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COMPUTERIZED ELECTORAL BALLOT DESIGN USING A TOUCH SCREEN

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All citizens of the United States over the age of 18 have the right to vote. Those who so choose should be able to exercise this right effectively and without confusion. The year 2000 presidential election indicated that many voters were flustered by the ballot, however, leading to the widely debated controversies about the results. Particularly in Palm Beach County, Florida, several display design principles were violated on the ballot, leading to problems for the diverse population using it. This demonstration presents a new system designed to decrease the number of voting errors and facilitate an efficient tallying system, further reducing errors in the counting process. The redesigned ballot also proposes a nationwide standard to alleviate many of the problems exposed by the November 2000 election.

The general voting process with the system outlined here will remain the same: The voter arrives at the designated voting location, checks in, votes, and turns in the ballot. The act of casting a ballot, however, will be fundamentally changed. The conceptual model of the system, the actions possible at any time, and the system's current state will be readily apparent. The system will also allow for backtracking and error recovery throughout the process. Computerization of the ballot system will decrease individual errors and increase the system reliability, and a well-designed and user friendly display will boost voter confidence.

The voting system will use computer interfaces, connected to a small Local Area Network (LAN) at each polling place. The voter sees simple instructions on a monitor that explain the process, then proceeds to make his or her choices, and confirms each choice. The system will use a touch screen to eliminate the problem of ambiguous voter intent. The size of the touch-boxes are designed according to anthropometric principles so that all fingers can easily hit only the correct box (Wickens, Gordon, & Liu, 1998).

In accordance to the consistency principle, each office on the ballot is displayed in the same manner, with black text on a white background to maximize contrast (Wickens, Gordon, & Liu, 1998). The font will be chosen for discriminability and be large enough to allow also those with poor vision to easily read it (Woodson, Tillman, & Tillman, 1992). Colors and graphics will represent the same concept throughout the entire process. Color is only used to reinforce principles, and the total number of colors is limited. All candidates' names will be shown in the left of the screen, and the voting graphics (touch-boxes) on the right for a decluttered display.

To vote the voter simply touches the touch-box next to the preferred candidate. The graphic then changes to provide the voter immediate feedback on the action taken. A confirmation window then appears, asking the voter to confirm the choice made. Instructions are provided for the voter to go back and change his or her vote or continue to the next office. This process is repeated for each office until the voter is satisfied with the choices. The system only allows the voter to choose one candidate for each office, thus alleviating the problem of multiple votes for one office. Ability to easily change a vote also mitigates the stress associated with voting. The feedback received throughout the process gives the voter confidence in the process. Finally, a summary screen appears displaying each election, the name of candidate chosen, and a change box for each. This gives the voter one more chance to verify his or her votes and correct mistakes before submitting the ballot.

The screen's height is adjustable and step stools will be available to accommodate people of varying height and to ensure an optimum viewing angle and the ability to reach the touch screen. After the vote has been confirmed, two hard copies will be printed by a small and inexpensive printer (e.g., similar to ticket printers at the movies or ATMs). One copy is for the voter and the other to be turned in to the election officials in a traditional manner. Candidate names and a bar-code, for a possible recount, are printed. These printouts will serve as a backup in case of loss of data from the computer and a final confirmation of the vote cast by the voter.

The results will be instantly tallied at the polling station over the LAN and given to the canvassing board without the delay associated with manual count. As the security and reliability of the Internet improves, provision for electronically aggregating the results nationwide will also be in place. Possible computer problems, such as crashes and viruses, are minimized: The disk drives are not accessible to the voters and the required hardware and software are very simple, increasing reliability and reducing the cost. Hard copies of the votes provide additional redundancy to the system. The staff at the polling places will also be trained to help voters and troubleshoot the system.

References:

Wickens, C., Gordon, S., & Liu, Y. (1998). *An Introduction to Human Factors Engineering.* New York: Addison-Wesley Longman

Woodson, W., Tillman, B., Tillman, P. (1992). *Human Factors Design Handbook.* New York: McGraw-Hill, Inc.

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