INNOVATIVE DESIGN OF ELECTRONIC BALLOT FOR GENERAL ELECTION

Thet Ni Moe[1], Khin San Yee[2], Aye Aye Myint[3]

Abstract

An innovative design of electronic voting system is introduced. It is intended to use in coming general election 2020 in Myanmar. The voting system consists of an Arduino Mega 2560 development board, a 3.5 inch TFT (Thin Film Transistor) color graphic liquid crystal display with micro SD card module, a non-contact distance sensor module, voting input switches, control input switches for polling officers, reset input switch, display LED indicators and two 3.7V rechargeable li-ion batteries. The system is capable of detecting and counting the incoming voter and votes. The voting was restricted exactly only one vote for each voter. The list of candidate and operating information are display on the LCD. The voting results are stored in a micro SD card. The circuit design helps the electoral process more efficient and speed up the processing of results and voting easier.

Keywords: Arduino MEGA, 3.5 inch TFT LCD, Micro SD Card, Printed Circuit Board (PCB)

Introduction

An election is a formal group decision-making process by which a population chooses an individual to hold public office. Elections have been the usual mechanism by which modern representative democracy has operated since the 17th century. The vote is a formal indication of a choice between two or more candidates or courses of action, expressed typically through a ballot or a show of hands. The ballot is a system of voting secretly and in writing on a particular issue. The voting can be used to choose someone or something. People choose the leader or ruler by voting.

In some cases, vote decisions are made for projects that will develop the country or destroy the natural resources. In practice, a secret ballot is used to prevent voters from being intimidated or threaten and protect their privacy.

Now, Myanmar is one of the democracy countries and general elections are made on every five years. There are many difficulties, large budget costing, and upcoming arguments on every general election. Therefore, an innovative design of electronic ballot was designed and presented to use in coming general election 2020. The system design is large and complex, but it is reliable and easy to use for both voters and polling officers.

The system design consists of an Arduino Mega 2560 development board, a large TFT color LCD display with micro SD card module, a non-contact distance ranging sensor module (HCSR04), a piezo buzzer, a few input switches, two LEDs, and two 3.7V li-ion batteries. The system is constructed on a specially designed printed circuit board. The Arduino Mega is loaded with a program code to operate the circuit.

The system design will automatically detect the presence of voter. If there is a voter in front of the sensor, the red LED illuminated and LCD describe the presence of voter and count the number of voter in the system memory. At the moment, the voter can search the candidate and vote using input switches given for voter. The voting can be made only one time for each visitor by created program code. After voting was successful for the voter, he or she has to leave from the sensor area within a few seconds. If the voter is not leaving within the predefined period, an alarm

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will continuously generate from the buzzer. When the voter leaves the area, the alarm will stop and the green LED illuminated, illustrating it is ready for next voter. The counted votes are stored in a micro SD card for voting officers. Moreover, the system provided to view or delete the result on the system LCD by using some input switches. Basic structure of the system design is illustrated with a block diagram in Figure 1.

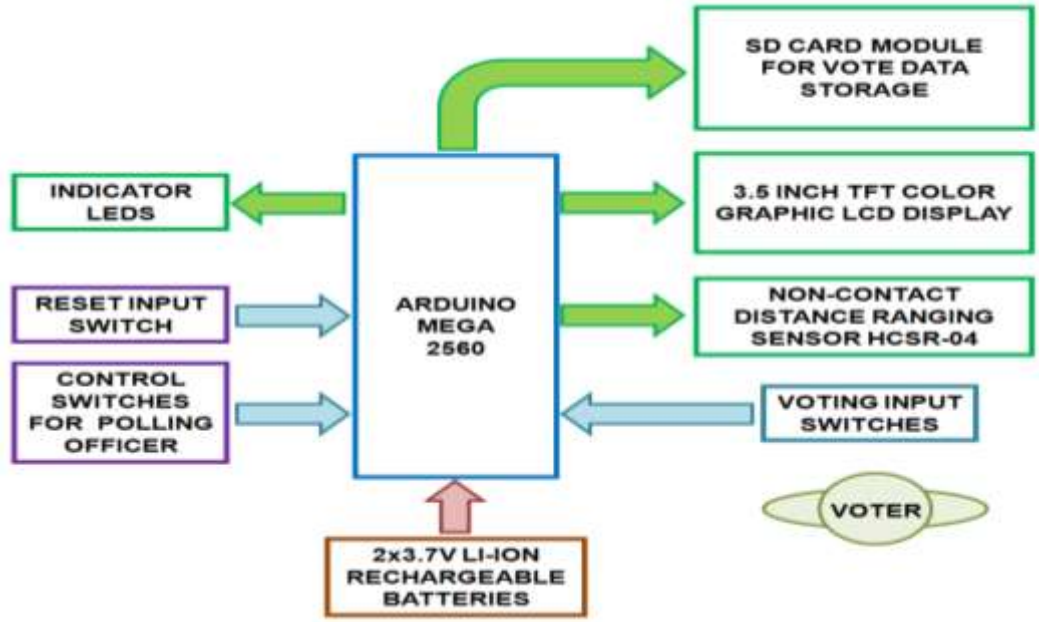

Figure 1 Block diagram of electronic ballot for General Election

Construction of the Circuit

The circuit construction was made on the fabricated printed circuit board. The use of fabricated printed circuit board in construction saves short circuits and loose contacts on the circuit board. Moreover, it is simple and easy to build the circuit. Some of the collected components are illustrated with a photo in Figure 2.

The fabricated PCB board has no outline drawing on the components side of the circuit board. Therefore, it is important to insert the components with the correct orientation and correct position on the board. But on the circuit PCB, wire connections are made very well and no jumpers are necessary on the components side. The resistors and other components were inserted and soldered in the following arrangement;

- Resistors
- Male terminal pins for Arduino Mega
- Button switches
- Female terminals for graphic LCD
- LEDs
- Piezo Buzzer
- Ultrasonic ranging module

Figure 2 Components of electronic ballot for general election

The soldering side and components side photos of connecting resistors and male terminal pins are illustrated in Figure 3a and 3b. There are only two resistors and they are 560Ω for two LEDs. The male terminal pins are used to connect with Arduino Mega development board.

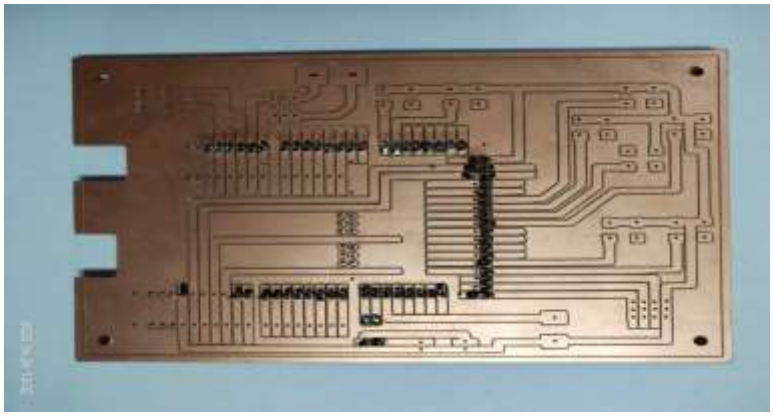

Figure 3a Soldering side of the resistors and male terminal pins

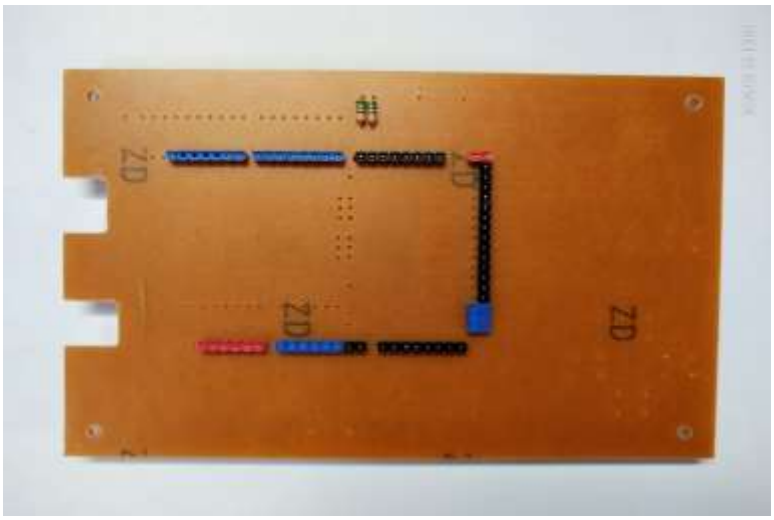

Figure 3b Components side of the resistors, and male terminal pins

Then nine input switches, female terminal pins for LCD, LEDs, piezo buzzer, and female pins for ultrasonic sensor module are inserted and soldered as shown in Figure 4a and 4b. Finally, the Arduino Mega, sensor module (HCSR04) and 3.5 inch TFT LCD are inserted on the circuit terminals as shown in Figure 5.

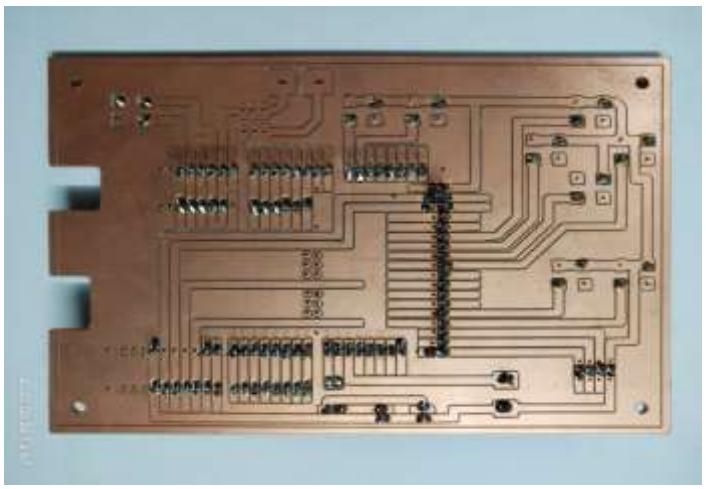

Figure 4a Soldering side of the constructed circuit board

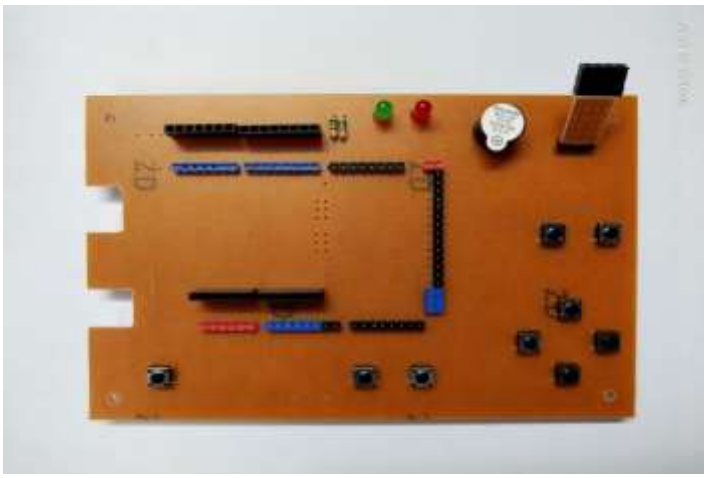

Figure 4b Components side of the constructed circuit board

Figure 5 Installation of circuit board with Arduino Mega, LCD and HCSR 04

Program Explanation

There are 517 program lines in the program. The program coding is written by using Arduino IDE software. The programming language is simplified C programming language. Flowchart diagram is very helpful in developing a program code. It is shown in Figure 6. An illustration of flowchart is used to briefly describe the flow of program. They are Adafruit_GFX, Adafruit TFTLCD, SPI, SD, WWPROM, and MCUFRIEND_kbv libraries. Then the defining the 16 bit color code with suitable color names for various colors. The void setup () routine starts from line 70 and end in line 110. In this routine, EEPROM memories are assigned with suitable names, setup I/O pin directions, initialize the LCD and SD card modules. Then the display illuminates the title and default background for the system.

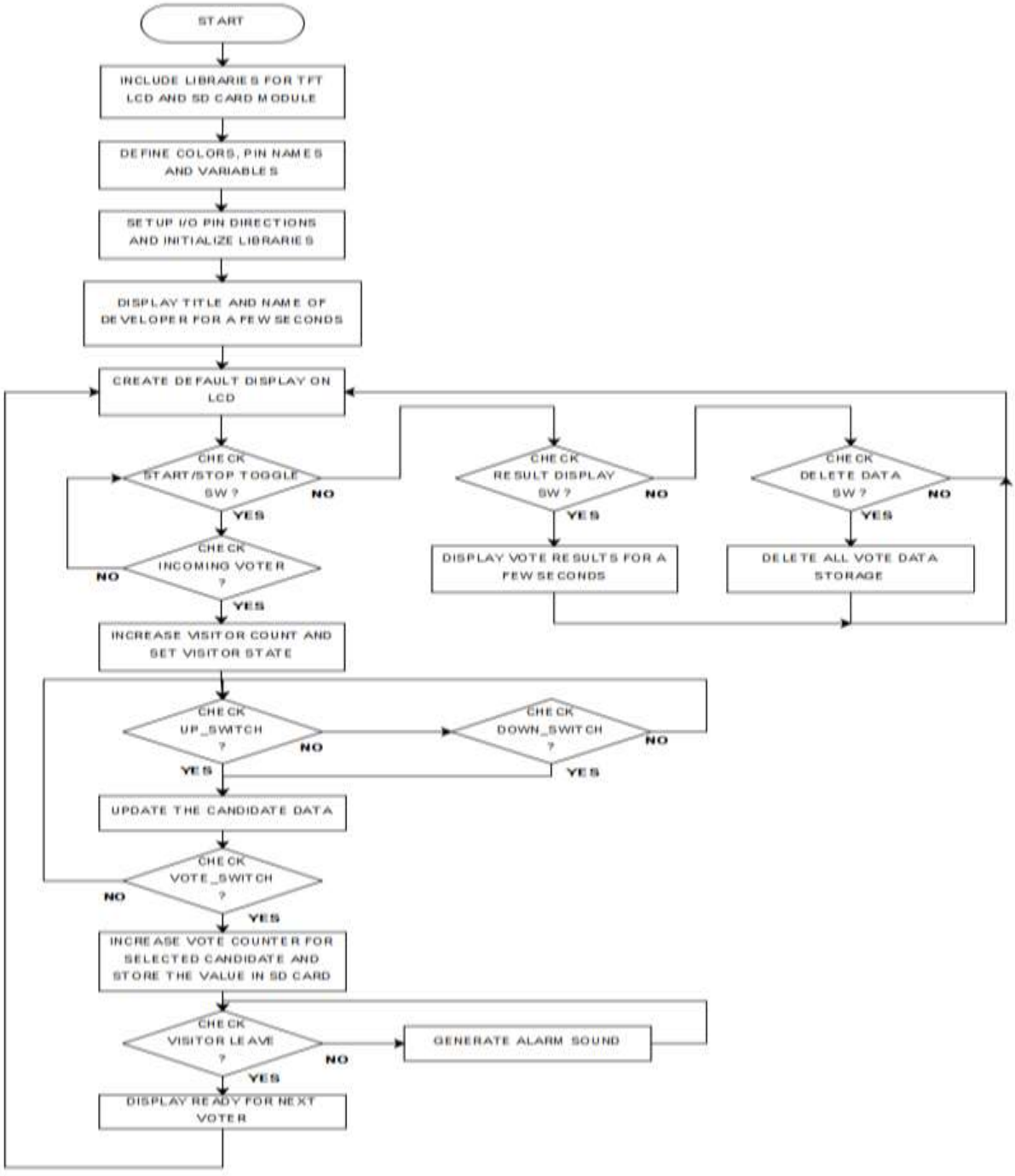

Figure 6 Flowchart diagram of the program

Circuit Operation

The whole circuit operation is user friendly, reliable and easy to use. The system can be power by three different methods, connecting with a USB cable to B type connector on Arduino Mega or using a 9V dc adaptor connect to the dc terminal socket on the Arduino Board or using batteries connected on the Vin pin terminals on power terminal of Arduino Mega. In this experimental and development, it is illustrated by connecting with USB (A-B) cable with a PC. But in the earlier schematic, it will be using two rechargeable li-ion batteries.

The parts and functions of components are illustrated with labels as shown in the Figure 7. The Arduino Mega is connected under the shield circuit board. It is the controller of every component on the circuit board. The board consists of 256K byte of program memory, 8K byte of RAM memory and a total of 70 I/O pins. Moreover, the board provided two on board voltage regulators 5V and 3.3V for other components on the circuit design. But the board itself cannot operate the system. Therefore, a program code was created and uploaded into the memory of microcontroller by using Arduino IDE software. The program coding was the most difficult part in this research and development of electronic ballot circuit.

As soon as the power supply is connected, the display initiated title of the project and name of developer for a few seconds. Each screen displays are illustrated in Figure 8. In this screen the background color is red and a title was created with white fonts for Candidate data. The voting area is labeled on a white square box. In this developing, a light green rectangular box is created under the vote area box to view the currently counted votes. But it is only for program developing.

Then a white horizontal stripe is in the 2/3 of the screen. It is used to display the operating information. Under the white stripe, the red background is again created for system information. There are two yellow colored boxes for visitor sensor and visitor counter. On initial background, it is assumed to be no visitor and the display area describes “No Visitor” on the area. But at the same area, a green LED sign is indicated on the LCD for detection of no visitor. On the area of visitor counter, there is no count on the display. On the lower right corner of the LCD, the system status is indicated for initial system status. It is OFF in the light green area. On the circuit there are a total of nine switches. They are divided for voter input switches and ballot officer switches. The voter input switches are up, down and enter switches. The ballot officer switches are start/stop, result and delete switches. Then the program checks the non-contact sensor module for incoming voter or visitor. If there is no visitor in front of the sensor, the Green LED is illuminated on both LCD and on the circuit board.

In this screen the candidate data started for the first candidate by display no of candidate, name and his or her party. On the white stripe, a string was illuminated “Vote for your candidate!”. On the visitor sensor area, the label changes to “Detect” and the Red LED illuminated on the LCD. Then the voter can press ENTER switch only one time for the selected candidate. When the voting is completed, a tick mark appeared on the vote area and vote counter was display under the vote area as shown in Figure 9.

On the white stripe, the label changes to “YOUR VOTE IS SUCCESSFUL”. Then the sensor check for the visitor to leave the area. If the voter is not leaving within 3000 ms, an alarm sound will be generated. If the voter is leaving before 3000 ms, the alarm will not sound and it will be ready for next voter.

After voting's are completed for every voter in the township, the polling officer can press the start/stop switch to stop the voting system. Then the storage results for each candidate can be read by pressing the RESULT switch. The result display photo of the system is shown in Figure 10 and 11.

The storage data on the SD card can be used as evidence of vote results for election.

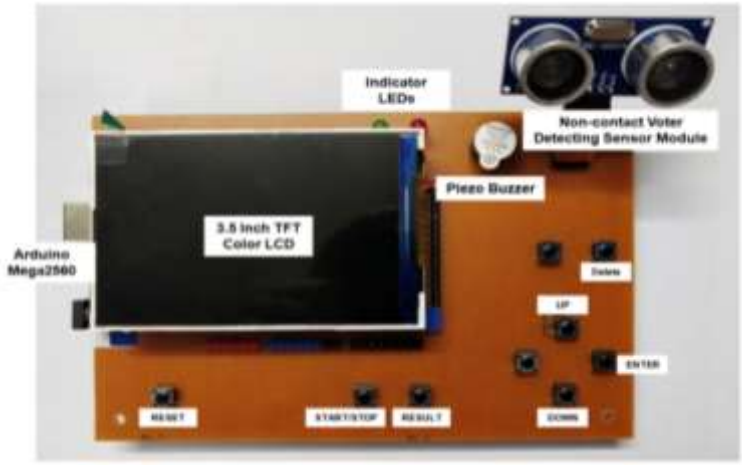

Figure 7 Name and function of components on the circuit board

Figure 8 The name of circuit developer illuminated on the LCD

Figure 9 The LCD display after voting successful

Figure 10 The LCD display for voting results

Figure 11 The photo of deleting voting results

Conclusion

The design of electronic ballot is not a new idea, but it is innovated to be secure and reliable. The system is very perfect to use in general election. It is restricted and limited only one vote for each voter. Moreover, the system stores the vote count permanently in a micro SD card for evidence of voting results. Although there are only five candidates in the prototype design, the number of candidates can be increased from the program code. The system provided information of each candidate and an audible alarm if the visitor is not leaving from the voting cell or voting area after a successful vote. The whole system can be operated with two rechargeable li-ion batteries. And the stored vote counts will not disappear while the battery is changing. The system will be a great help in general election forwarding the route to democracy in Myanmar.

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