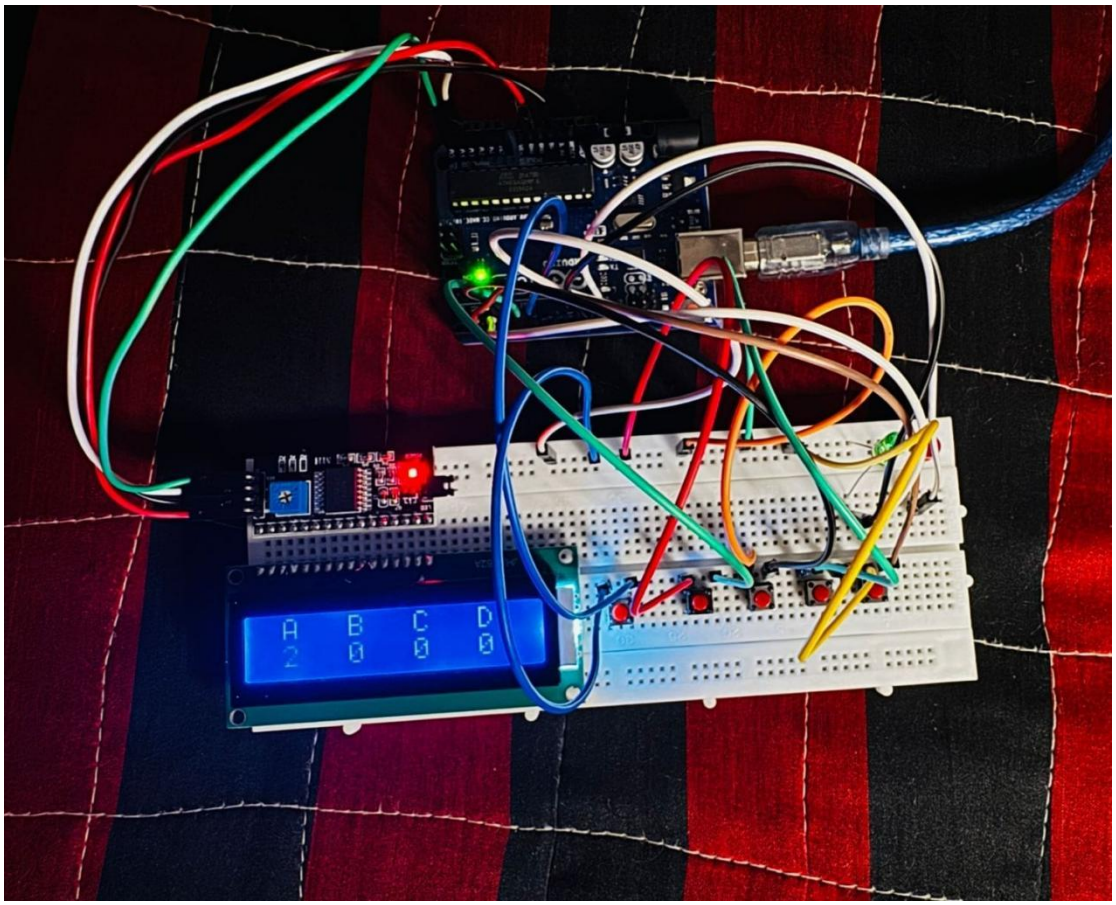

Figure 4: Result of an electronic voting machine

6. Conclusion:

An electronic voting machine using Arduino and an I2C converter offers a streamlined, efficient, and affordable solution for small-scale elections or educational projects. By simplifying communication between components, the I2C protocol makes the system less complex and more scalable. While this setup provides a reliable platform for learning and demonstration, it may not be robust enough for larger elections that require more advanced security and processing capabilities. Nonetheless, it offers valuable insights into how technology can modernize the voting process and enhance the overall efficiency of elections.

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