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## Method of screening and securing voting machines using Internet of Things

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- **Title:** Method of screening and securing voting machines using Internet of Things.

- **Abstract:**

An intelligent method that will enable voting machines or similar equipment's used for elections to improve overall election procedure by having real-time monitoring, screening and security by adopting latest communication technologies

- **Problem Solved:**

Electronic voting technology has provided a significant improvement over paper-based voting systems, where votes were counted by hand and had multiple problems in terms of printing, storage, transportation and security.

E-voting and I-voting have seen increased acceptance over the years, but still there are various problems related to monitoring and managing the equipment like getting the equipment health status, malfunction or faults details, counting of votes, location of the machines pre and post elections, most of these can be solved by using latest technologies.

Any malfunction in voting machines is not easy to identify, even after running variety of tests before the voting machine getting shipped to the election area or booth, and in case of any failure, the reporting of problem is mainly manual to the election commission or authorities responsible for the election to take any action, sometimes it takes substantial time for the authorities to replace the faulty machine's and the election for that area or location will be postponed to later date due to higher turnaround time, these delay can impact the election outcome.

It is not easy to figure out that voting machines are tampered, and always difficult to prove its working as per design, and also quite challenging to track the current location of the machines due to physical monitoring.

Very difficult to track the movement of the voting machines, whether shifting of voting machines from polling booth to the centralized store (where the votes will be counted) or even when the voting machines resides in the store after the voting but before the counting days.

It is not easy to conduct an election in a single day for large countries, generally it is done in multiple rounds to cover geographical large countries and elections are declared after few days or week, as voting machines has to be transported at the counting station and once all the machines reaches then only the counting starts. Security of the voting machines are always questionable due to unavailability of real-time status for such a long time

- **Prior Solutions:**

Below listed are few of the solutions mainly related to concerns expressed in above section, but these solutions are manual, prone to errors and cannot be fully trusted.

- a. Physical supervision of voting machine to avoid any tampering, there is no real-time monitoring.
- b. As soon as the malfunction is detected, request for the replacement of the faulty machines is raised but turnaround time is high which increases cost and adds more logistics problems.
- c. Trust on polling booth security in charge or presiding officer information for the location and custody of the voting machines to provide the right status.
- d. Counting begins only when all the voting machines reaches the counting station.

- **Description:**

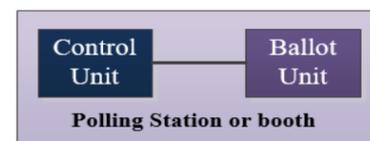
Communication or Telecom industry is continuously growing and adopting new generation of technology which is influencing the day to day life by bringing customer friendly services. Telecom industry evolution and potential coverage throughout a given country can help in multiple ways.

In larger democratic countries like India, USA etc. not easy to track, manage and monitor all the voting machine failures throughout the country. Voting is considered as a fundamental right, and authorities do their best to preserve the voting machines and the votes. Nowadays few of the machines are now capable of communicating over the internet.

A method can be implemented which will extract all the relevant data from IoT (Internet of Things) enabled voting machines. Internet of Things is already proven technology with numerous use cases like Smart appliances, Fleet management, Connected Cars, Smart Cities, Smart Street Lighting, Smart Metering, Smart Homes, healthcare, retail industries etc.

Adoption of Internet of things technology will provide the real-time information about these machines in terms working or health status, any malfunction, votes, current location of the machines, etc.

Electronic Voting Machine consists of two separate units Control and Ballot unit as shown in Figure 1, the ballot unit which is used by voters to register vote is connected to the control unit. Apart from configuration of candidate list, the management of ballot unit is completely done from the control unit.



**Figure 1**

Once the sensors are implemented at both type of units, lot of valuable information and significant parameters from both these units can be collected, as implemented sensors can send signals to the IoT platform using various protocols depends on type of sensors like temperature, operations performed, proximity, GPS, etc. as shown in Figure 2

Sensors as shown in Figure 2, will send all the collected data to the IoT applications/platform over secure interface, the IoT applications/platform will aggregate data collected from all the monitored units spread across all the polling booth or stations.

Real-time monitoring will also help to provide quick turnaround time in case any issue has been identified based on pre-defined conditions.

Apart from monitoring of the units, the collected real-time location data will also help in creating a geo-fencing (virtual boundary for a real area) for both control and ballot units. If the units location crosses or goes outside of the geo-fencing area the notification can be sent to alarm authorities. Collected data will help to calculate the duration how long the machines are kept at specific location like polling booth or store even after the voting but before the counting.

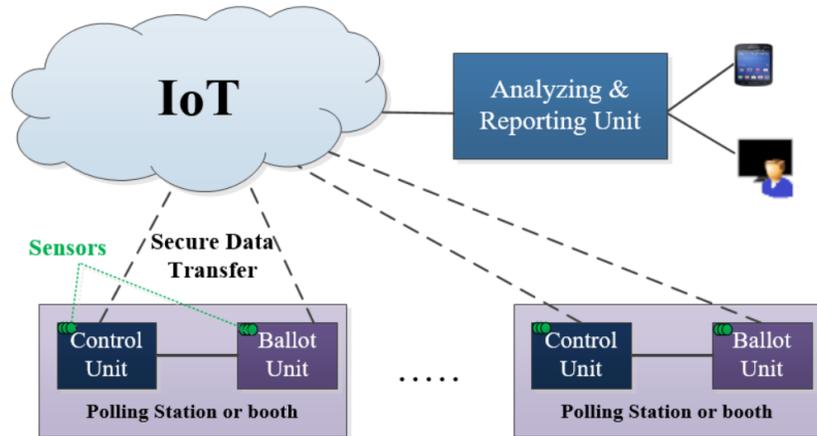


Figure 2

Later all the collected data from all the units will be made available to the ARU (Analyzing and Reporting Unit) for real-time analyzing and generating meaningful end reports for the authorized users identified for monitoring and managing the systems. Depends on the implementation of the ARU it is also possible to send the status reports to mobile users by using text message, based on the signals received the ARU can provide the real-time counting of votes.

Once these voting appliances or machines have capabilities to transmit the data similar to IoT devices then various platform and applications can be leveraged related to Internet of Things and analytics. For example

- Validating the identification of the voters
- Storing all the result at the centralized database or even in cloud for more security and quickly declaring the results.

- **Advantages:**

- a. 24x7 monitoring of the machines with geo-fencing enabled.
- b. Manual reporting of tampered machines will be ruled out, as all the machines will be monitored real-time and any possible replacement can be done much quickly as compared to earlier.
- c. The movement and location of machines can be easily tracked, which was not possible earlier.
- d. This method will bring advanced continuous remote security to the voting machines.
- e. Technology adoption to improve the overall electoral procedure