An Enhanced Online Voting System Using Mobile Agent and Associative Rule

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ABSTRACT

Human involvement in the electoral processes resulted into several issues such as election's fraud, arguments and violence. Electronic voting system which employs the use of computer system in organizing and managing electoral process were proposed by different studies with different techniques. This online system is expected to satisfy security requirements in the electoral process. Unfortunately, several attempts in online voting, focus on registration, authentication and vote casting phase while vote counting phase which is the determinant of any successful electoral process has not received proper attempt. This invariably shows that most of the existing systems developed have not been able to provide the necessary trusted platform for electoral process due to some technical flaws during vote counting. It is obvious that irregularities in election results, often lead to post-election violence. This study proposed an intelligent mobile agent for gathering and collation casted votes and max miner algorithm for proper classification of collated votes. Thus, eliminating irregularities in election results and satisfies necessary security requirements in election.

Keywords: Online voting, Mobile intelligent agents, Associative rule mining, Classification, Vote counting

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1. INTRODUCTION

Free and fair elections and voting are the essential ingredients for a democratic nation. Elections allow the populace to choose their representatives express their preferences for how they will be governed. Thus, the integrity and accuracy of election process is fundamental to the integrity of the democracy itself (Htet and Aye, 2013). Electronic voting has been considered to be an efficient and cost-effective alternative compared to the traditional classic voting procedures. Electronic voting technologies that have been in use varies from punch cards, optical scan voting systems and specialized voting kiosks, including self-contained direct-recording electronic (DRE) voting systems (Ali, 2012). Electronic voting encompasses several different types of voting embracing both electronic means of counting votes which includes punched cards, optical scan voting systems and specialized direct recording electronic voting system (Adebayo et. al., 2014). The integrity of any country's democracy rest solely on the veracity of the electoral process, hence, voting system must be transparent, secured and generally accessible to the populace (Kohno et. al., 2004).

Every voting system design must fulfill certain fundamental requirements which provide a platform for delivery of are liable, impartial and confidential election. These requirements are:

- Security: Ballots ought not to be altered throughout the entire election period.
- Accuracy: The result of the election is accurate and all valid votes are counted;
- Accessibility: The system should permit the casting of votes quickly, in a single session, and must not necessitate any special skill or coerce the electorates
- Transparency: Electorates should be well acquainted and possess utmost understanding of the election proceedings.
- Auditability: There should be room to confirm that all ballots were accurately tallied during vote collation, and there ought to be consistent and obviously genuine voting records (Olaniyi et, al., 2014)
- Auditability and accuracy in e-voting system amongst the aforementioned requirements are the most vital requirements whose purposes are to confirm that all votes were accurately tallied during vote collation and result of the election is accurate and all valid votes are counted. Human involvement especially during collation and counting of votes always results to irregularity and post-election violent. Although many studies have proposed mobile agents for security and load balancing in e-voting system. But, some of the studies have not used mobile agent in collation and counting of votes. This study proposed mobile agents for collation of votes from different voting centers and max-miner algorithm to accurately tallying the votes. Thus, the technique eliminates irregularities in the election and post-election violence.

2. LITERATURE REVIEW

Electronic voting has many advantages over the traditional way of voting. Some of these advantages are lesser cost, faster tabulation of results, greater accuracy and lower risk of human and mechanical errors (Shubhangi et al., 2013). There are many approaches from different studies to the usage of mobile agents in e-voting system, but some of these studies used agents to secure e-voting platform. This study used agents and max-miner for proper tallying and counting of votes

2.1 Mobile Agent

Agent as a software code that can execute a set of operations according to instructions given by a user or another software object. Mobile agents a network computing technology has been applied to solve various parallel and distributed computing problems, including parallel processing, information search and network management (Barna, 2006).

3. METHODOLOGY

E-noting system involves different phases which include registration phase, authentication/vote casting phase and vote tallying and counting phase as it is shown in figure 1

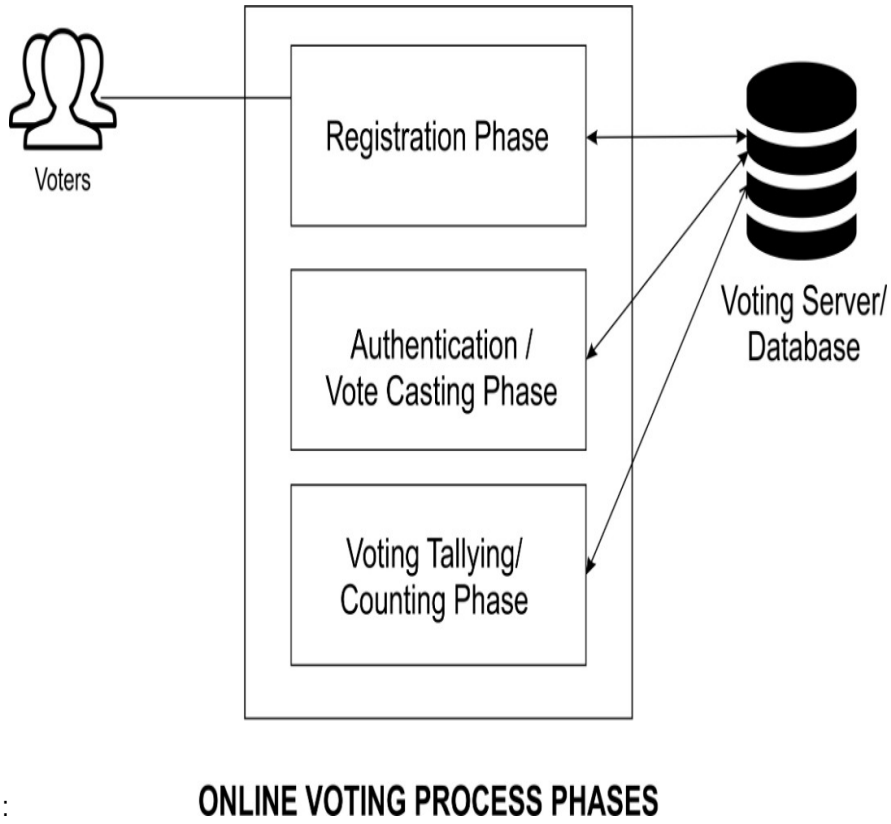

Fig. 1: Online Voting Process Phases

Tallying and counting stage is the final stage of any electoral processes; the stage is performed after the casting of vote has been completed. Before proceeding to the tallying and counting of votes, all the votes must be collated from different voting centers used for the election. E-voting system architecture is depicted in figure 2.

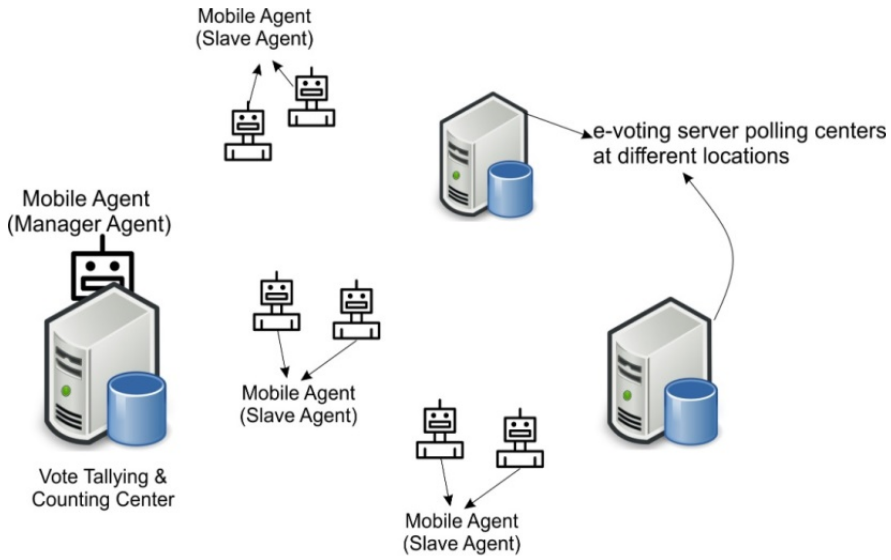

Figure 2: E-voting Architecture

This study used two types of mobile agents which include Manager Agent (MA) and Slave Agents (SA). MA overseeing activities of other agents used in the voting system while SA move around to collate casted votes from all the servers used in the system. All the collated votes and list of legitimate authenticated voters were sent to MA for tallying and counting. MA compares the lists with the received number of votes, if they are the same, then MA used max-miner algorithm to ensure that all votes are properly classified accordingly on bulletin boards. Manager Agent checks the consistency of the election through the lists of authenticated users. The interaction and operations of agents is depicted in figure 3.

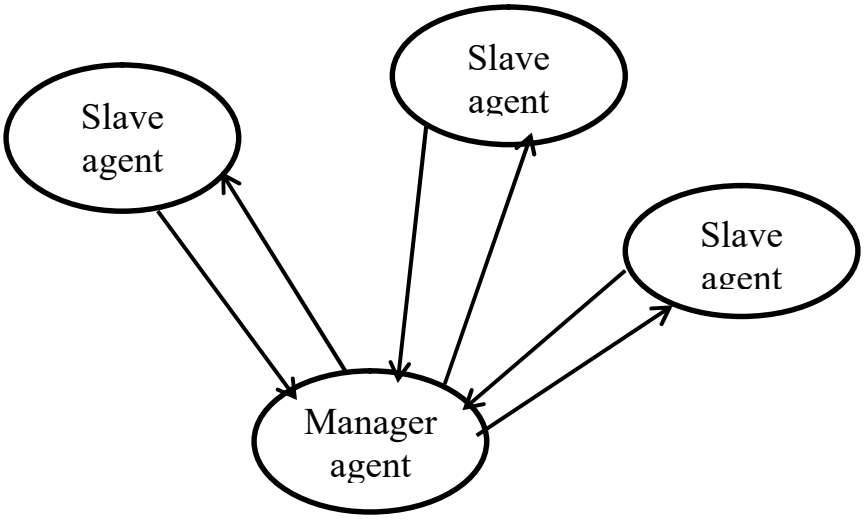

Figure 3: Agents Interaction in the System

In this study, difference objective (D) is used to give operations to each agent in the system for easy coordination of agents so that individual agent generates its plan to achieve their respective goals and avoid conflicts. To assign a role to an agent this can be represented by cap ($a_1, role_1$), where cap means capability of an agent to accomplish the task. The algorithm 1 represents coordination of agents so that individual agent generates its plan to achieve the system objectives and avoid conflicts.

Algorithm 2: Agents Plan Coordination Algorithm (Jeffrey and Edmund, 2005)

Step 1: Input: an inconsistent multi-agent plan
Step 2: Output: an optional and consistence multi-agent plan.
Step 3: Initialize solution to null;
Step 4: Add input plan to search queue;
Step 5: While queue not empty do
Step 6: Select and remove plan P from search queue
Step 7: If (p is bounded by solution) then
Step 8: If (p has no threat flaws) and (p is a cyclic)
Step 9: and (cost (p) < cost (solution)) then
Step 10: Solution =P;
Step 11: End If
Step 12: Select and repair a flaw in Pi
Step 13: Enqueue all required plans in search queue;
Step 14: End If
Step 15: End
Step 16: Return solution

Manager Agent used max-miner algorithm to tally and count the number of votes casted for each candidate and published the results of election on the bulletin board. Max-miner algorithm is depicted in algorithm 2.

Algorithm 2: MAX-MINER

Step 1: MAX-MINER(Data-set T) ;
Step 2: Returns the set of maximal frequent itemsets present in T
Step 3: Set of Candidate Groups c {}
Step 4: Set of Itemsets F {GEN-INITIAL-GROUPS(T C)}
Step 5: **while** is non-empty **do**
Step 6: Scan T to count the support of all candidate groups in C
Step 7: **for each** $g \in c$ such that $h(\mathrm{g}) \cup \mathrm{t}(\mathrm{g})$ is frequent **do**
Step 8: F $F \cup$ {GEN-SUB-NODES $(g$ $c_{new})$}
Step 9: C C_{new}
Step 10: remove F from any itemset with a proper superset in F
Step 11: remove C from any group g such that $h(\mathrm{g}) \cup \mathrm{t}(\mathrm{g})$ has a superset in F
Step 12: **return** F

4. CONCLUSION

Electronic voting systems any elections is a way of overcoming the shortcomings in traditional way of voting. But, irregularities can be eliminated when human involvement in all phases of voting process is erased, especially during tallying and counting phase. The usage of mobile agents and max-miner algorithm reduced irregularities in the election which may result into post-election violent.

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