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# Internet Of Things Based Electoral System

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***Abstract:*** The idea of IOT Based Electoral System proposes a novel approach to enhance the efficiency and integrity of electoral processes by integrating 5 various and different domains of Internet of Things (IOT), Edge Cloud Computing, Image processing, Network Security, and Cyber Security Technology to transmit, store the data's safely and securely. Traditional voting systems often encounter challenges such as logistical constraints, inaccuracies, and delays in counting votes. We aim to streamline the casting of votes, ensuring 100% participation of senior citizens, physically challenged people, NRI citizens, even Migratory Workers and also non-interested citizens to vote with accuracy. Our proposed system involves the establishment of main voting stations equipped with IOT enabled devices to collect and transmit votes with high safety measures. These main stations receive and transmit the votes to various sub-stations located across different regions. Through robust encryption protocols and real-time data transmission, the integrity and confidentiality of the voting process are ensured. Furthermore, IOT sensors integrated into the voting booths provide real-time monitoring of voting activities, ensuring transparency and preventing fraudulent practices. The substations serve as decentralized points for voters to cast their votes conveniently, eliminating the need for extensive travel to centralized voting locations. By harnessing IOT technology, our proposed system aims to revolutionize the electoral process, guaranteeing the casting of 100% votes while maintaining the highest standards of security, efficiency, and transparency.

**Keywords: Arduino Board, WIFI Module ESP8266, Finger Recognition Sensors, LCD (or) Touch screen display, NIR Cameras, PCB Board, Edge Cloud Computing, WAN, Image Processing, LAN, Image Processing and IOT.**

## I.INTRODUCTION

In the era of rapid technological advancement, our democratic processes are not immune to innovation. One such groundbreaking development is the integration of the Internet of Things (IOT) in electoral systems. This paradigm shift promises to streamline voting procedures, enhance transparency, and fortify the sanctity of the electoral process. In this article, we delve into the workings of an IOT-based electoral system where votes are transmitted seamlessly from the main station to substations and eventually to the Electronic Voting Machines (EVMs), ushering in a new era of democratic participation and the votes are being stored using the concept of edge cloud computing. For local votes casting, LAN network protocols are being used and for NRI citizens vote casting WAN network protocols are being used. Traditionally, electoral processes have been marred by logistical challenges, inefficiencies, and concerns regarding tampering and fraud. However, with IOT technology, these issues can be effectively mitigated. At the heart of an IOT- based electoral system lies a network of interconnected devices, sensors, and data hubs that facilitate the seamless transmission of voting data.The journey of a vote in an IOT- based electoral system begins at the main station, where voters cast their ballots through secure interfaces. These votes are then transmitted over encrypted channels to substations located strategically across the electoral constituency. The substations serve as intermediate nodes, ensuring the reliability and integrity of data transmission. Security is paramount in any electoral system, and IOT technology offers robust mechanisms to safeguard the sanctity of the voting process. Encrypted communication protocols, biometric authentication and firewalls are employed to thwart potential cyber threats and tampering attempts. Moreover, real-time monitoring and auditing mechanisms provide

stakeholders with unprecedented transparency and accountability.Once the votes reach th e substations, they are relayed to the Electronic Voting Machines (EVMs) deployed at polling stations. The integration of IOT technology ensures that the transfer of voting data is swift, reliable, and tamper-proof. Each EVM is equipped with built-in security features to prevent unauthorized access and manipulation, thereby upholding the integrity of the electoral process.

## II. LITERATURE SURVEY

The main agenda is to increase the no. of pooling percentage by integrating the 5 different domains of IOT (Internet of Things), Cloud Computing, Image Processing, Networks Security and Cyber Security by using the main concept of IOT and we required this following apparatus and are as follows –

1) Arduino Board
2) WIFI Module ESP8266
3) Finger Recognition Sensors
4) LCD (or) Touch screen display
5) NIR Cameras
6) PCB Board

### 2.1 Existing Method

The existing voting system is unable to give us the 100 percentage of voting and the datas of the voters are not being saved. Sometimes, the act of malpractices can also happen and it can only be prevented by the method of IOT Based Electoral System.

### 2.2 Disadvantages

☑ Corrupting the ECI (Election Commission Of India) pooling booth workers.
☑ Chances of pooling dual votes.

## III.PROPOSED SYSTEM

1. The adoption of IOT technology in electoral systems offers a myriad of benefits:
2. **Enhanced Accessibility**: IOT- enabled voting mechanisms facilitate remote voting options, thereby increasing accessibility for voters with disabilities or those residing in remote areas.
3. **Real-time Monitoring**: Stakeholders, including election officials and observers, can monitor the voting process in real-time, ensuring transparency and accountability.
4. **Cost Efficiency**: By minimizing manual intervention and streamlining logistical operations, IOT- based electoral systems help reduce costs associated with traditional voting methods.
5. **Mitigation of Fraud**: The robust security measures inherent in IoT technology mitigate the risk of electoral fraud and tampering, thereby instilling public trust in the electoral process.

### 3.1 Block Diagram

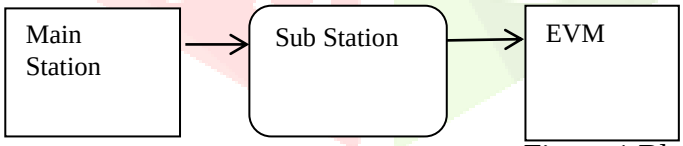


Figure 1 Block Diagram

### 3.2 Pin Diagram

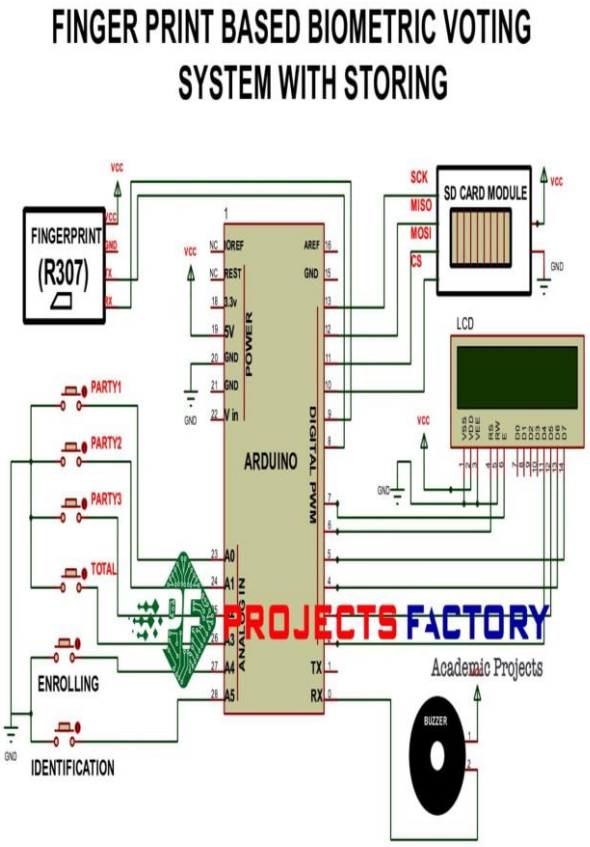


Figure 2 Pin Diagram

### 3.3 Flow Chart

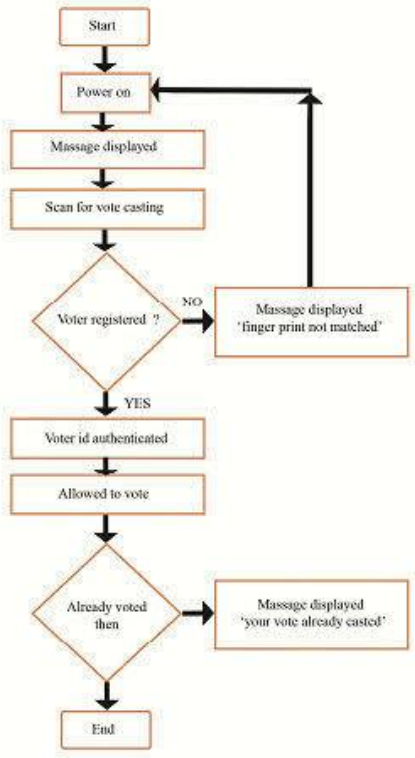


Figure 3 Flowchart

### 3.3.1 Arduino Board

The Arduino Board acts as the central control unit, coordinating the different components and managing the overall voting process. The Arduino board, the heart of the secure vote transmission system, acts as a versatile microcontroller platform. It easily integrated with other components, enabling secured data processing control, and communication capabilities to ensure the integrity of the voting process. With its programmable logic, the Arduino board coordinates the flow of information, orchestrating the synergetic operation of various subsystems, from voter identification to ballot verification and real-time reporting.

### 3.3.2 ESP8266 WiFi Module

Responsible for securely transmitting vote data from the main station to the sub-stations and EVMs using wireless connectivity. The ESP8266 WiFi module provides the critical wireless communication capabilities for the secure vote transmission system. It enables real-time transmission of vote data from local polling stations to the central servers, ensuring quick and reliable results reporting. With its low-power and compact design, the ESP8266 seamlessly integrates with the Arduino board to deliver robust and efficient wireless connectivity across the entire voting infrastructure.

### 3.3.3 Lcd Touch Screen: User Interface

Provides a best user interface for voters to interact with the system and cast their ballots. The LCD touch screen serves as the primary interface for voters to interact with the secure vote transmission system. It provides a sleek, intuitive, and responsive user experience for casting ballots and monitoring the voting process. Voters can easily navigate the touch screen menus to select their preferred candidates, review their choices, and confirm their votes. The touch screen also displays real-time updates on the voting status and turnout, keeping voters informed throughout the process.

### 3.3.4 Fingerprint Sensors

Ensure voter authentication and prevent unauthorized access, enhancing the integrity of the voting process. Secure voter authentication is critical to ensuring the integrity of the vote. High-precision fingerprint sensors capture each voter's unique biometric data, reliably verifying their identity before allowing them to cast their ballot. By integrating these sensors into the vote transmission system, we can ensure that only authorized individuals are participating, preventing fraud and maintaining the democratic process.

### 3.3.5 Camera: Ballot Verification

The integrated camera serves as a critical component for ballot verification. It captures high-resolution images of the completed ballots, ensuring transparency and integrity in the voting process. Advanced image recognition algorithms analyze the ballot images, validating the voter's selections and checking for any tampering or irregularities. This provides an additional layer of security and accountability in the vote transmission process. Especially, the NIR (Near Infrared Ray) camera is being used to capture the image of the biometrics very accurately and begins the verification process successfully.

### 3.3.6 UART (Universal Asynchronous Receiver and Transmitter)

The Universal Asynchronous Receiver and Transmitter is a protocol which is used to receive and transmit the datas safely and securely.

### 3.3.7 PCB Board (Printed Circuit Board)

A printed circuit board (PCB) is a flat, typically green board used in electronics to mechanically support and electrically connect electronic components using conductive pathways, tracks, or signal traces. These pathways are etched from copper sheets laminated onto a non-conductive substrate. PCBs are essential in modern electronics, providing a compact and efficient means of routing electrical signals a nd power between components. They are used in a wide variety of devices, from simple gadgets to complex machinery.

### 3.3.8 Edge Cloud Computing

Edge cloud computing is a distributed computing paradigm that brings computation and data storage closer to the location where it is needed, improving response times and saving bandwidth. This model combines the concepts of edge computing and cloud computing. In edge computing, processing happens on devices at the edge of the network (like IOT devices, sensors, or edge servers), whereas cloud computing involves processing in centralized data centers.

Edge cloud computing leverages both approaches by using edge devices to perform preliminary data processing and local computation, while the cloud handles more complex tasks and long-term storage. This synergy provides several benefits:

1. Reduced Latency: By processing data closer to the source, edge cloud computing significantly reduces the latency, which is critical for applications requiring real-time responses, such as autonomous vehicles, smart grids, and augmented reality.

2. Bandwidth Efficiency: It minimizes the amount of data that needs to be sent to the cloud for processing, thus saving bandwidth and reducing costs, particularly in applications involving large amounts of data like video surveillance or industrial IoT.
3. Improved Reliability: Local processing can continue even if the connection to the central cloud is intermittent or unavailable, enhancing the reliability of critical applications.
Enhanced Security and Privacy: By keeping sensitive data closer to its source, edge cloud computing can reduce the risk of data breaches and improve privacy controls, making it suitable for applications like healthcare and finance.
In essence, edge cloud computing optimizes the strengths of both edge and cloud infrastructures, creating a more responsive, efficient, and secure computing environment suitable for a wide range of modern applications.

**3.3.9 Cloud Computing VS Edge Cloud Computing**

Cloud computing and edge cloud computing differ primarily in where data processing and storage occur relative to the data source. Here are the key differences:
1. Location of Data Processing:
- Cloud Computing: Data processing and storage occur in centralized data centers located far from the data source. Users access these resources over the internet.
Edge Cloud Computing: Data processing happens closer to the data source, on edge devices or local servers, with only some data or further processing tasks sent to centralized cloud data centers.
2. Latency:
- Cloud Computing: Higher latency due to the distance between the data source and the cloud data centers. This can be a bottleneck for real-time applications.
- Edge Cloud Computing: Lower latency as processing happens near the data source, making it suitable for applications requiring real-time responses.
3. Bandwidth Usage:
- Cloud Computing: Higher bandwidth usage since large amounts of data need to be transmitted to and from the cloud.
- Edge Cloud Computing: Reduced bandwidth usage because data is processed locally, and only essential data is sent to the cloud.
4. Reliability:
- Cloud Computing: Dependent on continuous internet connectivity. Disruptions in connectivity can affect access to cloud resources.
- Edge Cloud Computing: More reliable in cases of network disruptions as local processing can continue without internet connectivity.
5. Scalability:
- Cloud Computing: Highly scalable with virtually unlimited resources available in the cloud.
- Edge Cloud Computing: Limited scalability at the edge, constrained by the capacity of local devices and infrastructure.
6. Security and Privacy:
- Cloud Computing: Data is transmitted over the internet to centralized locations, potentially increasing vulnerability to breaches.
- Edge Cloud Computing: Enhanced security and privacy by keeping sensitive data closer to its source, reducing the risk of exposure during transmission.
7. Cost:
- Cloud Computing: Can be cost-effective for large-scale data storage and processing but may incur higher costs due to data transmission and bandwidth.
- Edge Cloud Computing: Can lower costs associated with data transmission and reduce latency-related issues, though it may require investment in edge infrastructure.

In summary, while cloud computing provides powerful and scalable centralized resources, edge cloud computing enhances performance, reliability, and security by processing data closer to its source.

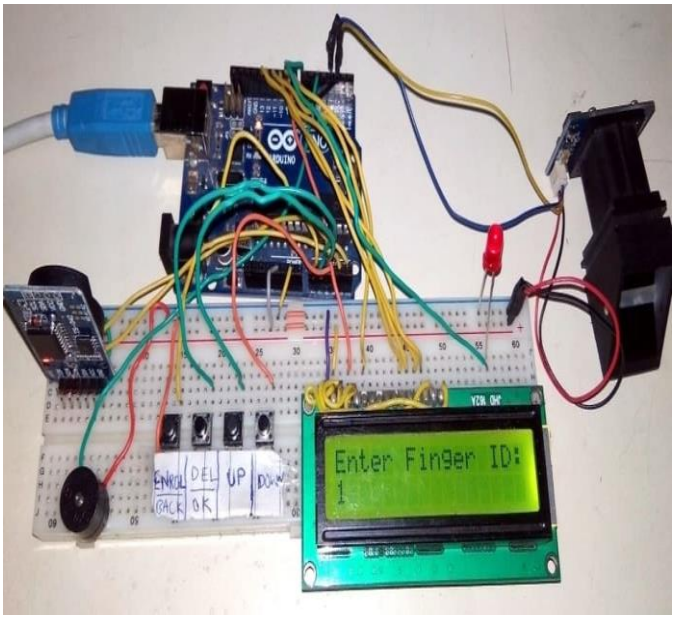


Figure 4 Working Prototype Image

### 3.3.10 IOT (Internet of Things)

The secure vote transmission system seamlessly integrates with the Internet of Things (IOT), enabling real-time monitoring and reporting of the voting process. Sensors and connected devices track every step, from ballot collection to final tabulation, providing complete visibility and transparency.

Live data streams are securely transmitted to a centralized dashboard, allowing election officials to closely monitor the system's performance and quickly identify and address any irregularities. This IOT-powered approach ensures the integrity of the voting process and boosts public confidence in the results.

### 3.3.11 Image Processing

Image processing is the manipulation and analysis of digital images to enhance them or extract useful information. It is widely used in fields such as medical imaging, remote sensing, and computer vision, employing techniques such as filtering, edge detection, and feature extraction, the biometric datas are being transmitted from the device to the main station, from main station to the substation and finally reaches the EVM (Electronic Voting Machine) directly.

### 3.3.12 Ensuring Security and Integrity

While the integration of IOT in electoral systems holds immense potential, it is not without its challenges. Privacy concerns, cyber security threats, and the digital divide are some of the key considerations that must be addressed to ensure the equitable and secure implementation of IOT-based electoral systems and it can be solved using Sophos and Cloud Next Generation Fire Walls which avoid multiple data trafficking and the datas are being safe and secured. Sophos is a cyber security company known for providing advanced threat protection solutions. One of its notable offerings is the Sophos XG Firewall, a next-generation firewall (NGFW) designed to secure networks with comprehensive threat protection. It combines deep packet inspection, intrusion prevention systems (IPS), web and application filtering, and real-time threat intelligence to guard against advanced cyber threats. Sophos NGFWs are renowned for their synchronized security feature, which allows the firewall to communicate with endpoint security products for enhanced threat detection and response.

Cloud Next Generation Firewalls (Cloud NGFWs) extend the capabilities of traditional NGFWs to cloud environments. They are designed to protect cloud-based assets and applications from threats while maintaining the flexibility and scalability of cloud infrastructure. Cloud NGFWs integrate seamlessly with cloud service providers like AWS, Azure, and Google Cloud, offering features like virtual private network (VPN) support, automated policy management, and advanced threat analytics. These firewalls provide visibility and control over network traffic, ensuring secure and compliant operations in cloud environments.

In essence, both Sophos and Cloud NGFWs represent the evolution of firewall technology, addressing the sophisticated threat landscape and the growing adoption of cloud computing.

### 3.3.13 System Software

### 3.3.13.1 Embedded C Programming Language

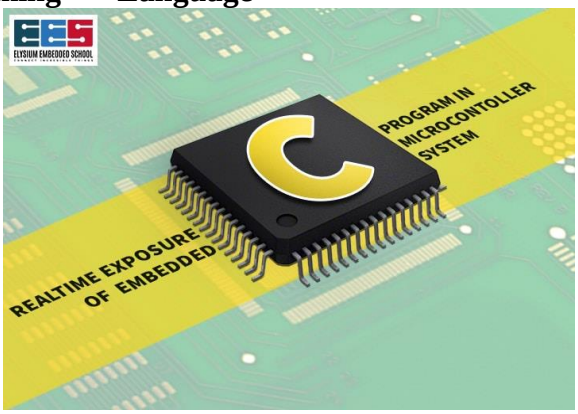


Figure 5 Embedded C Program Diagram

Embedded C is an extension of the C programming language tailored for programming embedded systems, which are small computing devices within larger systems. It focuses on efficiency, direct hardware interaction, real-time operation, and often involves specialized development tools for specific microcontrollers and also for arduino boards.

## IV. RESULTS

The secure vote transmission system leverages cutting-edge IOT and cloud computing technologies to enable 100% pooling of votes. By seamlessly integrating the Arduino board, ESP8266 WiFi module, LCD touch screen, fingerprint sensors, and camera, the system ensures reliable, tamper-proof transmission of votes from main stations to sub-stations and finally to the EVM machines.

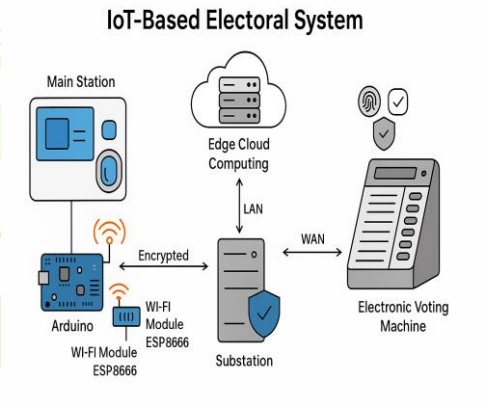


Figure 6 Sample Outputs

### 4.1 Citizens Residing Within the Country

Name: Mohandas Karamchand Gandhi
Gender: M
City: Gujarat
Country: India
Ward Name: Porbandhar
Ward No: 1
Aadhar Card No: 123456789012
Voter ID: 1001
Political Party: Indian National Congress Party
Party Symbol: Hand
Biometric Recognition: Recognized
Sending voter data to mainstation
Sending voter data to substation...
Sending voter data to EVM machine…

**4.2 For Citizens Residing in Abroad**

Name: Subash Chandra Bose
Gender: M
City: Washington
Country: USA
Ward Name: Calcutta
Ward No: 2
Aadhar Card No: 987654321012
Voter ID: 1002
Political Party: All India Forward Block Party
Party Symbol: Tiger
Biometric Recognition: Recognized
Sending voter data to mainstation
Sending voter data to substation...
Sending voter data to EVM machine.

## V. CONCLUSION

The convergence of IOT technology and electoral systems represents a paradigm shift in democratic governance. By leveraging the power of connectivity, transparency, and security, IOT- based electoral systems promise to revolutionize the way we conduct elections, ensuring fairness, integrity, and inclusivity in the electoral process. As we embrace the digital age, let us harness the transformative potential of IOT to strengthen democracy and uphold the fundamental principles of freedom, fairness, and equality.

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