

CODE

```
#define BLYNK_TEMPLATE_ID "TMPL6fPEXdHt2"
#define BLYNK_TEMPLATE_NAME "Smart Room"
#define BLYNK_AUTH_TOKEN "GWPZDgIENCWprIU_yL32-
bPvkvKysbJj"

#include <WiFi.h>
#include <BlynkSimpleEsp32.h>
#include <DHT.h>

// Pin definitions
const int stepperPins[4] = {13, 12, 14, 27}; //
Motor 1: IN1, IN2, IN3, IN4
const int sensor1Pin = 2; // Outside sensor (entry
first)
const int sensor2Pin = 4; // Inside sensor (entry
second)
const int lightPin = 15; // Light control pin
#define DHT_PIN 5 // DHT11 data pin
#define FAN_IN1 19 // L298N IN3
#define FAN_IN2 21 // L298N IN4
#define FAN_ENA 18 // L298N ENA (connected to
ENB)

const int cycles = 1200; // Number of cycles per
button press

// Wi-Fi credentials
char ssid[] = "OnePlus 12";
char pass[] = "xxxxxxxx"; // This is not the actual
password.

// Blynk virtual pins
```

```

#define LEFT_PIN V5    // Press left to rotate right
side (counterclockwise)
#define RIGHT_PIN V6  // Press right to rotate left
side (clockwise)
#define LIGHT_PIN V1  // Light control
#define FAN_PIN V2    // Fan ON/OFF
#define FAN_SPEED_PIN V3 // Fan speed (0-255) -
manual control
#define AUTO_MODE_PIN V4 // Auto fan mode toggle
#define COUNT_PIN V7    // People count display
#define TEMP_PIN V8     // *NEW: Temperature display*

// DHT11 setup
DHT dht(DHT_PIN, DHT11);

// Occupancy variables
volatile int peopleCount = 0;
enum State { IDLE, ENTRY_SENSOR1, ENTRY_SENSOR2,
EXIT_SENSOR2, EXIT_SENSOR1 };
volatile State currentState = IDLE;
volatile unsigned long lastTriggerTime = 0;
const unsigned long sequenceWindow = 2000; //
Increased to 2 seconds for multiple entries
const int debounceDelay = 10;              // 10ms
debounce
volatile bool sensor1Triggered = false;
volatile bool sensor2Triggered = false;
volatile int fanSpeed = 0; // Manual fan speed
control (0-255)
volatile bool autoFanMode = true; // Default to auto
mode

// OPTIMIZATION: Timing variables for reduced CPU
and Blynk usage
unsigned long lastTempRead = 0;
unsigned long lastSensorPrint = 0;
unsigned long lastBlynkUpdate = 0;
const unsigned long tempReadInterval = 3000;    //
Read temperature every 3 seconds

```

```
const unsigned long sensorPrintInterval = 5000; //
Print sensor status every 5 seconds
const unsigned long blynkUpdateInterval = 5000; //
Update Blynk every 5 seconds maximum
float lastTemperature = 0.0; // Store last valid
temperature
float lastBlynkTemperature = -999.0; // Store last
temperature sent to Blynk
const float tempChangeThreshold = 0.5; // Only
update Blynk if temperature changes by 0.5°C or more
```

```
// OPTIMIZATION: Batch Blynk updates to reduce
messages
```

```
bool needsBlynkUpdate = false;
bool tempNeedsUpdate = false;
bool fanNeedsUpdate = false;
bool lightNeedsUpdate = false;
bool countNeedsUpdate = false;
```

```
// Stepper variables
volatile bool leftAllowed = true; // Initially
allow left
volatile bool rightAllowed = false; // Initially
disable right
volatile int stepIndex = 0;
volatile unsigned long previousStepTime = 0;
const int stepDelay = 1; // 1ms step delay
volatile bool isStepping = false;
volatile int stepsRemaining = 0;
```

```
// Step sequences
const int clockwiseSeq[8][4] = {
    {1, 0, 0, 0},
    {1, 1, 0, 0},
    {0, 1, 0, 0},
    {0, 1, 1, 0},
    {0, 0, 1, 0},
    {0, 0, 1, 1},
    {0, 0, 0, 1},
    {1, 0, 0, 1}
```

```

};
const int counterclockwiseSeq[8][4] = {
    {1, 0, 0, 1},
    {0, 0, 0, 1},
    {0, 0, 1, 1},
    {0, 0, 1, 0},
    {0, 1, 1, 0},
    {0, 1, 0, 0},
    {1, 1, 0, 0},
    {1, 0, 0, 0}
};

// Task handles
TaskHandle_t stepperTaskHandle = NULL;
TaskHandle_t occupancyTaskHandle = NULL;

void setup() {
    Serial.begin(115200);

    // Stepper setup
    for (int i = 0; i < 4; i++) {
        pinMode(stepperPins[i], OUTPUT);
        digitalWrite(stepperPins[i], LOW);
    }

    // Occupancy setup
    pinMode(sensor1Pin, INPUT);
    pinMode(sensor2Pin, INPUT);
    pinMode(lightPin, OUTPUT);
    pinMode(FAN_IN1, OUTPUT);
    pinMode(FAN_IN2, OUTPUT);
    pinMode(FAN_ENA, OUTPUT); // Controls both ENA and
    ENB if wired together
    digitalWrite(lightPin, LOW);
    stopFan();
    dht.begin();
    delay(2000); // Sensor stabilization

    // Create tasks

```

```

    xTaskCreate(stepperTask, "StepperTask", 2048,
NULL, 1, &stepperTaskHandle); // Core 0
    xTaskCreate(occupancyTask, "OccupancyTask", 4096,
NULL, 1, &occupancyTaskHandle); // Core 1
    delay(500); // Allow tasks to start

    // Connect to Blynk on the main core
    Blynk.begin(BLYNK_AUTH_TOKEN, ssid, pass);
    Serial.println("Combined System Started");

    // *NEW: Initial Blynk sync*
    syncInitialValues();
}

void loop() {
    Blynk.run(); // Handle Blynk on the main core

    // OPTIMIZATION: Batch update Blynk to reduce
messages
    unsigned long currentTime = millis();
    if (needsBlynkUpdate && (currentTime -
lastBlynkUpdate >= blynkUpdateInterval)) {
        performBatchBlynkUpdate();
        lastBlynkUpdate = currentTime;
        needsBlynkUpdate = false;
    }
}

// NEW: Sync initial values to Blynk
void syncInitialValues() {
    Blynk.virtualWrite(LIGHT_PIN,
digitalRead(lightPin));
    Blynk.virtualWrite(FAN_PIN, (fanSpeed > 0) ? HIGH
: LOW);
    Blynk.virtualWrite(FAN_SPEED_PIN, fanSpeed);
    Blynk.virtualWrite(COUNT_PIN, peopleCount);
    Blynk.virtualWrite(AUTO_MODE_PIN, autoFanMode);
    if (lastTemperature > 0) {
        Blynk.virtualWrite(TEMP_PIN, lastTemperature);
        lastBlynkTemperature = lastTemperature;
    }
}

```

```

    }
    Serial.println("Initial values synced to Blynk");
}

// NEW: Batch Blynk updates to reduce server load
void performBatchBlynkUpdate() {
    if (tempNeedsUpdate) {
        Blynk.virtualWrite(TEMP_PIN, lastTemperature);
        lastBlynkTemperature = lastTemperature;
        tempNeedsUpdate = false;
        Serial.print("Temperature updated to Blynk: ");
        Serial.println(lastTemperature);
    }

    if (fanNeedsUpdate) {
        Blynk.virtualWrite(FAN_PIN, (fanSpeed > 0) ?
HIGH : LOW);
        Blynk.virtualWrite(FAN_SPEED_PIN, fanSpeed);
        fanNeedsUpdate = false;
    }

    if (lightNeedsUpdate) {
        Blynk.virtualWrite(LIGHT_PIN,
digitalRead(lightPin));
        lightNeedsUpdate = false;
    }

    if (countNeedsUpdate) {
        Blynk.virtualWrite(COUNT_PIN, peopleCount);
        countNeedsUpdate = false;
    }
}

// Stepper task (unchanged)
void stepperTask(void *pvParameters) {
    for (;;) {
        if (isStepping) {
            unsigned long currentTime = millis();
            if (currentTime - previousStepTime >=
stepDelay) {

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        if (stepsRemaining > 0) {
            const int* seq = leftAllowed ?
counterclockwiseSeq[stepIndex] :
clockwiseSeq[stepIndex];
            for (int i = 0; i < 4; i++) {
                digitalWrite(stepperPins[i], seq[i]);
            }
            stepIndex = (stepIndex + 1) % 8;
            stepsRemaining--;
            previousStepTime = currentTime;
        } else {
            isStepping = false;
            delay(10); // Stabilize
        }
    }
    delay(1); // Yield
}
vTaskDelete(NULL);
}

```

// OPTIMIZED: Occupancy task with reduced Blynk updates

```

void occupancyTask(void *pvParameters) {
    for (;;) {
        int sensor1 = digitalRead(sensor1Pin);
        int sensor2 = digitalRead(sensor2Pin);
        unsigned long currentTime = millis();

        // Print sensor status less frequently
        if (currentTime - lastSensorPrint >=
sensorPrintInterval) {
            Serial.print("Sensor 1: ");
Serial.print(sensor1);
            Serial.print(", Sensor 2: ");
Serial.println(sensor2);
            Serial.print("People Count: ");
Serial.println(peopleCount);
            lastSensorPrint = currentTime;
        }
    }
}

```

```

switch (currentState) {
  case IDLE:
    if (sensor1 == LOW && !sensor1Triggered) {
      delay(debounceDelay);
      if (digitalRead(sensor1Pin) == LOW) {
        sensor1Triggered = true;
        lastTriggerTime = currentTime;
        currentState = ENTRY_SENSOR1;
        Serial.println("Sensor 1 triggered
(entry start), state: ENTRY_SENSOR1");
      }
    } else if (sensor2 == LOW &&
!sensor2Triggered) {
      delay(debounceDelay);
      if (digitalRead(sensor2Pin) == LOW) {
        sensor2Triggered = true;
        lastTriggerTime = currentTime;
        currentState = EXIT_SENSOR2;
        Serial.println("Sensor 2 triggered (exit
start), state: EXIT_SENSOR2");
      }
    }
    break;

  case ENTRY_SENSOR1:
    if (sensor2 == LOW && (currentTime -
lastTriggerTime <= sequenceWindow)) {
      delay(debounceDelay);
      if (digitalRead(sensor2Pin) == LOW) {
        peopleCount++;
        updateLightsAndFan();
        currentState = IDLE;
        sensor1Triggered = false;
        Serial.print("Person entered. Count: ");
        Serial.println(peopleCount);
      }
    } else if (currentTime - lastTriggerTime >
sequenceWindow) {
      currentState = IDLE;
    }
  }
}

```



```

        sensor1Triggered = false;
        Serial.println("Entry sequence timed out,
state: IDLE");
    }
    break;

    case EXIT_SENSOR2:
        if (sensor1 == LOW && (currentTime -
lastTriggerTime <= sequenceWindow)) {
            delay(debounceDelay);
            if (digitalRead(sensor1Pin) == LOW) {
                if (peopleCount > 0) peopleCount--;
                updateLightsAndFan();
                currentState = IDLE;
                sensor2Triggered = false;
                Serial.print("Person exited. Count: ");
Serial.println(peopleCount);
            }
        } else if (currentTime - lastTriggerTime >
sequenceWindow) {
            currentState = IDLE;
            sensor2Triggered = false;
            Serial.println("Exit sequence timed out,
state: IDLE");
        }
        break;
    }

```

// OPTIMIZED: Temperature reading with smart Blynk updates

```

    if (currentTime - lastTempRead >=
tempReadInterval) {
        float temp = dht.readTemperature();
        if (!isnan(temp)) {
            lastTemperature = temp;
            Serial.print("Temperature: ");
Serial.print(temp); Serial.println(" °C");

```

// OPTIMIZATION: Only update Blynk if temperature changed significantly

```

        if (abs(temp - lastBlynkTemperature) >=
tempChangeThreshold) {
            tempNeedsUpdate = true;
            needsBlynkUpdate = true;
        }

        if (peopleCount >= 1 && autoFanMode) { //
Auto mode logic
            if (temp >= 33) {
                setFanSpeed(255);
                Serial.println("Temperature >= 33°C, fan
set to 255");
            } else if (temp >= 30) {
                setFanSpeed(180);
                Serial.println("Temperature >= 30°C, fan
set to 180");
            } else if (temp > 25) {
                setFanSpeed(128);
                Serial.println("Temperature > 25°C, fan
set to 128");
            } else {
                stopFan();
                Serial.println("Temperature <= 25°C, fan
stopped");
            }
        }
        else {
            Serial.println("Failed to read DHT11 - using
last valid reading");
        }
        lastTempRead = currentTime;
    }

    delay(50);
}
vTaskDelete(NULL);
}

// OPTIMIZATION: Update lights and fan with batched
Blynk updates

```

```
void updateLightsAndFan() {
  if (peopleCount > 0) {
    digitalWrite(lightPin, HIGH);
  } else {
    digitalWrite(lightPin, LOW);
    stopFan(); // Turn off fan and light when no one
is present
  }
}
```

```
  // OPTIMIZATION: Mark for batched update instead
of immediate update
```

```
  lightNeedsUpdate = true;
  fanNeedsUpdate = true;
  countNeedsUpdate = true;
  needsBlynkUpdate = true;
}
```

```
// Fan control
```

```
void setFanSpeed(int speed) {
  digitalWrite(FAN_IN1, HIGH);
  digitalWrite(FAN_IN2, LOW);
  analogWrite(FAN_ENA, speed);
  fanSpeed = speed;
}
```

```
  // Optimization: Mark for batched update
  fanNeedsUpdate = true;
  needsBlynkUpdate = true;
```

```
  Serial.print("Fan speed set to: ");
  Serial.println(speed);
}
```

```
void stopFan() {
  digitalWrite(FAN_IN1, LOW);
  digitalWrite(FAN_IN2, LOW);
  analogWrite(FAN_ENA, 0);
  fanSpeed = 0;
}
```

```
  // Optimization: Mark for batched update
  fanNeedsUpdate = true;
```

```

    needsBlynkUpdate = true;

    Serial.println("Fan stopped");
}

// OPTIMIZED: Blynk handlers with reduced updates
BLYNK_WRITE(LEFT_PIN) {
    int value = param.asInt();
    if (value == 1 && leftAllowed && !isStepping) { //
Check !isStepping to prevent interruption
        Serial.println("Rotating to right side
(counter-clockwise) for " + String(cycles) + "
cycles");
        isStepping = true;
        stepsRemaining = cycles * 8;
        stepIndex = 0;
        leftAllowed = false;
        rightAllowed = true;
    } else if (value == 1 && isStepping) {
        Serial.println("Open operation in progress -
ignoring close request");
    }
}

BLYNK_WRITE(RIGHT_PIN) {
    int value = param.asInt();
    if (value == 1 && rightAllowed && !isStepping) {
// Check !isStepping to prevent interruption
        Serial.println("Rotating to left side
(clockwise) for " + String(cycles) + " cycles");
        isStepping = true;
        stepsRemaining = cycles * 8;
        stepIndex = 0;
        rightAllowed = false;
        leftAllowed = true;
    } else if (value == 1 && isStepping) {
        Serial.println("Close operation in progress -
ignoring open request");
    }
}

```

```

BLYNK_WRITE(LIGHT_PIN) {
  int value = param.asInt();
  if (value == HIGH) {
    digitalWrite(lightPin, HIGH);
    Serial.println("Lights ON (Manual)");
  } else if (value == LOW) {
    digitalWrite(lightPin, LOW);
    Serial.println("Lights OFF (Manual)");
  }
  // OPTIMIZATION: Immediate update for manual control
  Blynk.virtualWrite(LIGHT_PIN,
digitalRead(lightPin));
}

BLYNK_WRITE(FAN_PIN) {
  int value = param.asInt();
  if (value == HIGH && !autoFanMode) {
    fanSpeed = 128;
    setFanSpeed(fanSpeed);
    Serial.println("Fan ON (Manual, Half Speed)");
  } else if (value == LOW && !autoFanMode) {
    fanSpeed = 0;
    stopFan();
    Serial.println("Fan OFF (Manual)");
  }
  // OPTIMIZATION: Immediate update for manual control
  Blynk.virtualWrite(FAN_PIN, (fanSpeed > 0) ? HIGH
: LOW);
}

BLYNK_WRITE(FAN_SPEED_PIN) {
  int value = param.asInt();
  if (value >= 0 && value <= 255 && !autoFanMode) {
    fanSpeed = value;
    setFanSpeed(fanSpeed);
    Serial.print("Fan Speed set to: ");
    Serial.println(fanSpeed);
  }
}

```

```

    }
    // OPTIMIZATION: Immediate update for manual control
    Blynk.virtualWrite(FAN_SPEED_PIN, fanSpeed);
}

BLYNK_WRITE(AUTO_MODE_PIN) {
    autoFanMode = param.asInt();
    Serial.print("Auto Fan Mode: ");
    Serial.println(autoFanMode ? "Enabled" :
"Disabled");
    if (autoFanMode) {
        // Use last valid temperature reading
        if (lastTemperature > 0 && peopleCount >= 1) {
            if (lastTemperature >= 33) setFanSpeed(255);
            else if (lastTemperature >= 30)
setFanSpeed(180);
            else if (lastTemperature > 25)
setFanSpeed(128);
            else stopFan();
        } else {
            stopFan();
        }
    } else {
        // OPTIMIZATION: Immediate sync for mode change
        Blynk.virtualWrite(FAN_SPEED_PIN, fanSpeed);
    }
}

```

We used the Grok AI tool for assistance

<https://grok.com/>