Advantages of Smart EVM

The proposed IoT-based Smart EVM is aimed to overcome the deficiencies of traditional EVMs by incorporating advanced features like biometric voter authentication, secure cloud-based vote storage, and real-time election monitoring. The system is based on few key components that cooperate effectively to ensure the security of this voting process and make it efficient yet user-friendly.

System Architecture

The core part is the Arduino Uno, being the central microcontroller that collects acts of other hardware components in the whole system. The ESP32 module provides Wi-Fi access, so the system can automatically update vote data in a cloud server in real time. It may ensure the safe storage of votes and the proper monitoring of the votes by officials located in a remote area.

The Fingerprint Sensor Module scans the fingerprint of the voter and checks against a pre-registered database to verify his/her identity. Therefore, the security is enhanced by only allowing qualified voters eligible to participate in the election. Upon verifying the voter's identity, they are then given a set of Push Buttons representative of available candidates. The voter selects his preferred candidate by pressing the button representative of that candidate.

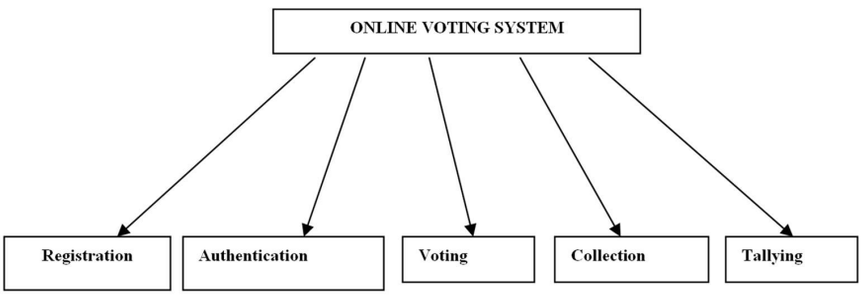
Challenges and Limitations

Though IoT-based Smart EVM has many advantages, still there are several challenges and limitations that need to be addressed:

Cybersecurity Risks: The need to rely on cloud storage as well as the use of network connectivity exposes the system to cybersecurity risks like hacking, denial-of-service attacks, and other breaches in data. To protect against cyber risks, such vulnerabilities need to have robust encryption protocols and secure authentication mechanisms implemented. Constant updates and patches on the system will also come in handy protecting emerging vulnerabilities.

Infrastructure Requirements The IoT-based Smart EVM is proposed to be deployed with high-speed internet connectivity which may not be available in all regions, mainly in rural and underdeveloped areas. It will also handicap its real-time transfer of vote data to the cloud if this network connectivity is not available.

Cost: The component of the hardware could be rather expensive to procure and keep up for the IoT-based Smart EVM, which consists of the fingerprint sensor, OLED display, ESP32 module, and cloud server. The cost of spreading the system implementation across large masses, especially in developing countries, would be a significant barrier.



Conclusion

The IoT-based Smart EVM is a new concept developed with the objective of changing the security, transparency, and efficiency characteristics in the process of the electoral system. Most of the drawbacks that traditionally existed within an EVM have been overcome due to the introduction of this system with real-time vote transmission, user-friendly feedback mechanisms, and biometric authentication. Since all the components, including Arduino Uno, ESP32, fingerprint sensors, buzzers, LED indicators, OLED displays, and cloud servers are used, the voting process is secure, transparent, and accessible to all voters.

Even so, the benefits that it provides hold great promise for electoral modernization. Cyber risk and infrastructure requirements carry a very high price. This opens the door for such an IoT-based Smart EVM to play a pivotal role in election processes making them highly intelligent and efficient. In the not-so-distant future, as the technology would continue to evolve further, solutions like the Smart EVM are going to be an inseparable component of electoral systems from all over the world.