MIT | Academy of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule University)

EMBEDDED INNOVATORS HACKATHON 2025

IMITATION OF TELEVISION REMOTE CONTROL SYSTEM USING STM32 MCU

Presented By :

Pritesh Purkar - 202301060010

Nachiket Mahajan - 202301060047

Shivraj Nalawade - 202301060008

Guided By

Prof. Ashish Mulajkar

PROBLEM OBJECTIVE

- **Simulate TV Remote Control: Design an embedded system mimicking the basic functions of a television remote.**
- **Channel Control: Implement functionality to change TV channels.**
- **Volume Adjustment: Implement functionality to increase and decrease the TV volume.**
- **Power ON/OFF Control: Implement functionality to turn the simulated TV power ON and OFF.**

COMPONENTS AND SOFTWARE REQUIREMENTS :

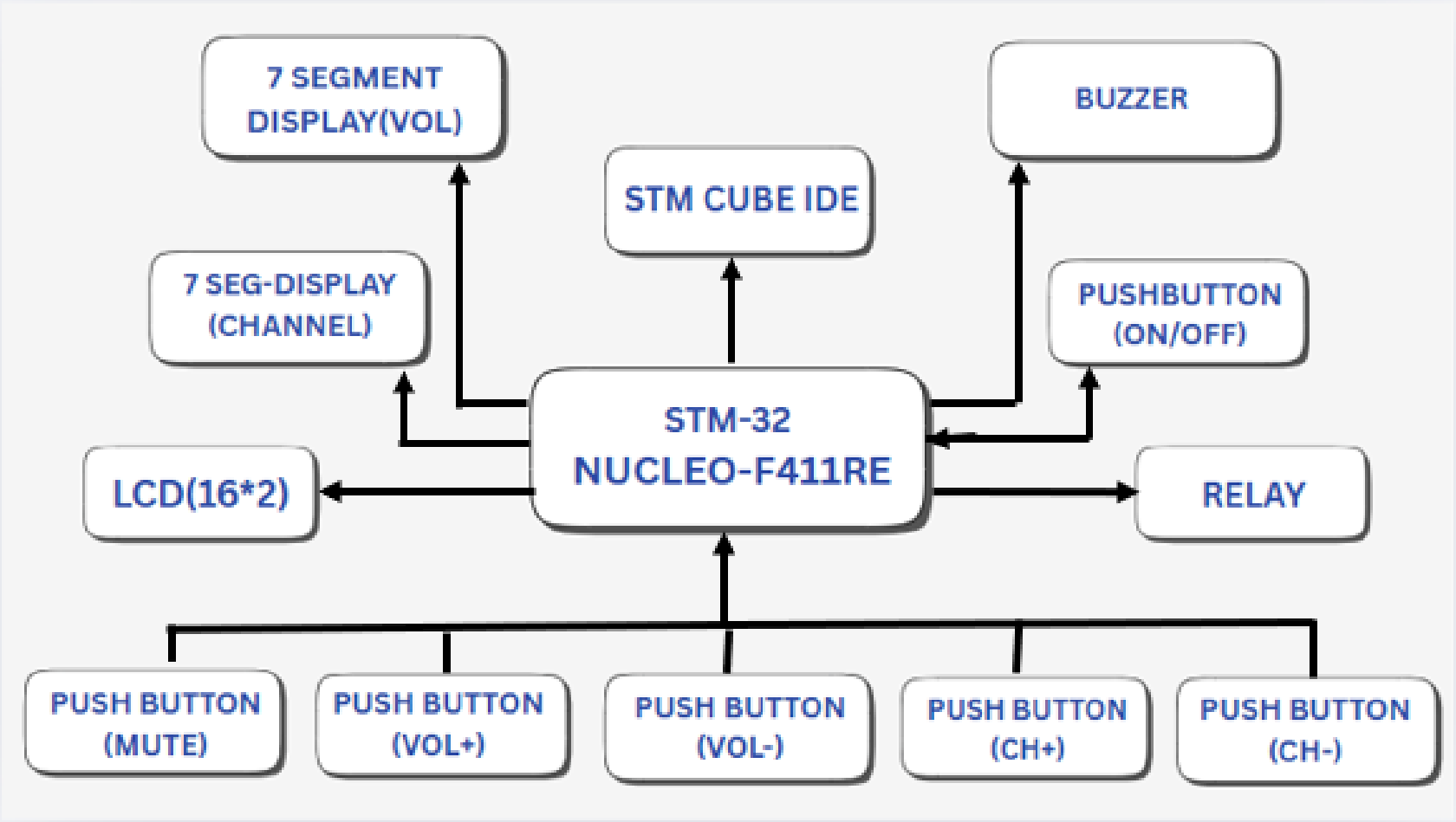
Hardware :

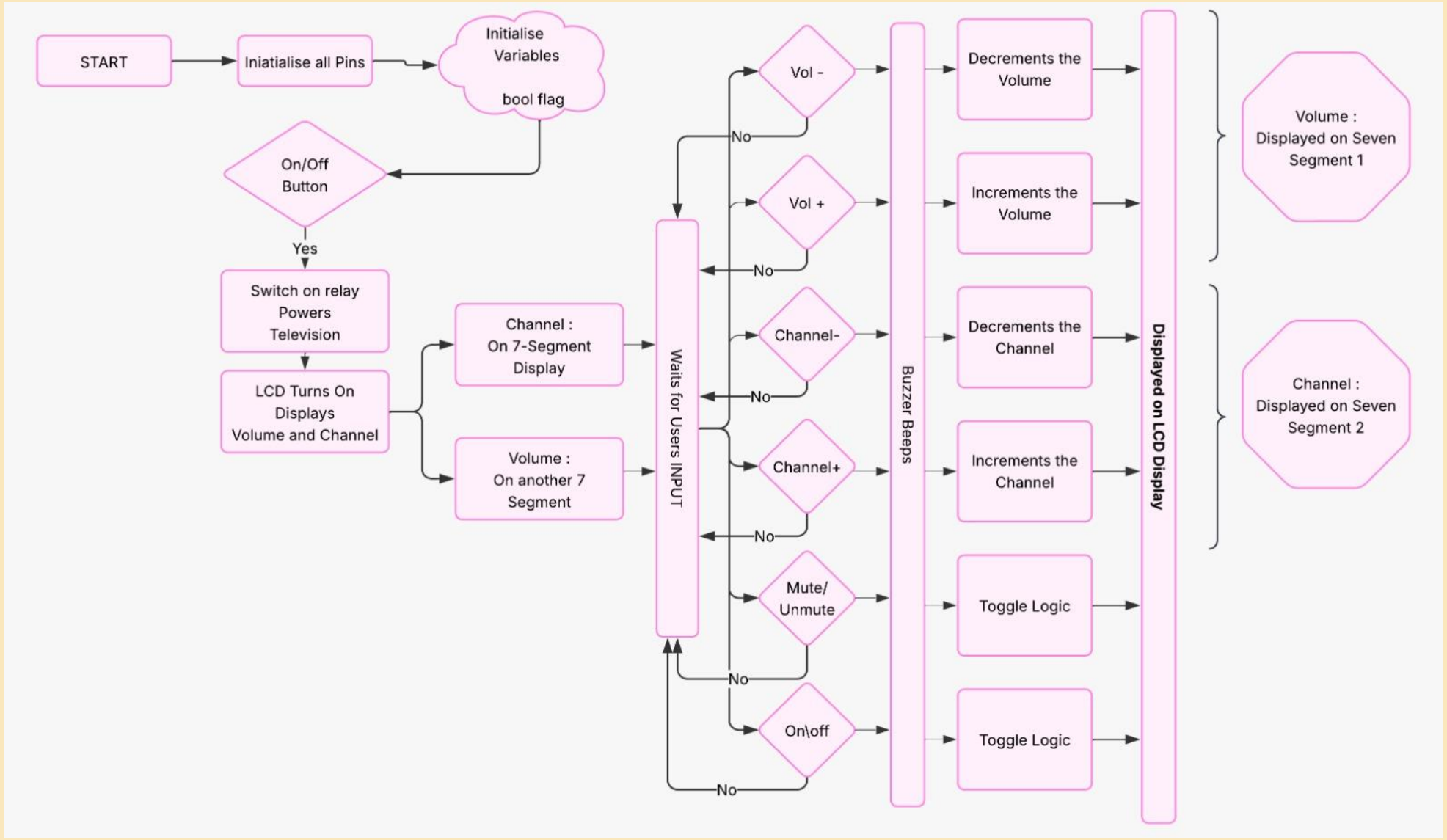
- STM32 Microcontroller
- Push Buttons
- 7-Segment Display
- LCD Display
- Buzzer
- IR Receiver

Software:

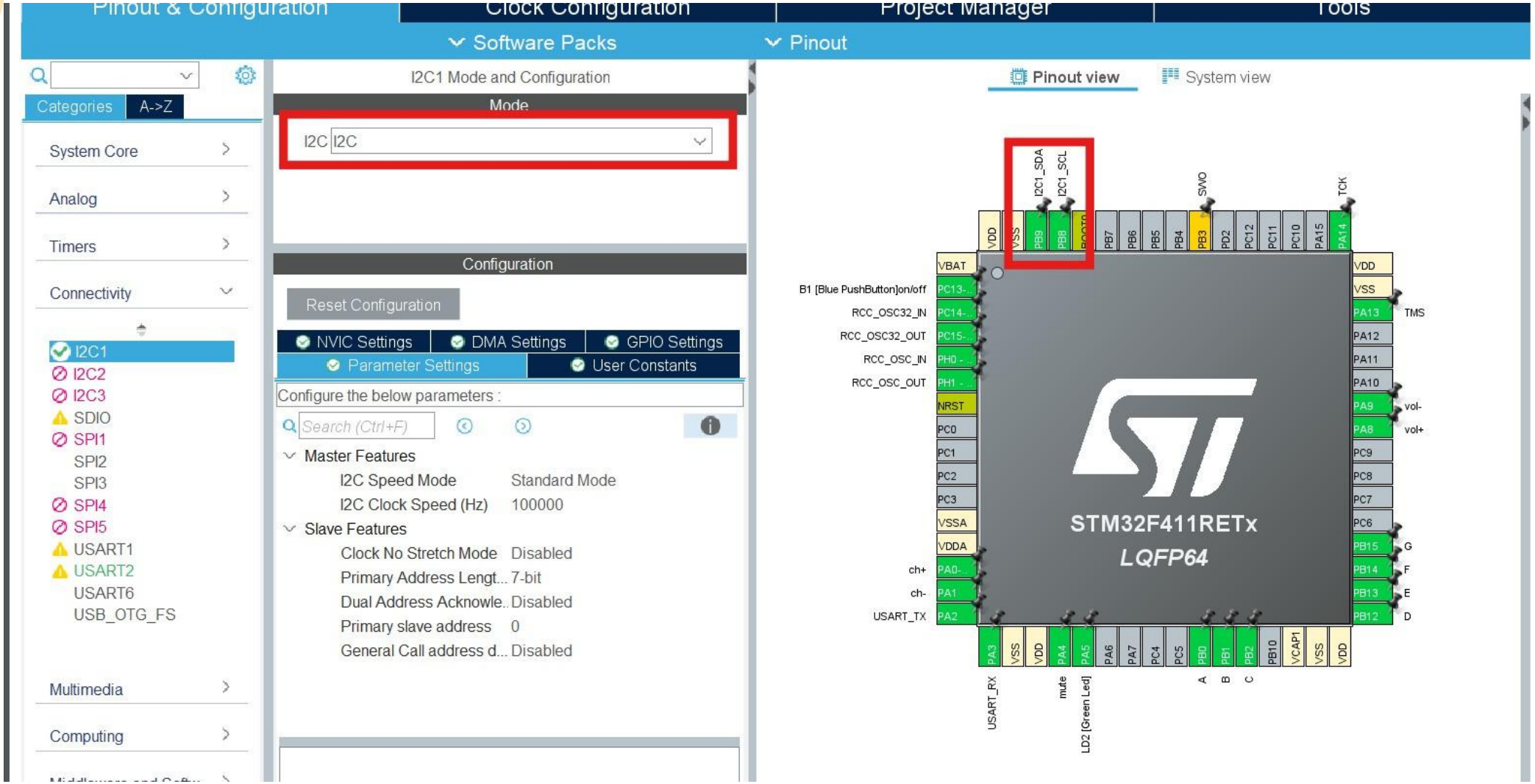
- Real-time firmware
- Volume adjustment logic
- Channel selection logic
- Mute functionality
- Error handling and alerts
- Display management system

BLOCK DIAGRAM

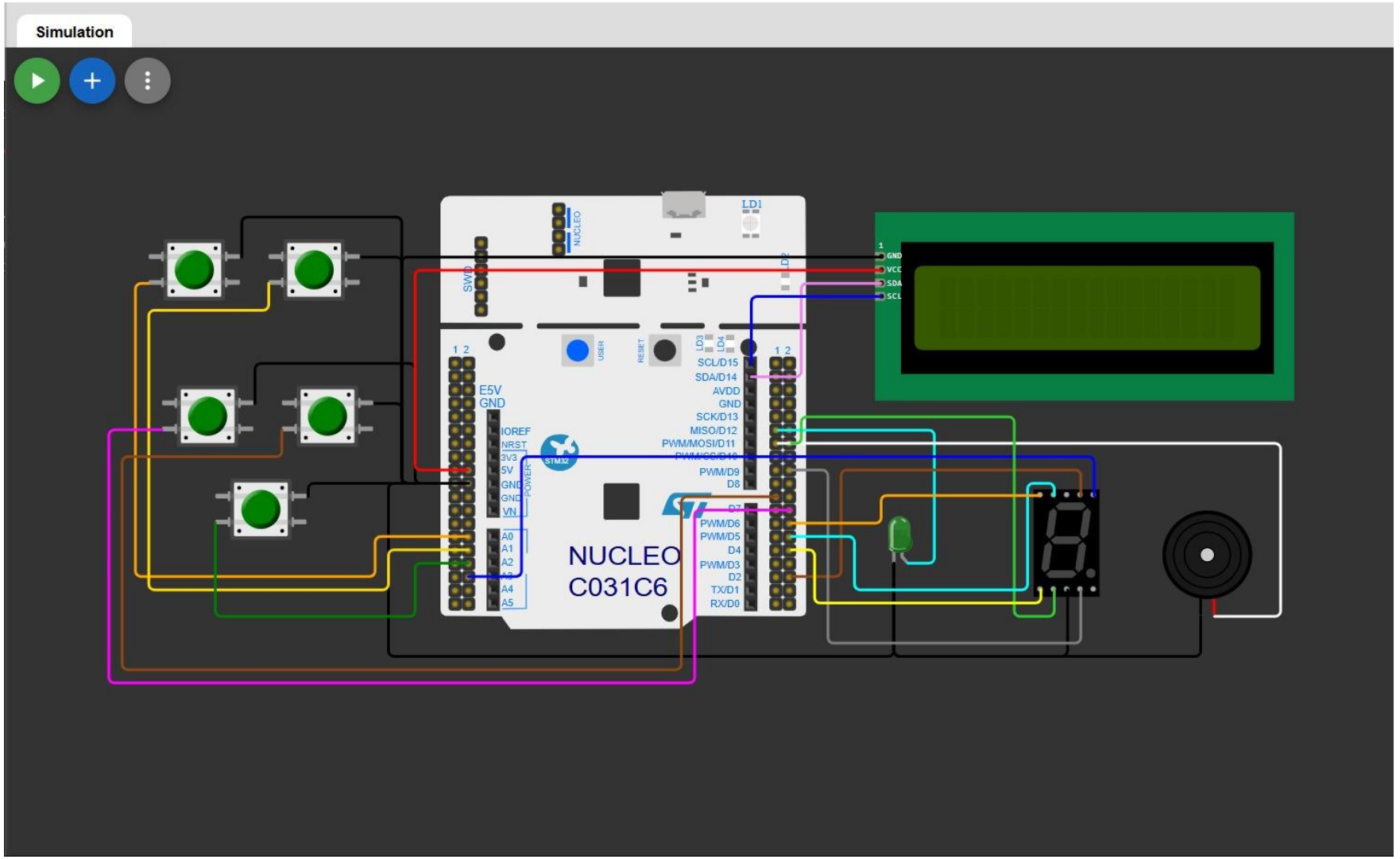



START
Iniatialise all Pins
Initialise Variables
bool flag
On/Off Button
Yes
Switch on relay Powers Television
LCD Turns On Displays Volume and Channel
Channel : On 7-Segment Display
Volume : On another 7 Segment
Waits for Users INPUT
Vol -
Vol +
Channel-
Channel+
Mute/ Unmute
On\off
No
Buzzer Beeps
Decrements the Volume
Increments the Volume
Decrements the Channel
Increments the Channel
Toggle Logic
Toggle Logic
Displayed on LCD Display
Volume : Displayed on Seven Segment 1
Channel : Displayed on Seven Segment 2

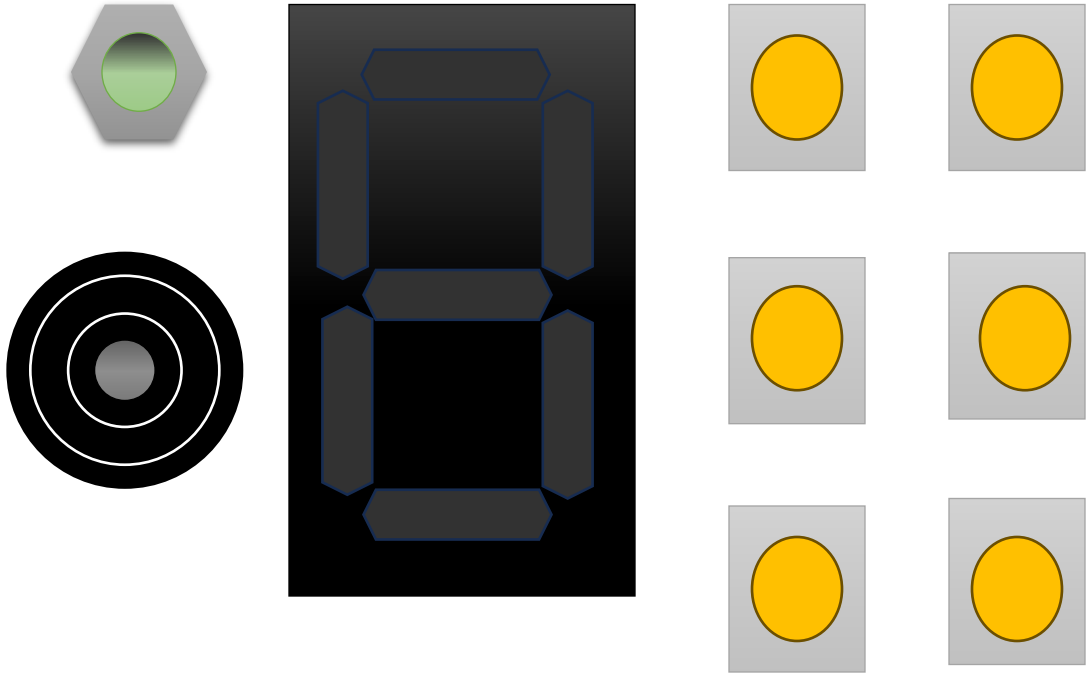
PIN CONFIGURATION



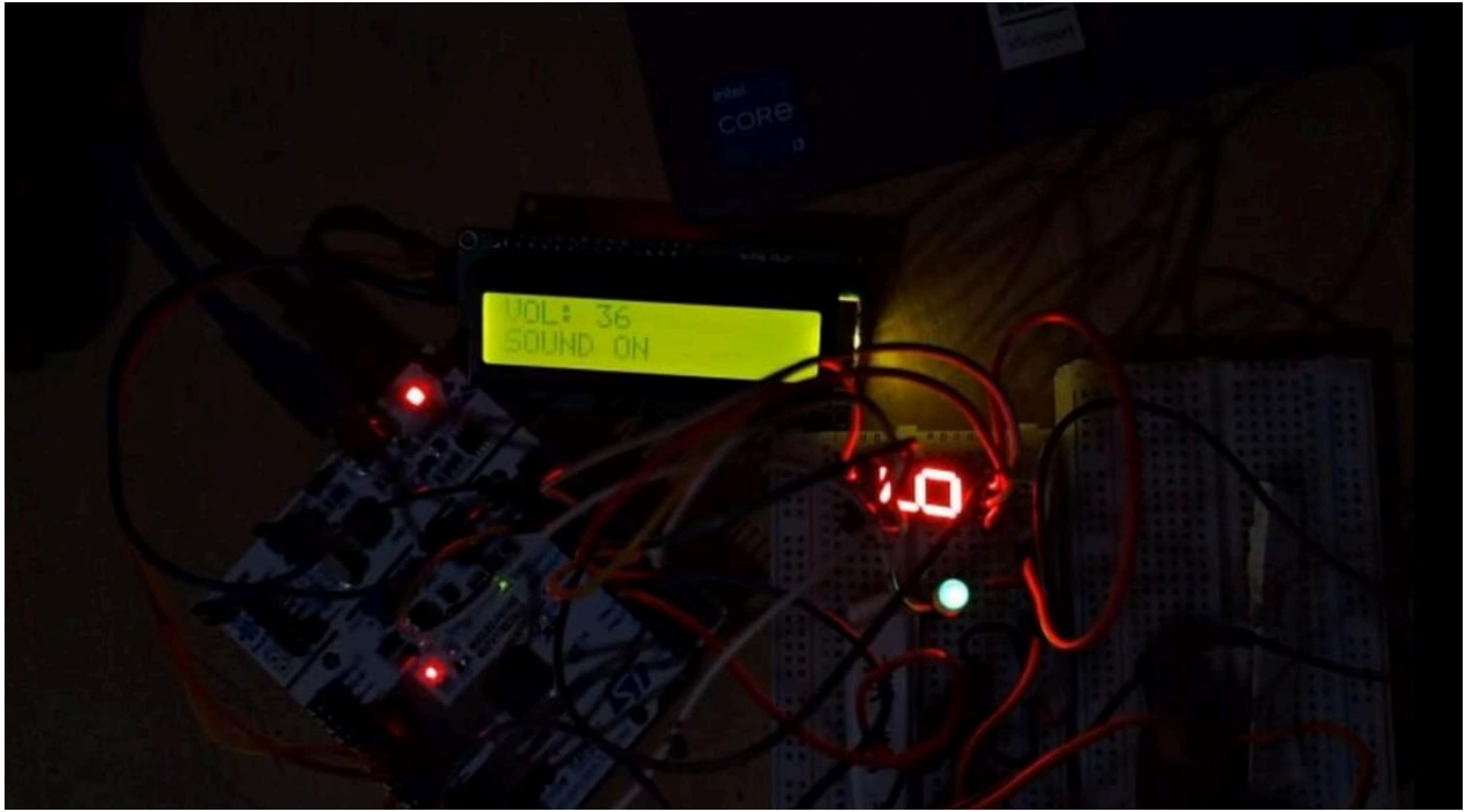
CIRCUIT DIAGRAM



```
if (HAL_GPIO_ReadPin(GPIOC, GPIO_PIN_13) == GPIO_PIN_RESET)
{
  HAL_Delay(200); // debounce
  isOn = !isOn;
  HAL_GPIO_WritePin(GPIOA, GPIO_PIN_5, isOn ? GPIO_PIN_SET :
GPIO_PIN_RESET);
  lcd_clear();
  HAL_Delay(500);
  display_digit(0);
}
```



RESULT



ADD-ONN'S

We upgraded our system by replacing the traditional push-button based imitation of a remote with an actual IR Receiver module that decodes signals from a real remote control using the NEC protocol.

Working:

- When a key is pressed on the remote controller, the message transmitted consists of the following, in order: a 9ms leading pulse burst (16 times the pulse burst length used for a logical data bit)
- a 4.5ms space
- the 8-bit address for the receiving device
- the 8-bit logical inverse of the address
- the 8-bit command
- the 8-bit logical inverse of the command
- a final 562.5µs pulse burst to signify the end of message transmission

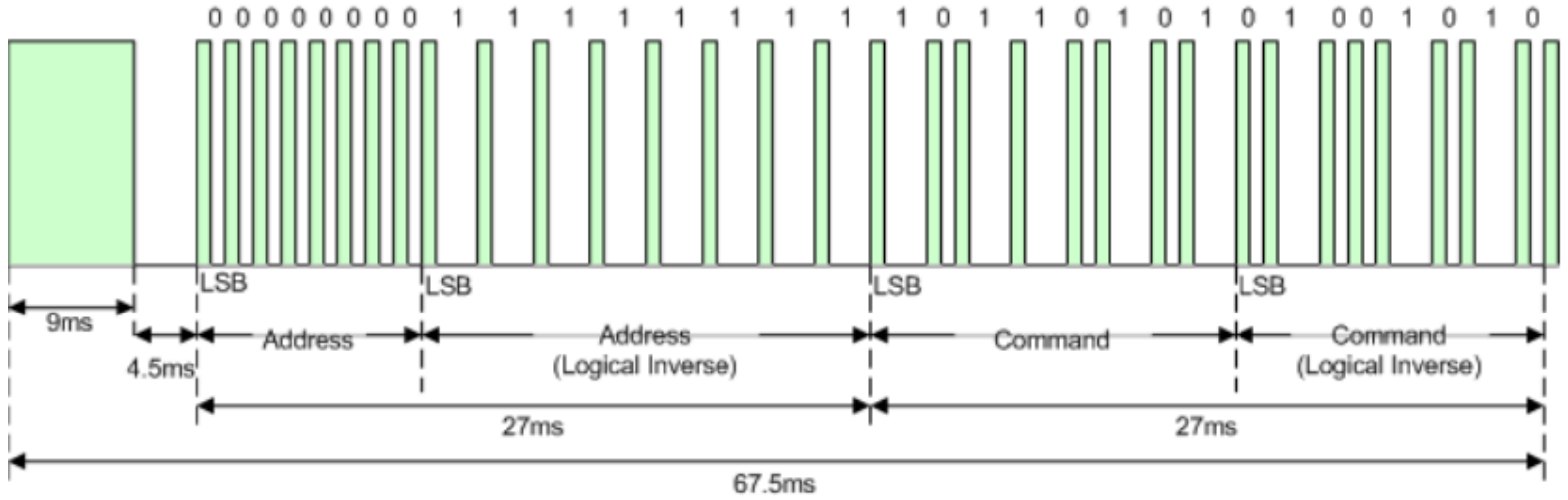
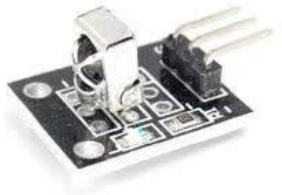
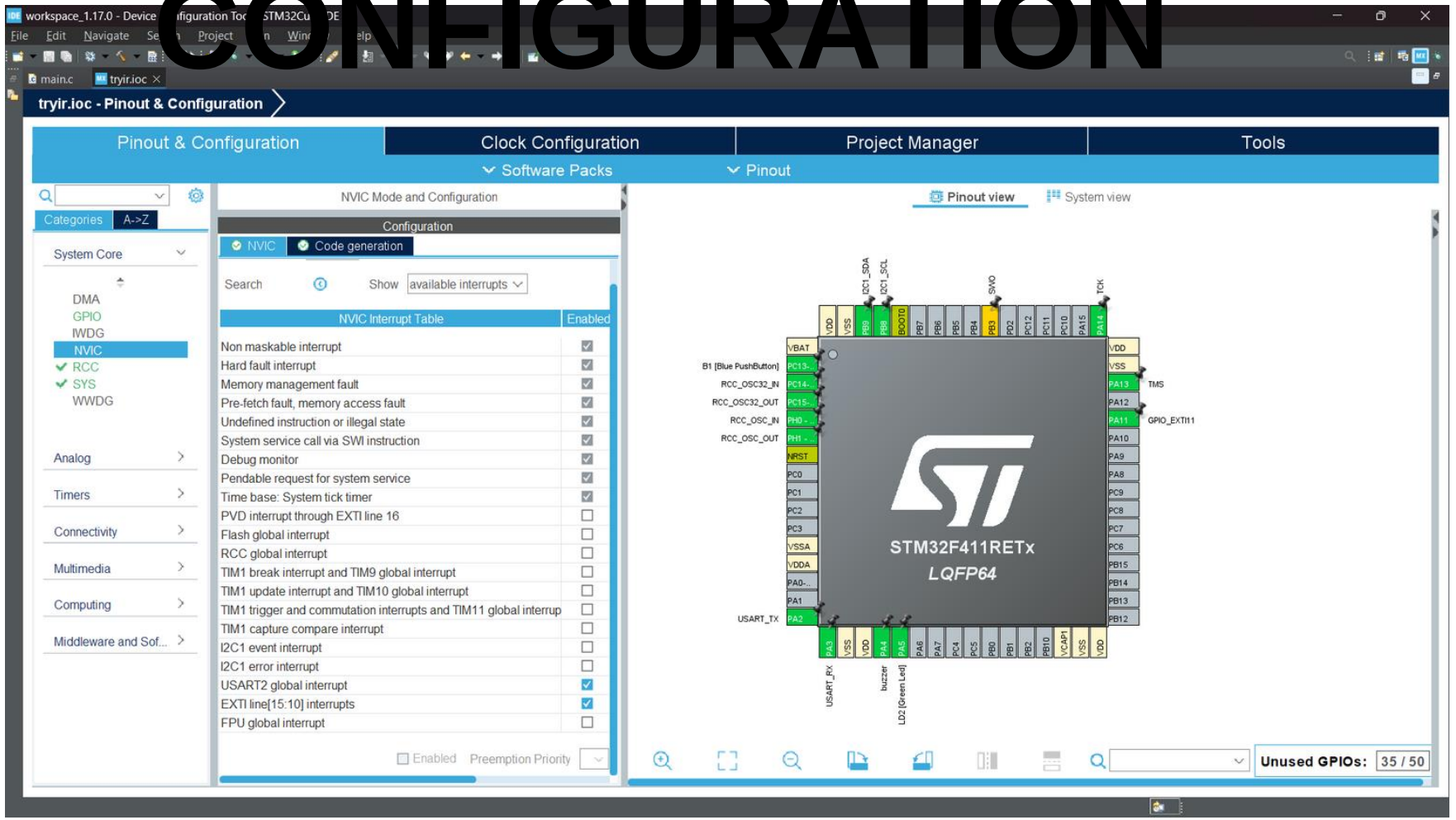


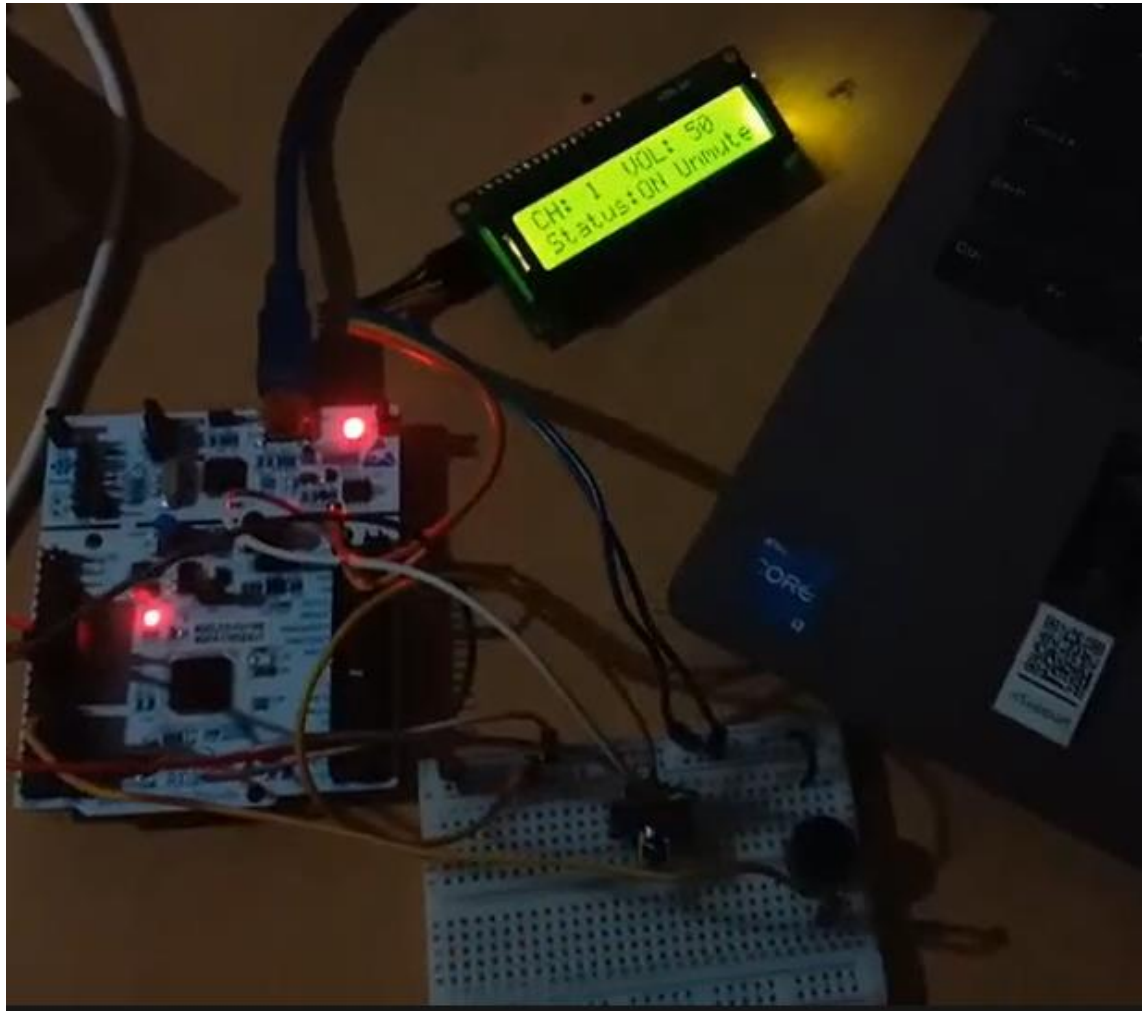
Figure 1. Example message frame using the NEC IR transmission protocol.



ADD-ONN'S- PIN CONFIGURATION



RESULT



CONCLUSION

In this project, we created a simple TV remote control simulation using the STM32 microcontroller. We used push buttons to represent remote functions, allowing us to control channel switching, volume adjustment, and power ON/OFF. Each button was programmed to perform a specific task, and the system responded smoothly to user input.

THANK YOU