Prime III: A Multimodal Electronic Voting System

http://www.PrimeVotingSystem.com

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(Summary Description and Claims)

Prime III is a secure, open-source, multimodal electronic voting system that delivers the necessary system security, integrity and user satisfaction safeguards in a user friendly interface that accommodates all people regardless of ability. Moreover, Prime III integrates into the current voting process that the voter is accustomed to using. This approach allows the voter to remain comfortable and confident while using an enhanced voting system. Prime III was designed using user centered design principles that combine security with multimodal user interaction. This multimodal approach permits voters to hear and/or see the candidate names while they cast their votes using voice and/or touch. When voters interact with Prime III using their voice, their privacy is maintained via a numbering system. Prime III prompts voters using numbers instead of names; therefore, voters speak numbers. The candidates are randomly assigned to numbers, which limits an eavesdropper from determining how someone is voting. In addition, Prime III requires that all system monitors face walls in order to protect touch screen voter's privacy, In most voting places, system monitors face the inside of the room, which allows someone to view the voting screen unknown to the voter. These measures allow voters to privately cast their electronic ballots.

Before finalizing their ballot, the voter confirms their selections by looking at the screen and/or listening to the spoken response. After the voter confirms their selections using the touch screen and/or their voice, their ballot is recorded in an encrypted, Portable Document Format (PDF) file amongst many other encrypted imposter PDF files. The encrypted imposter files make it more difficult for a hacker to identify the actual voter ballot files. Finding correct ballot files is like finding a specific strand of hay in one of many hay stacks. Each Prime III system uses restricted access to provide additional security against hackers via SELinux or Microsoft Windows. Furthermore, all interactions on each Prime III machine are video recorded with a date and time stamp. The voters are not captured in the video; only their interactions with Prime III. This is accomplished by directly connecting a video recorder to each Prime III machine using the VGA and audio out ports on each machine. There are no video cameras. As such, the surveillance video provides an actual layer of security against hackers and it serves as an audit trail for recounts. In the event of a recount, election officials can simply watch the video from each Prime III machine and count the votes as the voter intended.

In summary, Prime III implements multiple layers of security to protect against attacks before, during and after the election. Prime III provides video surveillance of each machine for security and audit purposes. With Prime III, every one votes on the same system regardless of ability. To our knowledge, Prime III is the only system that provides equal access via one machine for all voters as required by the Help America Vote Act. Voters that can't see, hear, read or have a physical disability can still vote using Prime III. Furthermore, Prime III can be implemented using multiple languages. Finally, the open-source model allows experts from various disciplines to freely evaluate Prime III. The open-source approach to electronic voting will increase voter confidence as well.

2.0 Architecture and System Design

2.1 System Hardware:

- ✓ Computer System Specification
  - ➢ Processor: Intel Pentium
  - ➢ Video: 64 MB
  - ➢ Ram: 1 GB
  - ➢ Disk Space: 40 GB or more
  - ➢ Network Connection: None
  - ➢ Optical Drive: CD/DVD drive
- ✓ Headset with Microphone
- ✓ Touchscreen: ELO 15 or 18 in. LCD Touchmonitor
- ✓ Video Recorder (VHS)
  - ➢ Tapes (VHS)
- ✓ VGA to Video Converter Box
- ✓ VGA Splitter Cable

2.2 System Software:

- ✓ Java 1.5 or higher Runtime Environment
- ✓ Ubuntu Linux running SELinux or Microsoft Windows
- ✓ Prime III
- ✓ CMU Sphinx-4

3.0 Functional Specification

The design of the system is as such that a trained poll worker is responsible for a voting booth. This worker will initiate the voting process for each voter by entering a unique code. The voter will then proceed to vote by making a number of selections. The first selection is for the voter to choose to vote by Franchise or by Menu. In our test election we replaced the traditional options of voting by Party or by Office with voting for your favorite fast food restaurant and menu in order to relieve any pressure for someone to reveal their political affiliation. Within each visual screen the user is also given an auditory prompt that matches the visual display (see interface design below. The text below each screen shot represents the audio prompts that a voter using the headset would hear).

Prime III allows voters to privately and securely vote using voice, touch or both. The functions provided in Prime III are:

- ✓ Multimodal User Interface - The multimodal user interface for Prime III allows voters to speak or touch their ballot choices. This is accomplished by providing a touch screen interface with an auditory interface. The auditory interface allows voters to cast votes by speaking randomly generated numbers for each candidate. This approach ensures voter privacy. The multimodal user interface allows every registered voter to cast their votes equally using one system. This is a major convenience for all voters regardless of ability or disability.

- ✓ Voting - Before the voter enters the voting booth, a poll worker will initiate the voting session by entering his/her poll worker id. Poll worker ids will be pre-assigned the day of the election when the poll worker arrives at the voting place.

- ✓ Security - Prime III has multiple security measures in place. First, each ballot is stored as an encrypted PDF file. These ballots can be decrypted and printed for later review if necessary. The encrypted key for the ballot files is also encrypted; therefore, there are two layers of encryption for the key. Second, Prime III uses encrypted imposter files to confuse any would be hackers. The imposter files are updated in real time along with the ballot files. Furthermore, the imposter files are no different from the real ballot files. This makes hacking them extremely difficult because the imposter files and the real ballot files are on the hard drive in different directories. The directory structure on the Prime III machines has no pattern. The directory names are numbers and letters of varying length. Third, Prime III uses video to monitor each machine. A separate video recorder is attached to each Prime III machine. The video recorders record all on screen interactions. They do not record the actual individuals voting, therefore, the voters' privacy is not compromised. In the event of an attack on Prime III voting machines; all ballots are recorded on video. Ultimately, this provides a reproducible trail of what actually occurred on each machine. The voters' intent will be clearly captured on each video recorder, yielding an optimal audit trail.

- ✓ Audit Trail - Prime III uses video recorders to record all interactions on each machine. The video provides an audit trail for recounts and security.

- ✓ Ballot Counting - When all votes are in, the election administrator will enter a password that requests Prime III to tally all the votes. All the votes are counted at this time and displayed on the screen. Additionally, the election tally is recorded on the video recorder as well and it can be printed.