Electronic Voting Machine System Design

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1 Abstract

This project presents the design and implementation of an Electronic Voting Machine (EVM) for future elections, utilizing digital system design principles. The EVM incorporates essential features such as voter authentication, ballot selection, secure vote storage, and result calculation. By employing digital logic components, the system ensures the integrity and security of the voting process. The EVM's user-friendly interface and accessibility features aim to enhance voter participation and confidence in election outcomes.

1. **Motivation:** The increasing concerns over election integrity and the need for more accessible voting systems have motivated this project. By developing an advanced EVM that utilizes blockchain technology and robust security measures, we aim to establish a more transparent, secure, and inclusive voting process. This innovative approach has the potential to enhance voter confidence, strengthen democratic principles, and ensure fair and equitable elections.

2. **Problem Statement:** The current state of voting systems is plagued by concerns regarding security, accessibility, and transparency. Traditional voting methods are vulnerable to fraud, manipulation, and disenfranchisement. This project aims to address these challenges by developing an innovative Electronic Voting Machine (EVM) that incorporates advanced digital technologies to ensure the integrity, inclusivity, and efficiency of the voting process.

3. **Features:** Feature-1: **User Authentication**

   - The system includes a voter authentication feature to ensure that only authorized voters can access the machine. This typically involves an ID check before the voter can proceed with the voting process.

   Feature-2: **Candidate Selection**

   - Voters can select from multiple candidates. This system typically supports three options (Candidate 1, Candidate 2, and Candidate 3), though it can be expanded as needed.

   - The system ensures that only one candidate can be selected per voter.

   Feature-3:**Vote Confirmation**

- A confirmation step is included to allow voters to verify their choice before casting the vote. This step helps avoid accidental or incorrect votes.
- The vote is only counted after the voter confirms the selection.

Feature-4: **Vote Counting**

- The system securely counts and stores votes for each candidate. This count is automatically updated each time a valid vote is cast and confirmed.
- Separate counters keep track of each candidate's votes, making it easy to tally results at the end.

Feature-5: **Invalid Input Handling**

- If any invalid input is detected (like incomplete selections or unconfirmed votes), the system resets to the Idle state. This prevents any unintentional votes from being registered.

Feature-6: **Reset Functionality**

- After a vote is registered, the system resets automatically for the next voter, which allows for a continuous and efficient voting process.

Feature-7: **Security and Reliability**

- The system enforces strict controls, like ensuring only authenticated votes are counted, preventing multiple votes from the same user, and resetting if any irregular input is detected.
- Vote data is securely managed to ensure an accurate and trustworthy result.

Feature-8: **Simple User Interface**

- The system is designed to be straightforward and intuitive, making it easy for voters to navigate the steps without additional assistance.

2 Working

Working of the Electronic Voting Machine (EVM)

1. Authentication:

   The system begins in an Idle state, awaiting voter authentication. Once the voter provides valid identification, the system moves to the Voter Authenticated state.

2. Candidate Selection:

   After authentication, the voter selects a candidate by pressing the button corresponding to their choice (Candidate 1, Candidate 2, or Candidate 3). The system registers the selected candidate and prepares to confirm the selection.

3. Vote Confirmation:

   The system prompts the voter to confirm their selection. Upon confirmation, the system verifies the input, and if valid, the vote is counted for the selected candidate.

4. Vote Registration and Reset:

   The vote count for the chosen candidate is incremented. The system resets, returning to the Idle state, ready for the next voter.

5. Error Handling:

   If invalid inputs (e.g., no candidate selected or incomplete confirmation) are detected, the system transitions to an Invalid Input state before returning to Idle to prevent invalid votes from being cast.

Equation

Valid Vote Logic:

- A vote is considered valid if the voter is authenticated (V = 1), a candidate is selected (C1, C2, or C3), and the vote is confirmed (Cn = 1).
- The equation for a valid vote, ValidVote, is: ValidVote = V (C1 C2 C3) Cn

Vote Count Logic:

- The vote count for each candidate increments when the vote is confirmed and valid.
- The equations for each candidate's vote count are as follows:
- Candidate 1:

  VoteCount C1 = VoteCount C1 + (ValidVote C1)
- Candidate 2:

  VoteCount C2 = VoteCount C2+(ValidVote C2)
- Candidate 3:

  VoteCount C3 = VoteCount C3 + (ValidVote C3)

Truth Table
Inputs:

- VoterID (V): Indicates if the voter is authenticated (1 if authenticated, 0 if not).
- Candidate Selection (C1, C2, C3): Indicates which candidate the voter selected.
- Confirm (Cn): Confirms the vote.
- Reset (R): Used to reset the system for the next vote.

Outputs:

- ValidVote: Indicates if the vote is valid.
- VoteCount C1, VoteCount C2, VoteCount C3: Counters for each candidate's vote.

V	C1	C2	C3	Cn	R	ValidVote	VoteCount C1	VoteCount C2	VoteCount C3
0	0	0	0	0	0	0	0	0	0
1	1	0	0	1	0	1	+1	0	0
1	0	1	0	1	0	1	0	+1	0
1	0	0	1	1	0	1	0	0	+1
1	0	0	0	0	1	0	0	0	0

Table 1: Truth Table

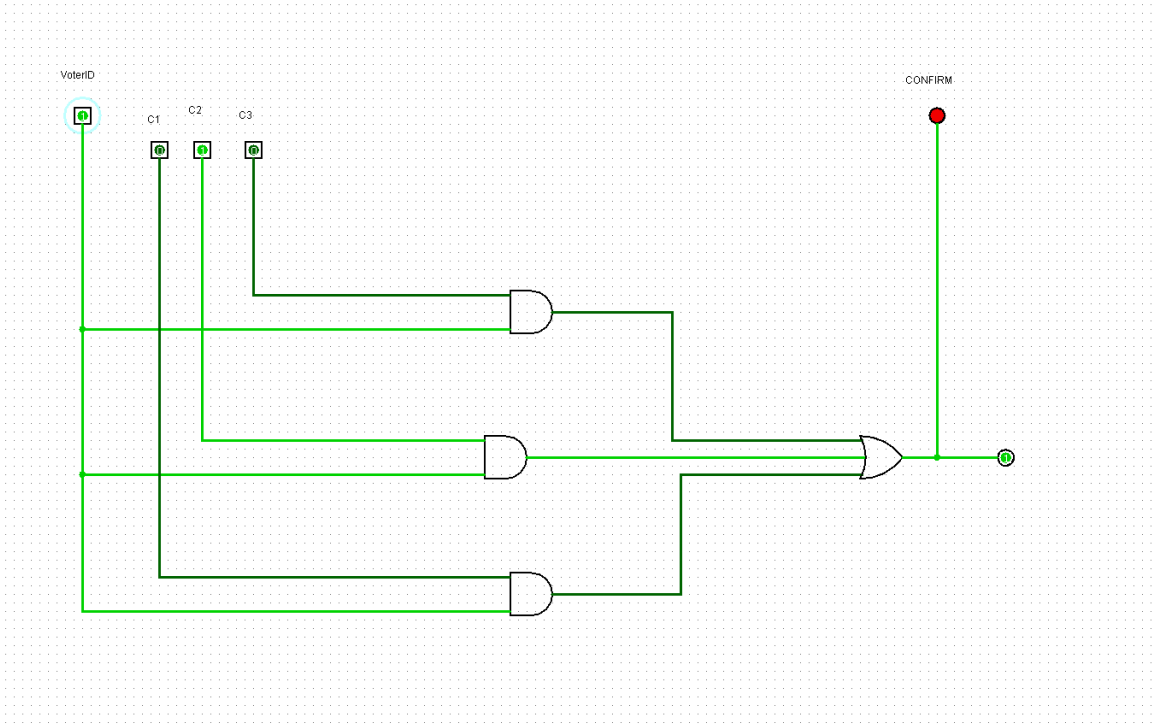

Figure 1: logisim circuit

3 Logisim

4 Verilog

```
module EVM (
    input wire VoterID,           // Voter authentication input
    input wire C1, C2, C3,        // Candidate selection inputs
    input wire Confirm,           // Confirmation input
    input wire Reset,             // Reset input to reset all counts
    output reg ValidVote,         // Output for valid vote indication
    output reg [3:0] VoteCount_C1, // 4-bit counter for Candidate 1
    output reg [3:0] VoteCount_C2, // 4-bit counter for Candidate 2
    output reg [3:0] VoteCount_C3  // 4-bit counter for Candidate 3
);

// ValidVote calculation based on VoterID, candidate selection, and confirmation
always @(*) begin
    ValidVote = VoterID & (C1 | C2 | C3) & Confirm;
end

// Counting logic for each candidate
always @(posedge ValidVote or posedge Reset) begin
    if (Reset) begin
        // Reset counters to zero if Reset is pressed
        VoteCount_C1 <= 4'b0;
        VoteCount_C2 <= 4'b0;
        VoteCount_C3 <= 4'b0;
    end else begin
        // Increment corresponding candidate's count if ValidVote is true
        if (C1) VoteCount_C1 <= VoteCount_C1 + 1;
        if (C2) VoteCount_C2 <= VoteCount_C2 + 1;
        if (C3) VoteCount_C3 <= VoteCount_C3 + 1;
    end
end

endmodule
```

5 References:

Digital Logic Design and Logisim:

- Digital Logic Design - Covers fundamentals of digital circuits and state machines, which are crucial for understanding and building an EVM circuit.
- Digital Circuits Logic Design on All About Circuits
- Logisim Guide - Official documentation for Logisim, detailing the software's features, components, and examples to help you get started with digital circuit simulation.
- Logisim User Guide on SourceForge

Verilog Basics:

- Digital Design and Verilog - MIT OpenCourseWare offers free resources on digital design with Verilog, which are valuable for projects like the EVM.
- MIT OCW - Digital Design

Voting Machine Design Concepts:

- Design and Implementation of a Secure Electronic Voting System - This research paper outlines a secure EVM design, highlighting authentication, vote selection, and vote counting.
- IEEE Xplore - Secure EVM Design
- Digital Electronic Voting Systems and Challenges - An in-depth review of digital EVMs, covering various methods, technologies, and challenges in implementing secure systems.
- ResearchGate - EVM Systems