TOUCH SCREEN VOTING MACHINE

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ABSTRACT

This study aimed to develop a device that can make the election easier, faster, and honest. The device is comprised of touch screen tablet, fingerprint scanner, wireless transceivers and thermal printer. The project was designed to address such problems concerning the election issues and indecorum. The issues that were tackled included the features of the touch screen voting system with wireless canvasser and the level of efficiency in terms of functionalities of the touch screen, data transmission, printing, and wireless transmission. It also dealt with the accuracy and efficiency of fingerprint function. The purposively chosen 46 evaluators assessed the design in terms of effectiveness and efficiency of its components. The results of evaluation of the apparatus revealed that the device was effective as a voting system gadget with components that could perform the expected functionalities. Nevertheless, certain factors still need to be considered for the improvement of the device.

Keyword: Engineering, Touch Screen, Voting, Machine, design project, experimental development Philippines

INTRODUCTION

The right of individuals to vote for representatives is at the heart of the democracy that they enjoy today (ShaAlam, 2004). According to IBIMA 2004, election is a process in which voters choose their representatives and express their preferences for the way that they will be governed; thus an election is a way to elect the leaders that people think can help the society. "Naturally, the integrity of election process is fundamental to the integrity of democracy itself," Amangan (2010) said. Historically, great effort and care have been taken to ensure that elections are conducted in a fair manner such that the candidate who should win the election is based on the vote counts (Park, 2013). Yet, there were still a lot of problems that occurred during election despite the implementations of strict rules and regulations.

In global setting, Daniel Rubin stated that "One person, one vote," a guiding principle of America suffrage, is devalued when votes are lost, miscounted, or erroneously discarded. In Florida, the nation's system for casting and counting ballots was antiquated, unreliable, often capricious and unable to produce a clear-cut winner in an election with razor-close margin (Beaker & Keating, 2000). Bjornlund statement was "International election monitoring often falls apart after Election Day, after the large delegations have departed and the international media have their attention elsewhere."

For the Philippines, Lordz Den (2010) described how the Filipinos voted through traditional way of writing manually the names of their chosen candidates in an ordinary piece of paper. It has always been a burden for public teachers who served as poll watchers to do the counting of votes which took for days and the long process has been the cause of countless fraud. As a result, candidates would file an appeal to the Commission on Elections (COMELEC) to review the counting of votes because of the alleged cheating in elections. Manual voting system encourages fraudulent election practices like tampering of election returns and statements of votes. Many lives were put to risk or even lost before, during and after election because of the anomalies done

to win the candidacy for a certain position (Dejaño, Henry. Personal Interview, 29 August 2009).

In local setting, the Bagong Alyansang Makabayan has expressed apprehension on possible failure of election because some of the ballots were invalidated and that there was no transparency in the transmittal of the election results, as cited by John Birondo in BAYAN-SMR. As observed by Cheryll D. Fiel, the use of Precinct Count Optical Scanner Machine or PCOS Machine still encountered problems as some flashcards used in certain area were defective and could not be read during the canvassing. In the University of Immaculate Conception, the process of student election is slow and therefore, is not far different from the national government elections done periodically.

A research study about voting system is important to generate valid information for the welfare of the public. It is essential because the people must be enlightened regarding all aspects of the electoral process since the society will be affected in every decision or policy made by elected government official. With all the issues and arguments stated, the researchers found this study relevant. Thus, research effort aimed to develop a voting machine that can speed up the voting process, provide easy operation, establish accuracy in transmitting data and prevent counterfeit votes. As technology is rapidly advancing, most of processes are done through automation and with this device; election process can be performed faster. Consequently, the researchers came up with an idea to innovate the traditional way of voting by making the process technically advanced.

The study aimed to construct and develop a Touch Screen Voting System with Wireless Canvasser using Biometric Fingerprint to have easier and faster election process and also to avoid counterfeiting of votes.

Specifically, it sought to answer the following questions:

1. What are the features of the Touch Screen Voting System with

Wireless Canvasser?

2. What is the level of efficiency in terms of:

   a. Functionality
      - Touch Screen
      - Data Transmission Component
      - Printing

   b. Wireless Transmission
      - Distance
      - Obstruction
      - Speed

   c. Accuracy
      - Fingerprint

METHOD

This design project was done through experimental development method and descriptive approach. Experimental method was made in trial and error manner of which all components were assembled in accordance to their functions. On the other hand, descriptive method was done for the evaluation of the functionalities of the device.

The study was conducted at the University of the Immaculate Conception in Davao City. This is a Catholic university run by the Religious of the Virgin Mary (RVM) Congregation which has been in existence for over 105 years. The proponents for this study did the design project, specifically in the UIC Bonifacio Campus at Electronics Engineering Laboratory Room 503.

The proponents used a 5-point Likert scaled researcher-made questionnaires as evaluation tools. This survey instrument which was

given to selected respondents, consists of set of questions answerable with *Strongly Agree, Agree, Moderately Agree, Disagree, Strongly Disagree.* The effectiveness of the touch screen voting machine was based on satisfactory rating given by evaluators for the machine's functionality.

The following functionality test procedure served as a guide for proper handling and installation of the system:

Testing Procedure Owner Side (2 Precincts):

- Plug the Touch Screen Voting Machine with Wireless Canvasser to a 220 Volts outlet.
- Turn on the tablet.
- Run the application "Voting Machine."
- Login username and password as administrator.
- Register the candidates and students.
- Click the button "VOTE NOW."
- In canvasser part, run the application "Voting Machine" in another computer.
- Plug in the 2 USB ports in the desired ports in the computer.

Testing Procedure Student Side:

- Register first before voting. Contact the administrator for more information.
- To vote, enter the ID number.
- Tap your finger in the fingerprint reader.
- Choose your representatives and click next to proceed.
- After voting, get your voting slip.

The evaluators of this research was comprised of five (5) COMELEC personnel, eight (8) program officers, eight (8) candidates and 5 engineering students per year level. The panel which was composed of engineering faculty members in the University of the Immaculate Conception also evaluated the voting system.

A survey was conducted to these evaluators after the researchers have completed the testing of accuracy and functionality of the machine. The results of the evaluation were tabulated and analyzed using descriptive statistics, particularly the mean. The mean was interpreted with respect to the level of functionality as reflected in the matrix below.

Mean Level	Descriptive Rating	Interpretation
4.20 – 5.00	Very High	It means that the system always exhibits the feature's functionality.
3.40 – 4.19	High	It means that the system often exhibits the feature's functionality.
2.60 – 3.39	Moderately High	It means that the system sometimes exhibits the feature's functionality.
1.80 – 2.59	Low	It means that the system rarely exhibits the feature's functionality.
1.00 – 1.79	Very Low	It means that the system never exhibits the feature's functionality.

Technical Flowchart

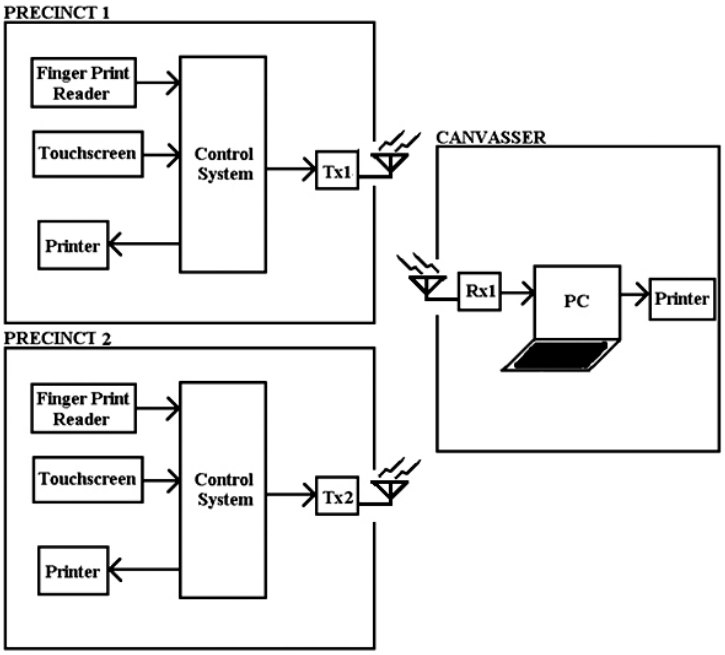

Figure 1. Flowchart for the Touch Screen Voting Machine with Wireless Canvasser

Figure 1 shows the flow chart for the operation of the touch screen voting machine with wireless canvasser. As revealed by the figure, the touch screen voting system with wireless canvasser will work once a biometric fingerprint reader recognized a registered voter. The system will check scanned fingerprint to match previous fingerprint from database. If multiple voting occurs, the system will reject the voting procedure. Otherwise, the touchscreen will indicate that it is ready for use. After the voter is done choosing his candidates, the printer will produce a voter's slip which proves that he/she has successfully voted. The data will be stored in the memory and sent via transceiver to the PC server which acts as a Canvasser. The Personal Computer will automatically tally, print and display the votes from the two precincts.

RESULTS AND DISCUSSION

Features of the Device

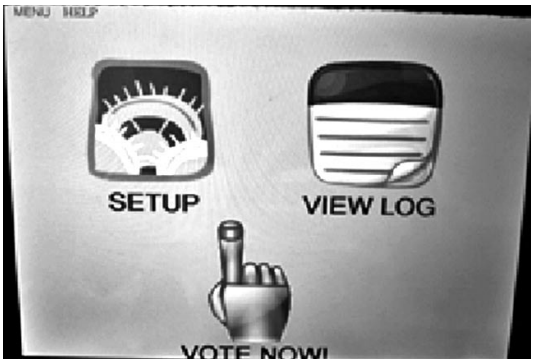

Image 1. Touch Screen Tablet Pc

Image 1 shows one of the features of the device which is the touch screen tablet pc where all programs and GUI (Graphic Unit Interface) are installed. The touch screen has its own hard drive where all data of the student can be saved.

Image 2. Fingerprint Scanner

Image 2 presents the fingerprint scanner of the device. It accepts fingerprints of the voters. These fingerprints accepted by the device will be inputted on the touch screen to verify the voter's identity.

Image 3. Printer and Thermal Printer

Image 3 pictures the printer and thermal printer of the device. It will print the tallied result on the canvasser portion. The thermal printer will provide the voter's copy. It also prints name, date and time the voter is done voting.

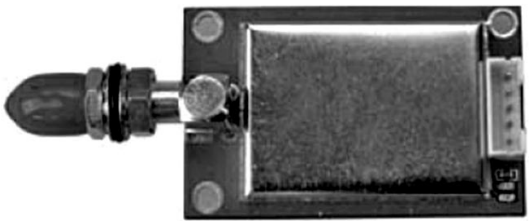

Image 4. Transceiver

Image 4 depicts transceiver of the device. It transmits the data from the precinct to canvasser and from precinct to precinct. The data transmitted from the precinct to canvasser are the votes cast by the voters. The data transmitted from precinct to precinct are the data informing those facilitating the voting process in the latter that the voter has already cast his votes and therefore shall not be allowed to vote anymore.

Table 1A. Functionality Level of the Touch Screen

TOUCH SCREEN				
Items	Mean	Standard Deviation	Descriptive Rating	Interpretation
1. The touch screen is sensitive in terms of pointing and cursor hovering.	4.63	0.48	Very High	ALWAYS
2. The device can detect finger to use as a mouse.	4.76	0.43	Very High	ALWAYS
3. The user can utilize the touch screen to control what is displayed.	4.76	0.43	Very High	ALWAYS

Table 1A shows the data describing the average levels of the functionality of the design in terms of the Touch Screen as evaluated by forty-six (46) evaluators. As revealed by the table, Item 1 gets a mean of 4.63 and standard deviation of 0.48 with a descriptive rating of very high which means that the Touch Screen Voting Machine with Wireless Canvasser ALWAYS shows that *the touch screen is sensitive in terms of pointing and cursor hovering.* Item 2 and Item 3 gets a mean of 4.76 and standard deviation of 0.43 with a descriptive rating of very high which means that the Touch Screen Voting Machine with Wireless Canvasser ALWAYS shows that *the device can detect finger to use as a mouse and the user can utilize the touch screen to control what is displayed.* It can be observed that Item 1 gets the lowest mean among the items. This might be because of the super sensitivity of the touch screen as observed by the evaluators. Items 2 and 3 have the same mean values which imply that the evaluator agreed on these items.

Table 1B. Functionality Level of the Data Transmission

DATA TRANSMISSION				
Items	Mean	Standard Deviation	Descriptive Rating	Interpretation
1. The device will receive the data transmitted without error.	4.80	0.40	Very High	ALWAYS
2. The device will analyze the data transmitted without error.	4.85	0.42	Very High	ALWAYS
3. The receiving portion of the device cannot recognize any data from the other wireless devices	4.76	0.52	Very High	ALWAYS

Table 1B shows the data describing the average levels of the functionality of the design in terms of the Data Transmission as evaluated by forty-six (46) evaluators. As revealed by the table, Item 1 gets a mean of 4.80 and standard deviation of 0.40 with a descriptive rating of very high which means that the Touch Screen Voting Machine with Wireless Canvasser ALWAYS shows that *the device will receive the data transmitted without error*. Item 2 gets a mean of 4.85 and standard deviation of 0.42 with a descriptive rating of very high which means that the Touch Screen Voting Machine with Wireless Canvasser ALWAYS shows that *the device will analyze the data transmitted without error*. Item 3 gets a mean of 4.76 with a descriptive rating of very high which means that the Touch Screen Voting Machine with Wireless Canvasser ALWAYS shows that the receiving portion of *the device cannot recognize any data from the other wireless devices*. Item 4 gets a mean of 4.87 and standard deviation of 0.34 with a descriptive rating of very high which means that the Touch Screen Voting Machine with Wireless Canvasser ALWAYS shows that *the data transmitted will automatically be inputted in the canvasser*. It can be observed that the Item 3 gets the lowest mean among the items. It might be because of the trashed "dirt" that enters on the receiver portion.

Table 1C. Functionality Level of the Printing

PRINTING FUNCTION				
Items	Mean	Standard Deviation	Descriptive Rating	Interpretation
1. The device will print within 5second after the last candidate has been chosen or the necessary skip buttons were pressed.	4.85	0.42	Very High	ALWAYS
2. The device will also reflect the date at the bottom portion of the print-out.	4.80	0.45	Very High	ALWAYS
3. The device will print the name of the voter.	4.85	0.36	Very High	ALWAYS

Table 1C shows the data describing the average levels of the functionality of the design in terms of the Printing Function as evaluated by forty-six (46) evaluators. As revealed by the table, Item 1 gets a mean of 4.85 and standard deviation of 0.42 with a descriptive rating of very high which means that the Touch Screen Voting Machine with Wireless Canvasser ALWAYS shows that *the device will print within 5 seconds after the last candidate has been chosen or the necessary skip buttons were pressed.* Item 2 gets a mean of 4.804 and standard deviation of 0.45 with a descriptive rating of very high which means that the Touch Screen Voting Machine with Wireless Canvasser ALWAYS shows that *the device will also reflect the date at the bottom portion of the print-out.* Item 3 gets a mean of 4.85 and standard deviation of 0.36 with a descriptive rating of very high which means that the Touch Screen Voting Machine with Wireless Canvasser ALWAYS shows that *the device will print the name of the voter.* It can be observed that all of the items have mean values ranging from 4.80 to a perfect 5.00 rating which indicate that the evaluator's strongly agreed that the design's printing operation is at its best functionality. In the table, Item 2 gets the lowest

mean because some evaluator cut in half the voter's copy so that the date on the bottom part can no longer be seen.

Table 1D. Functionality Level of the Wireless Transmission

WIRELESS TRANSMISSION				
Items	Mean	Standard Deviation	Descriptive Rating	Interpretation
1. The device will transmit data within 400 meter radius.	4.76	0.43	Very High	ALWAYS
2. The device can receive data within 1 second in 400 meter radius.	4.80	0.40	Very High	ALWAYS
3. The device will not receive data from other devices within 400 meter.	4.74	0.49	Very High	ALWAYS
4. The device will transmit data within 400 meter radius even though there is physical obstruction to its pathway.	4.71	0.50	Very High	ALWAYS

Table 1D shows the data describing the average levels of the functionality of the design in terms of the Wireless Transmission as evaluated by forty-six (46) evaluators. As revealed by the table, Item 1 gets a mean of 4.76 and standard deviation of 0.43 with a descriptive rating of very high which means that the Touch Screen Voting Machine with Wireless Canvasser ALWAYS shows that *the device will transmit data within 400 meter radius.* Item 2 gets a mean of 4.80 and standard deviation of 0.40 with a descriptive rating of very high which means that the Touch Screen Voting Machine with Wireless Canvasser ALWAYS shows that *the device can receive data within 1 second in 400*

meter radius. Item 3 gets a mean of 4.74 and standard deviation of 0.49 with a descriptive rating of very high which means that the Touch Screen Voting Machine with Wireless Canvasser ALWAYS shows that *the device will not receive data from other devices within 400 meter*. Item 4 gets a mean of 4.71 and standard deviation of 0.50 with a descriptive rating of very high which means that the Touch Screen Voting Machine with Wireless Canvasser ALWAYS shows that *the device will transmit data within 400 meter radius even though there is physical obstruction to its pathway*. It can be observed that all of the items have mean values ranging from 4.71 to a perfect 5.00 rating which indicate that the evaluator's strongly agreed that the design's Wireless Transmission operation is at its best functionality. In table, the item 2 gets the highest mean. It means that most of the evaluators agreed that the data can be received by the canvasser within or less than 1 second. Item 4 gets the lowest mean because some evaluators cannot really determine how far the distance really was.

Table 1E. Evaluation result of the Finger Print Function

FINGER PRINT FUNCTION				
Items	Mean	Standard Deviation	Descriptive Rating	Interpretation
1. The device can read or scan a fingerprint.	4.91	0.28	Very High	ALWAYS
2. The device is accurate in identifying the fingerprint of a person.	4.80	0.40	Very High	ALWAYS

Table 1E shows the data describing the average levels of the functionality of the design in terms of the Touch Screen as evaluated by forty-six (46) evaluators. As revealed by the table, Item 1 gets a mean of 4.91 and standard deviation of 0.28 with a descriptive rating of very high which means that the Touch Screen Voting Machine with Wireless Canvasser ALWAYS shows that *the device can read or scan a*

fingerprint. Item 2 gets a mean of 4.80 and standard deviation of 0.40 with a descriptive rating of very high which means that the Touch Screen Voting Machine with Wireless Canvasser ALWAYS shows that *the device is accurate in identifying the fingerprint of a person*. It can be observed that all of the items have mean values ranging from 4.80 to a perfect 5.00 rating which indicate that the evaluator's strongly agree that the design's Fingerprint reading operation is at its best functionality. In table, Item 1 gets the highest mean and a standard deviation of 0.28 which mean that most of evaluators strongly agreed that the device can really scan the finger print. Item 2 gets the lesser mean because some of evaluators did not try to use their finger for the fingerprint enrolment and verification.

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