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Electronic System for Accreditation and Voting In Election.

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ABSTRACT
Election is a vital activity in a democracy, where people select their choice amongst several who present themselves for service. In some context, the activity is tedious and requires man's attention. The two germane activities in election are accreditation and voting. The electorate ques for these two activities and does it in turn. Ad-hoc staffs are employed for the deployment of those activities. A stand-alone electronic system is presented in this work. The system consists of three input devices to capture fingerprints, authenticate the voter's card and supply instruction to the system. The system is controlled via a microcontroller. It incorporates a display that renders result for accreditation and voting at the end of each activity. The system was tested and messages that confirms the activities was displayed on the display.

Keywords: Fingerprint, card-reader, microcontroller, display, accreditation and voting.

I. INTRODUCTION

In any setting with persons of differing and inconsistent opinions, decisions are made amongst several options in such situations, often times voting is a tool implemented. By voting, citizens participate in the democratic process, wherein citizens vote for leaders to represent them and their ideas, and the leaders support the citizens' interests(Dubagari, 2017). This happens in business environment, educational environment, social organizations, and mostly in governance. One of the ways of making such a decision is through voting. Voting is a formal process of expressing individual opinions for or against some motion. One of the key areas where voting is applied is in election. Election is the formal process of selecting a person for public office or of accepting or rejecting a political proposition by voting. Election is also a way people choose their candidate or their preferences in a representative democracy or other form of government. Most democratic countries hold new elections for their national legislature every few years.

In Nigeria, there are various stages for election in Nigeria. Elections are conducted periodically into various political offices across the 36 states and federal capital territory. The independent National Election Commission (INEC) is set up by the constitution to conduct, supervise elections for the office of the president, vice president, National Assembly, Governors, Deputy-Governors, and States Assembly(Ismaila & Othuman, 2015). Election is characterized by two stages namely, accreditation and voting. Electorate comes for accreditation where their voters' card is authenticated and returned back for voting. This result slows the process of electioneering and it is also time wasting. It also gulps so much fund as ad-hoc staff are employed for these two activities. In this paper, a system is presented that renders the services of accreditation of voters and supply of ballot paper for voting remotely. It is an electronic system that is a stand-alone system.

Nigeria operates a multi-party system. Oftentimes, two or three parties are the strongest, amongst which one wins the election. The election in Nigeria is held every four (4) years. During the electoral process, Nigerianselect a representative to the office of the president at the federal level as a head of state, a Governor is elected across the 36 states in Nigeria and representatives for the legislature (the National Assembly)(Zainawa, 2021). The House of Representatives and the Senate are the two chambers of the National Assembly.There are different types of election in Nigeria, they include primary, general, local, special, direct and indirect elections(Zainawa, 2021).

A primary election is the process by which voters, either the general public (open primary) or members of a political party (closed primary), can indicate their preference for a candidate in an upcoming general election or by-election, thus

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narrowing the field of candidates.A general election is an election in which all or most members of a given political body are chosen. local elections take place to select office-holders in local government, such as mayors, councilors and local government chairman(Omotola, 2010). Elections to positions within a city or town are often known as "municipal elections". Their form and conduct vary widely across jurisdictions.Special elections are held in extraordinary situations such as the necessity to fill a vacancy that occurs during the term for which a person was elected, or when a referendum is held on some particular question or proposition such as the issuance of bonds.

Direct election is a system of choosing political officeholders in which the voters directly cast ballots for the person, persons, or political party that they desire to see elected.

The following things are done in the three activities of the electoral process(Aghamelu, 2014),(Aiyede, 2007), (Odusote, 2014).

Registration of voters.

1. A Nigerian citizen must go to the INEC website and find his polling station.
2. Visits the selected polling station for registration.
3. Photographedand informed about therecord.
4. Given a card, which is the right to vote on election day.

Accreditation at the Polling Station.

1. Visits the polling station and join the queue.
2. Confirms name on the list and cleared.

Voting

1. Take a turn (que)
2. Locates name in the voter registry list
3. Given ballot paper
4. Proceeds to voting booth and marks party's of one's choice.
5. Drop ballot paper in the ballot box

The registration activity is that which commences the electoral process. The activity registers eligible voters. These processes is done by

II. METHODOLOGY

The block diagram of the system is as shown in Fig. 1. The system comprises of the following units;

- Power supply
- Input 1
- Input 2
- Input 3
- Controller
- Display

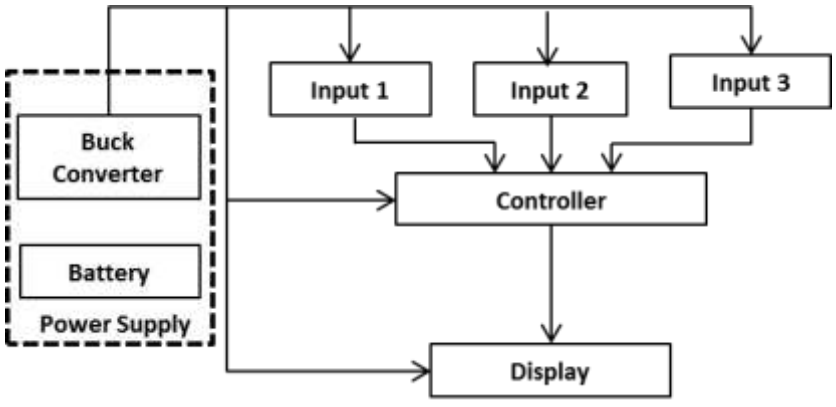

Figure 1: System's block diagram

Input 1

This input is for finger capture. A finger capture is used to identify a person's fingerprint for security purposes. After a sample is taken, it gives accessif the fingerprint matches the stored sample. An AS608 Optical Fingerprint Module type is used for the system design. This choice is made for itsfast characteristicas well as its vast amount of biometric data capacity, making it more secure(Tower, 2015). It comprises sensors that are so sensitive to the extent that they can detect blood flow within someone's finger and prevent hackers from faking prints using molds or photographs.The AS608 optical fingerprint sensor scans fingerprints and it sends the processed data to a microcontroller via serial communication as well. All registered fingerprints are stored in this module. The AS608 is capable of storing up to 127 individual fingerprints. The AS608 optical fingerprint module is as shown in Fig. 2. It has the following specifications.

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Figure 2: Fingerprint module

- Voltage supply range: 3.6 V to 6 V
- Maximum operating current: 120 mA
- Peak current: 150 mA
- Max Prints imaging time: 1s
- False accept rate (FAR): <0.001%
- False reject rate(FRR): <1.0%
- Interface: UART or TTL serial
- Storage capacity: 162 fingerprints
- Signature file: 256 bytes
- Template file: 512 bytes
- Default baud rate: 57600
- Window area: 14mm x 18mm
- Working temperature: -20℃ to 50℃
- Working humidity: 40% RH-85%RH

Input 2

This input is a card reader. Card readers are used alongside smart cards. These smart cardsare a type of plastic technology card with a built-in chip designed to perform the functions of personal identification, access control, authentication, and financial transactions. An RC522 Smart Card is used for the system design because it is designed to create a 13.56MHz electromagnetic field that it uses to communicate with the radio frequency identification (RFID) tags (ISO 14443A standard tags). The reader can communicate with a microcontroller over a 4-pin Serial Peripheral Interface (SPI) with a maximum data rate of 10Mbps. The RFID is a wireless application to transfer data in the purpose of identifying and tracking tags.

The RS522 has an internal transmitter capable of driving a reader/ writer antenna designed to communicate with ISO/IEC 14443A cards and transponders without additional active circuitry(UG, n.d.). A robust and efficient implementation for demodulating and decoding signals from ISO/IEC 14443A compatible cards and transponders is provided in its internal receiver.

The RC522 module has total 8 pins that interface it to the outside world. The connections are as shown in Fig. 3.

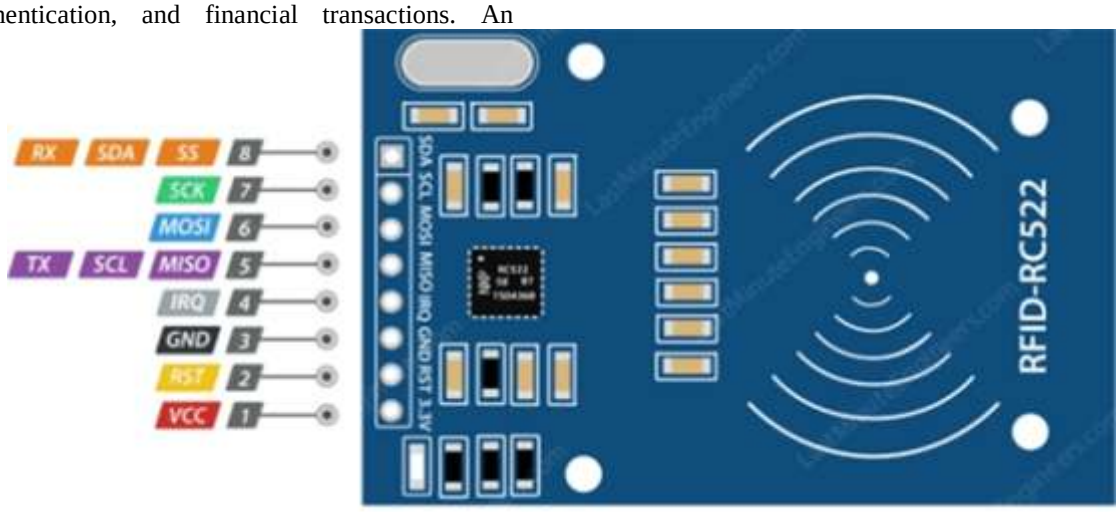

Figure 3: RC522 module

Pin 1: VCC

Supplies power for the module. It can be from 2.5 to 3.3 volts.

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Pin 2: RST
This is an input for Reset and power-down. When this pin goes low, hard power-down is enabled. This turns off all internal current sinks including the oscillator and the input pins are disconnected from the outside world. On the rising edge, the module is reset.
Pin 3: GND
This is the ground pin and needs to be connected to GND pin of the other circuits.
Pin 4: IRQ
This is an interrupt pin that alerts the microcontroller when RFID tag comes into its vicinity.
Pin 5: MISO / SCL / TX
This pin acts as Master-In-Slave-Out when SPI interface is enabled, acts as serial clock when I2C interface is enabled and acts as serial data output when UART interface is enabled.
Pin 6: MOSI (Master Out Slave In)
This is SPI input to the RC522 module.
Pin 7: SCK (Serial Clock)
This pin accepts clock pulses provided by the SPI bus Master.
Pin 8: SS / SDA / Rx
This pin acts as signal input when SPI interface is enabled, acts as serial data when I2C interface is enabled and acts as serial data input when UART interface is enabled. This pin is usually marked by encasing the pin in a square so it can be used as a reference for identifying the other pins.

Input 3
This is a keypad that is responsible for the initiating and reset of the entire system. This unit issue commands to the controller unit.

Controller
The system's controller is developed around the ATMEGA328 Microcontroller. ATmega328P microprocessor can process instructions up to 10 times fasterthroughout a wide temperature range, from -40 to 125^{o} Celsius than other comparable microcontrollers. Its pictorial diagram is shown in Fig. 4.

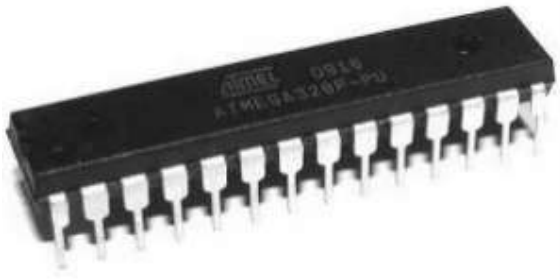

Figure 4: ATmega328P microprocessor

The ATMEGA328 Microcontroller is a 28 pin IC. Its pin configuration is shown in Fig. 5

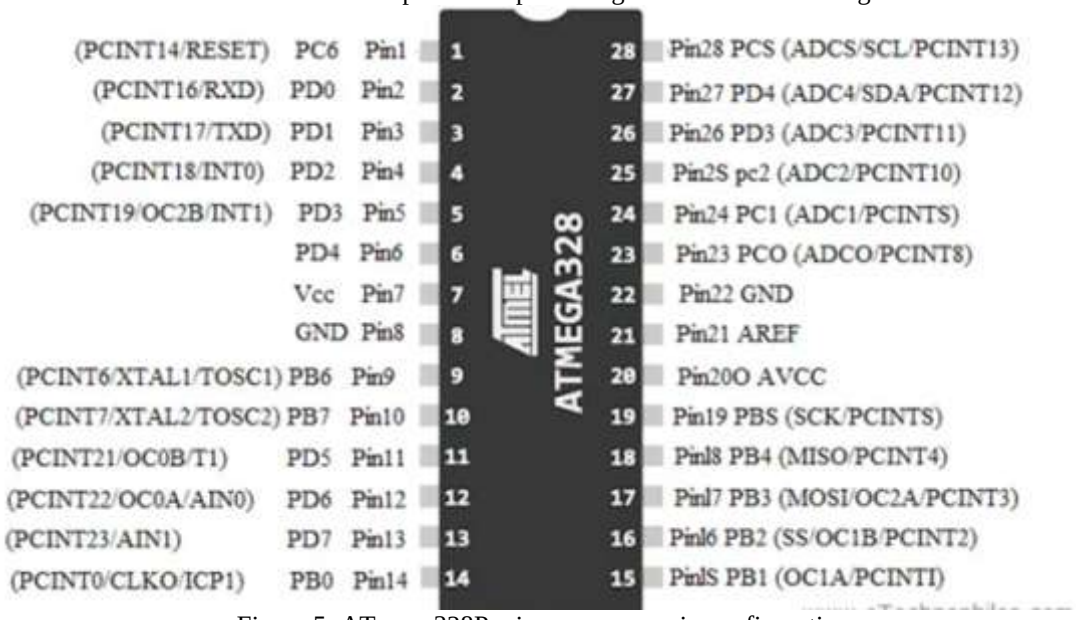

Figure 5: ATmega328P microprocessor pin configuration

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The microcontroller was programmed following the Arduino board method.

Power Supply

The system was powered via a dc power source, battery. A lithium-ion batterywas used because its high energy density. of any battery Li-ion battery cells can deliver up to 3.6 Volts, 3 times higher than technologies such as Ni-Cd or Ni-MH.A lithium-ion battery or Li-ion battery is a type of rechargeable battery in which lithiumions move from the negative electrode through anelectrolyte to the positive electrode during discharge and back when charging. Li-ion batteries use an intercalated lithium compound as the material at the positive electrode and typically graphite at the negative electrode.Li-ion batteries have a high energy density, no memory effect (other than LFP cells)and low self-discharge. Its characteristic of self-discharge, low maintenance, and no requirement for priming makes for its choice.

The circuit diagram designed is as shown in Fig. 7.

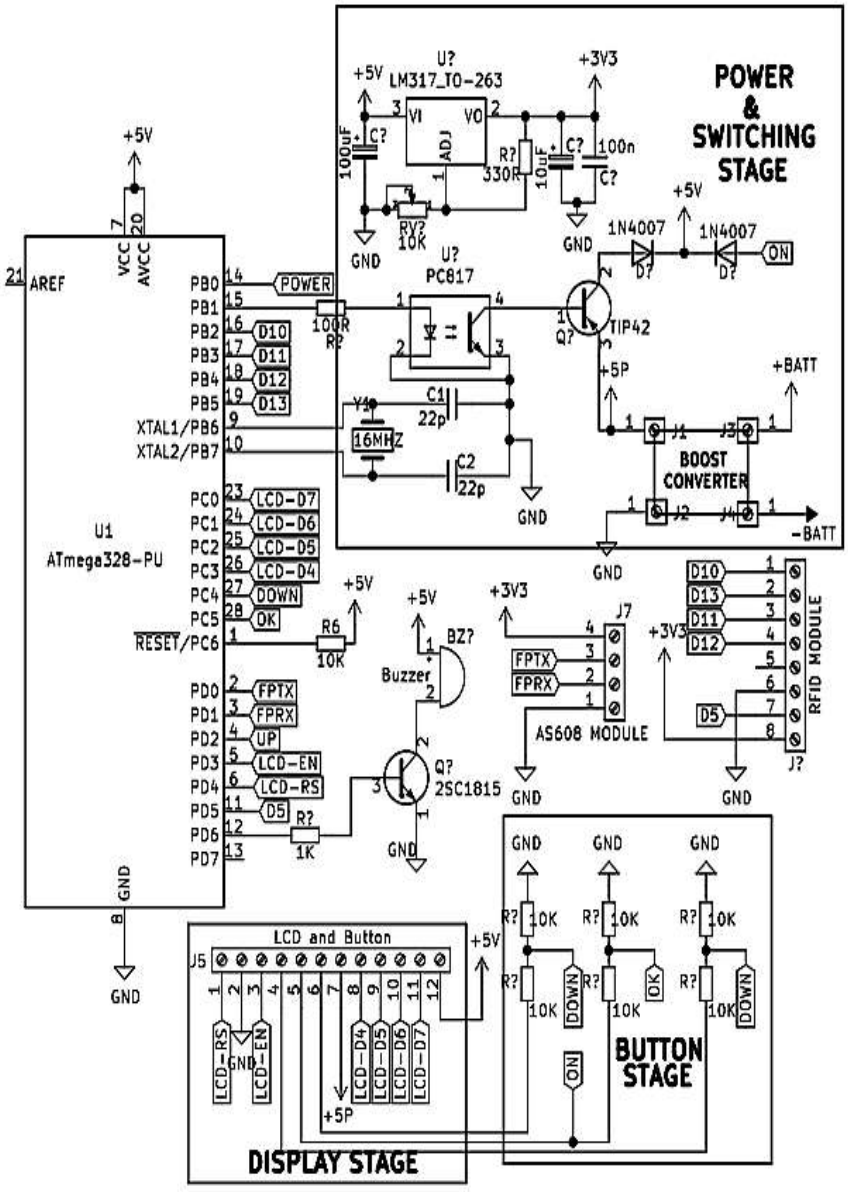

Figure 7: System's circuit diagram

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III. CONNECTION

The Vcc pin of the RFID module was connected to 3.3V on the Arduino and its GND pin to ground. The pin RST was connected to one digital pin on the Arduino, pin 5 precisely.

Since RC522 module requires a lot of data transfer, it is connected to the hardware SPI pins on a microcontroller. The hardware SPI pins are much faster than 'bit-banging' the interface code using another set of pins. The Arduino Board has different SPI pins which should be connected accordingly. These SPI pins are digital 13 (SCK), 12 (MISO), 11 (MOSI) and 10 (SS). The connection set-up is shown in Fig. 8.

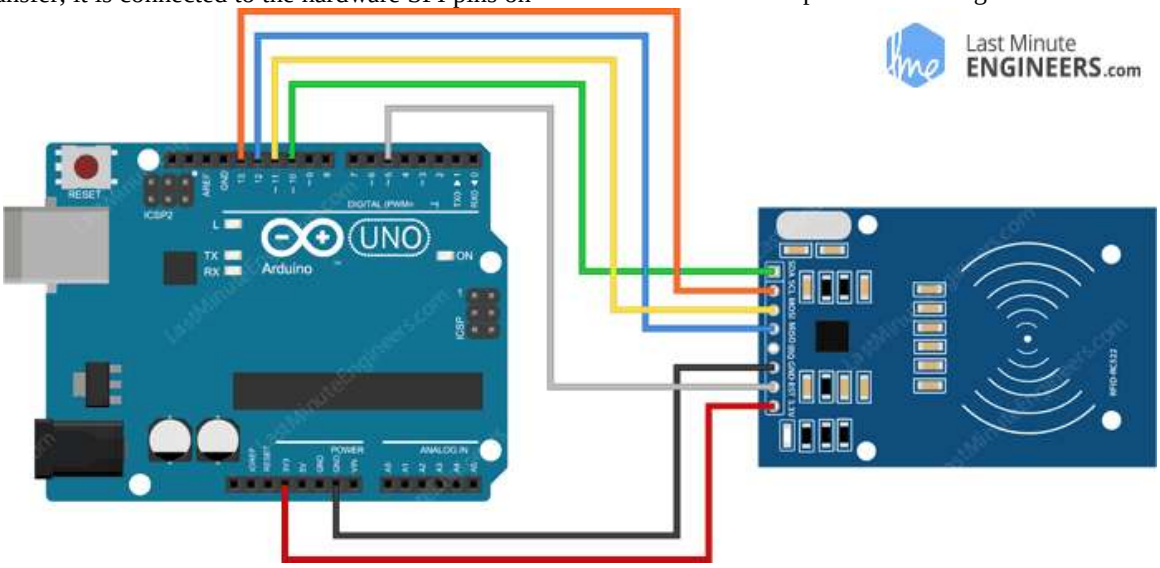

Figure 8: Wiring RC522 RFID Reader Writer Module with Arduino UNO

IV. RESULT AND DISCUSSION

The constructed system is shown in Fig. 9.

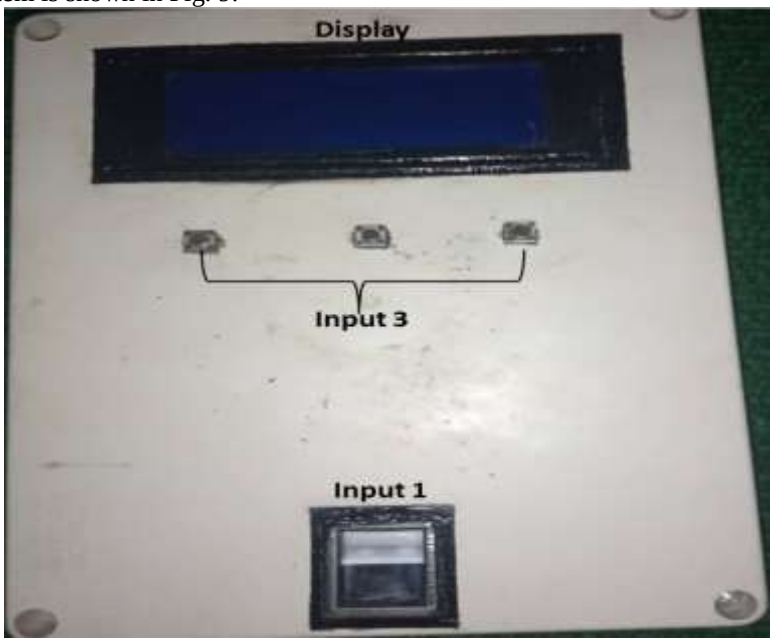

Figure 9: Electronic voting system

The system test carried out is contained in the Table 1

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Table 1: System's Test Procedure

Test	Steps	Expected result	Test result
Output voltage Test	Plug the power unit to an AC power source (220V-240V). Connect the probes of a mult-meter to the output end of the power source	The multi-meter should read 5V	4.9 volts of was read from the multi-meter
Finger Print Module Test	Connect the pins of the finger print scanner to be appropriate pins.	The LED fingerprint scanner blink and stay on steadily	The LED of the fingerprint blinked and stayed on.
Voter's Registration Test	Double click the registration button and registrar by input your fingerprint.	Display registration successful	Registration successful displayed.
Vote Castin Test	Authenticate as PO slot in card choose parties confirmed votes with fingerprint	Screen should display voted.	Voted DISPLAYED
Election Result Viewing Test	Click on result icon to display result	Result interface should show	Result interface shown
Battery Duration Test	Use the voting for some time without charging	The battery should last for 3 hours	The battery lasts as expected.
Card Reader test	Plug in card reader to the system Slot in card	Display smart card reader present	Displayed smart card reader present
Fingerprint Read Test	Plug in fingerprint scanner select finger on scanner.	Fingerprintview updated (darkened)	Fingerprint view was updated
Voter's Registration Test	Get all voter details check for input validity capture fingerprint	Display voter registration	Voter registered displayed

The administrator login interface and voting interface displays are shown in Figures 10 and 11.

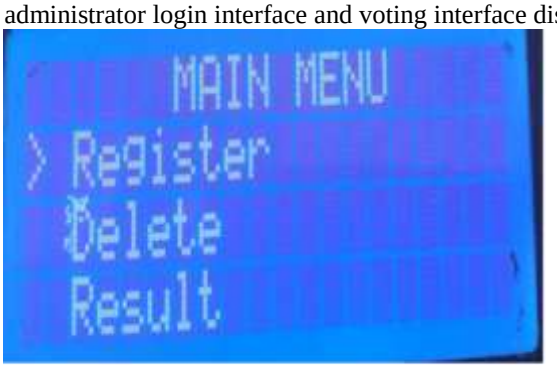

Figure 10: Administrator login interface

Figure 11: Voting interface

V. CONCLUSION

The E-voting system was implemented to solve the proximity bottlenecks, unnecessary time delays, with very secure and accurate recording of votes. The system has been thoroughly tested in voting accuracy, ruggedness, responsiveness, battery life expectancy, and security by means of simulation and mini voting sessions to be a successful one. It is seen that the system is fault tolerant at all end points (registration, voting platform). The voting device can last for more than 6 hours which is very sufficient for a quick system like ours. This system will provide boundless voter participation in remote areas with very little or no cost on the voter greatly reducing apathy. Further improvements can be done on the system to increase the credibility of the votes and further reduce proximity issues.

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