ESP32 + C Programming Project Sets

Project Set 1: Sensor Basics + Data Handling

1A. Environment Monitor

Components: DHT11, LM35DZ, ESP32

- Read temp & humidity.
- Convert raw ADC data (LM35) to C.
- Use structs to organize data.
- Send values over serial every 5 seconds.

1B. Smart Light Detection

Components: FOTOREZYSTOR, LED, ESP32

- Detect light intensity.
- If light drops below threshold, turn on onboard LED.
- Use a potentiometer to adjust sensitivity threshold.

Project Set 2: Outputs + Shift Registers + Display

2A. Binary Counter with Shift Register

Components: 74HC595, LEDs, ESP32

- Create a binary counter using the shift register.
- Implement button-based step-up/step-down counter.
- Use bit-shifting and masking in C to control outputs.

2B. RGB Mood Lamp

Components: RGB LED, Potentiometer, ESP32

- Potentiometer controls brightness.
- Cycle RGB colors using PWM (ESP-IDF LEDC driver).
- Bonus: Use timer to auto-cycle every 10 seconds.

Project Set 3: Bluetooth + RFID

3A. RFID + Bluetooth Access Control

Components: MF RC522, ESP32, HC_SR501 (optional)

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- Use RFID to unlock access.
- On successful scan, send 'ACCESS GRANTED' to phone via Bluetooth.
- Use Bluetooth SPP (Serial Port Profile) in ESP-IDF.
- Optional: Motion detected activate RFID system.

Project Set 4: WiFi + Cloud + Time

4A. ESP32 Web Temp Logger

Components: DHT11 / LM35DZ, DS3231, ESP32

- Read and timestamp data.
- Store values in JSON format.
- Upload to cloud (Firebase or custom HTTP server).
- Use DS3231 as RTC backup.

Project Set 5: Game & User Input

5A. Reaction Game

Components: Push buttons (SWT-00377), LEDs, ESP32

- LED blinks randomly.
- User presses button as fast as possible.
- Timer records reaction time.
- Track high score.

5B. Simon Says with LEDs

Components: 74HC595, Buttons, RGB LEDs, ESP32

- Generate a color or LED sequence.
- User repeats the sequence.
- Use arrays, timing logic, and pattern comparison.

Project Set 6: Motors + Motion Detection

6A. Motion-Activated Fan

Components: HC_SR501, NPN BC547B, L293D, Motor, ESP32

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- Motion detected? Spin fan for 10 seconds.
- Use transistor to drive relay or control L293D H-Bridge.
- Optional: Control motor speed with potentiometer.

6B. Robot Car Brain (Simulation Prep)

Components: L293D, DC Motors, ESP32, Potentiometer

- Simulate differential drive with two motors.
- Use potentiometers as joystick control.
- Set up PWM motor control.

Project Set 7: Distance + Analog Sensing

7A. Distance Warning System

Components: GP2Y0A21YKOF, RGB LED, ESP32

- Measure distance.
- If distance < 20cm Red LED, else Green.
- Add serial output for real-time debug info.

Project Set 8: I2C + Multiplexing + Expansion

8A. I/O Expander Button Board

Components: PCF8574N, Buttons, LEDs, ESP32

- Read button states from expander.
- Light up corresponding LEDs.
- Practice modularizing I2C driver code.

Project Set 9: Audio + Bluetooth Streaming

9A. Voice Recorder + Bluetooth Transfer

Components: DFR0830, ESP32 BT

- Record audio sample using DFR0830.
- Save to SPIFFS or external memory.
- Send over Bluetooth to PC/phone.

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Project Set 10: Power & Real World Deployment

10A. Smart Clock + Energy Saver

Components: DS3231, ESP32, YD40-5 motor

- Wake up every hour using RTC.

- Move YD40-5 motor to signal time change.

- Put ESP32 into deep sleep between events.