

DESIGN OF AN IOT-BASED SMART VOTING SYSTEM

Abstract:

Voting has become an integral part for every nation practicing democracy especially in Nigeria. Considering the electoral system of the country is very poor and various process are involved in manipulating and rigging the votes of citizens, in turn causing bad governance, mayhem and destruction across the country as citizen do not have a standard voting system free of manipulation and any form of electoral malpractice. The proposed IOT Based Smart Voting System has two- factor authentication which are the Biometric Fingerprint Authentication to make use of the uniqueness of human fingerprint and A Cam Scanner to match the fingerprint and face. The system is designed to register voters online and save it in a database then whenever there is an ongoing election, voters can just go into the system, log-on with their fingerprint and a face ID then cast their vote by simply tapping the touchscreen of the system, viewing different candidates and their party plus having interactive session with An Embedded AI voice. Votes are casted and immediately sent to the Electoral Body Database System, saving the casted votes in few Nano seconds with the aid Iots and Microcontrollers in general.

Keywords: ESP32 CAM, Fingerprint, IOT, INEC, TFT Display and Voter

Introduction:

Abraham Lincoln famously quoted Democracy as “Government of the People, by the people and for the people”. One of the most interesting feature about democracy is that it allows its citizens to select leaders to govern them.

Nigeria also known as “The Giant of Africa” due its population of more than two hundred billion people with different ethnicity, tribes, religious beliefs and many more. Still yet citizens keeps their differences aside and exercise their fundamental human right to vote and to be voted for.

The Independent National Electoral Commission (INEC) the most important body responsible for conducting elections. Elections should be conducted in the right manner so that democracy does not lose its value. After various surveys and experiences by voters, it has been observed that there are so many problems involved in our current system of voting making it unjust. Few among are rigging of votes, long queues, logistical and transportation Challenges and so on. This proposed system consists of an ESP Cam and a Fingerprint scanner to initiate voting. Prior to this, the Voter is required to register is fingerprint along with his personal details to the system and INEC Database for further validation.

Problem Definition:

Voting for a particular candidate in our country is quite tasking as you are not sure if your vote is or not going to count because of the long awaits, foul plays during the election. Stealing of ballot boxes and causing chaos in polling units has become a norms during election plus buying of votes.

Issues like this pose a fundamental threat to the leadership of the national as it tends to elect corrupt leaders forcefully in being decision maker thereby making the country more corrupt, and less develop. In circumstances like this the whole meaning of Democracy and the main point of people electing their leaders is lost.

Literature Review:

This section elaborates on the various voting system introduced by experts over time. The review aims at giving information about the proposed model followed by the pros and cons of the model.

Paper [1] suggests the use of GSM modules along with the biometric system for voting. A touch screen is implemented to overcome the button problem in a regular EVM and also to select suitable candidates during voting. The GSM module is used to send the results to the corresponding authority. A PC is used to store the details of people in the database. If a match is not found an alarm/buzzer is used to generate the error message. Although the system can be considered to be secured and reliable, it may not cater for the system that intends to conduct voting in multiple location simultaneously.

The following paper [2] suggests a model that implements a biometric voting system using an EVM. Here the fingerprint is scanned and checked with the database. If the user exists, he/she is allowed to cast his vote using the EVM. In this system each EVM is used for a particular location and the winner candidate is declared by the EVM itself after a particular period of time.

Paper [3] the system used here is quite robust and reliable but uses a web application. Fingerprints can be bypassed by hackers when connected to a network server. So it is not that reliable in the sense that votes can be bypassed by hackers because not all web application are secured plus no camera to check the authenticity of the face of voters.

Among all paper [4] uses the principle of image processing to cast the votes of citizen which is very robust but not reliable because no any form of biometric liveness capture. Different pictures can be placed in the Cam scanners which are not live and the system will capture and cast votes which is not reliable too.

Finally the system of voting used in Permanent Voters Card used in Nigeria are just for verification and validation but still yet does not solve the problems of electoral misconducts.

Theoretical analysis:

The proposed system is an IOT based smart voting system which uses a fingerprint Sensor, ESP32 CAM, TFT Display and Voice Interface as its major peripherals. It is an enclosed system (more or less like an ATM) in which a microcontroller serves as the brain of the system plus other peripherals like the ESP32 and more. This proposal will only look at the Voting stage prior to the fact that registration has already been done by voters.

Hardware Architecture

The major hardware employed here are:

1. Arduino Microcontroller
2. ESP32 WIFI CAM
3. Fingerprint Sensor
4. TFT Display
5. Buzzer

Arduino Microcontroller

An Arduino Uno Microcontroller was used here, it Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button. It has an operating voltage of 5V while the input voltage may vary from 7V to 12V.it has a maximum current rating of 40mA, so the load did not exceed this current rating so as not to harm the board. It comes with a crystal oscillator of 16MHz, which is its operating frequency.

The software used for writing, compiling & uploading code to Arduino boards is called Arduino IDE (Integrated Development Environment), it is written in C-language and C++. The software has a lot of in-built libraries which makes it easy to be interfaced with various component of electrical and electronics units such as sensors, modules etc.



Fig.1 Arduino UNO

ESP32 WIFI CAM

ESP32 is a series of low-cost, low-power system on a chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth. The ESP32 series employs either a [Tensilica](#) Xtensa LX6 microprocessor in both dual-core and single-core variations, Xtensa LX7 dual-core microprocessor or a single-core RISC-V microprocessor and includes built-in antenna switches, RF [balun](#), power amplifier, low-noise receive amplifier, filters, and power-management modules. ESP32 is created and developed by Espressif Systems, a Shanghai-based Chinese company, and is manufactured by TSMC using their 40 nm process.^[2] It is a successor to the ESP8266 microcontroller.



Fig.2 ESP32 CAM

Fingerprint Sensor

The fingerprint sensor is one kind of sensor which is used in a fingerprint detection device. These devices are mainly inbuilt in the fingerprint detection module and it is used for computer safety. The main features of this device mainly include accuracy, better performance, robustness based on exclusive fingerprint biometric technology. Both fingerprint scanner otherwise reader are an extremely safe & suitable device for safety instead of a secret word. Because the password is easy to scan and also it is hard to keep in mind.



TFT Display

A **thin-film-transistor liquid-crystal display (TFT LCD)** is a variant of a liquid-crystal display that uses thin-film-transistor technology^[1] to improve image qualities such as addressability and contrast. A TFT LCD is an active matrix LCD, in contrast to passive matrix LCDs or simple, direct-driven (i.e. with segments directly connected to electronics outside the LCD) LCDs with a few segments.

TFT LCDs are used in appliances including television sets, computer monitors, mobile phones, handheld devices, video game systems, personal digital assistants, navigation systems, projectors,^[2] and dashboards in automobiles.

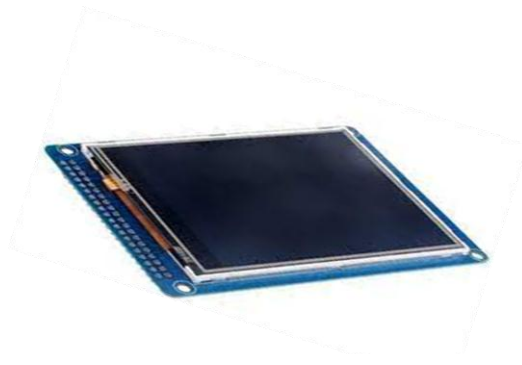


Fig. 4 TFT Display

Buzzer

A **buzzer** or **beeper** is an [audio](#) signaling device,^[1] which may be mechanical, electromechanical, or piezoelectric (*piezo* for short). Typical uses of buzzers and beepers include alarm devices, [timers](#), [train](#) and confirmation of user input such as a mouse click or keystroke. This buzzer might come in passive form or active depending on its application in a circuit.



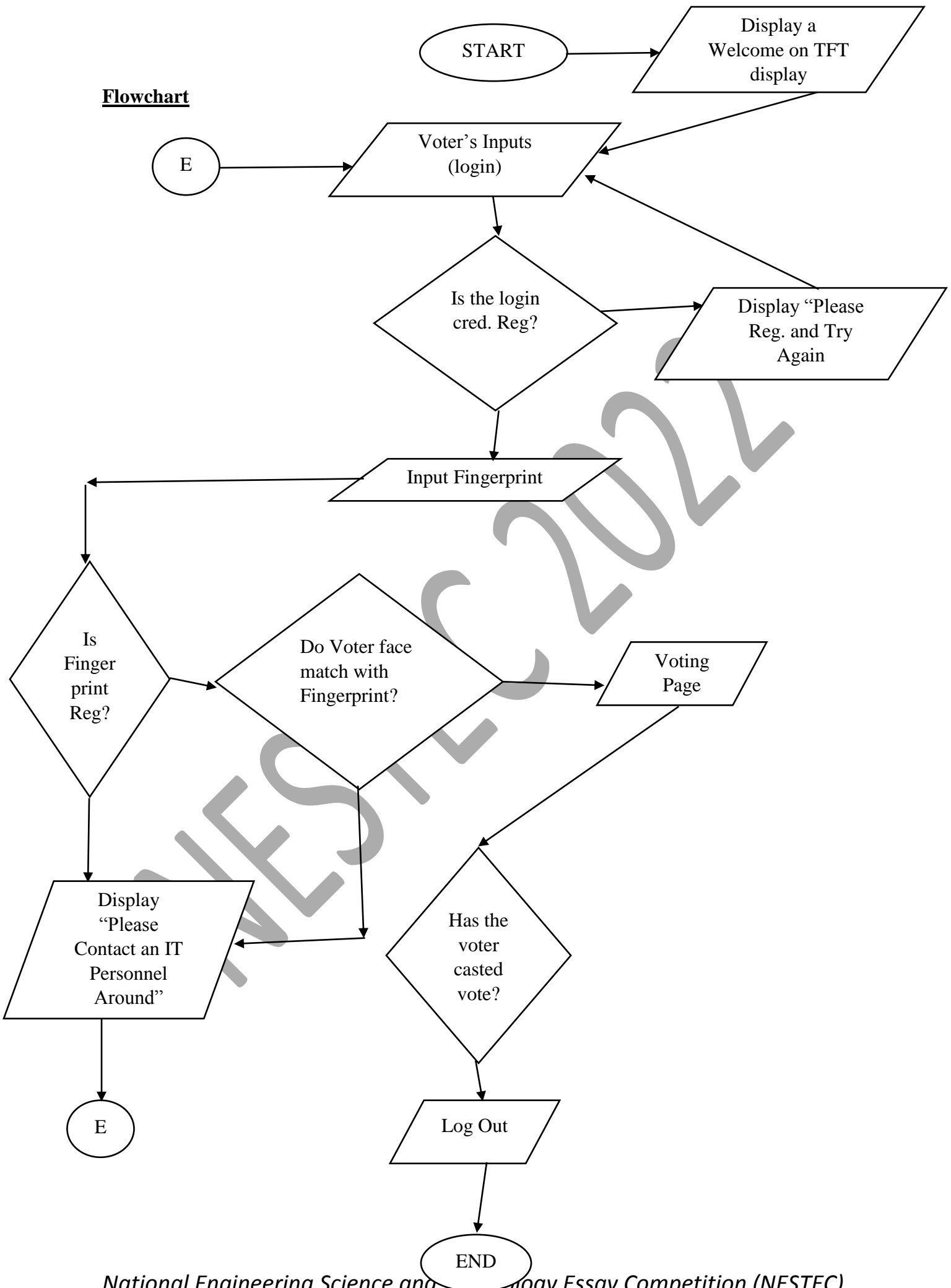
Fig. 5 Buzzer

Software Architecture

Basically, the major software used here is the Arduino Integrated Development Environment in which all the codes and programs to be run are been written in here. The IDE contains quite a number of libraries which makes it easy to interface with different modules.

Below is the flowchart of the entire voting system

Flowchart



Results:

After this proposed idea has been implemented, it is seen that the system will reduce almost all forms of electoral misconducts in all areas of the country. This prototype helps citizen to be rest assured that their votes will surely count and the main essence of democracy is achieved.

Discussion:

This prototype was designed to help curtail almost all forms of electoral malpractices cut across every parts of the country. The proposed system works on the basic principle of Microcontrollers and its interfaces. This microcontrollers comes in form of Arduino and esp32 which are just peripherals of the major microcontroller (ATMEGA328).

Conclusion:

After the implementation of this proposed project we hope it will be advanced in such a way that the system will be readily available in all polling units and beyond.

Reference:

- [1] Anandaraj S, Anish R and Devakumar P.V, "Secured electronic voting machine using biometric," 2015 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS), Coimbatore, 2015, pp. 1-5. [2] R. Rezwan, H. Ahmed, M. R. N. Biplob, S. M. Shuvo and M. A. Rahman, "Biometrically secured electronic voting machine," 2017 IEEE Region 10 Humanitarian Technology Conference (R10-HTC), Dhaka, 2017, pp. 510-512.
- [3] Aswathy Saji, Gopika Sreekumar Nair, Mekha Nair C A, Sidharth Minu, Shibu V S, "Iot Based Voting System For Election" International Journal of Scientific & Engineering Research Volume 11, Issue 7, July-2020, pp. 731-736.
- [4] A.Aravindhan, M.Kalaiyarasi, S.Bharanikumar, P.Dhanapal, R.Dharmaraj, " Smart Online Voting System Using Facial Recognition Based On IoT and Image Processing " Department of Electronics and Communication Engineering V.S.B Engineering College, Karur, India, 2020, pp 1-4.

Links:

<https://en.wikipedia.org/wiki/ESP32>