

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**DEPARTMENT OF COMPUTER ENGINEERING**

**COE 381 - MICROPROCESSORS**



# **PROJECT DOCUMENTATION**

**TOPIC: Smart Home Lighting System**

**GROUP 1**

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## Introduction

The Smart Home Lighting System is an automated lighting solution that enhances home automation by using motion sensors (PIR), push buttons, and an LCD display to control lighting. The system integrates an Arduino Uno for processing and various electronic components for sensing and switching lights.

## System Components

- Arduino UNO R3 (Microcontroller)
- 16x2 I2C LCD Display
- 3 PIR (Passive Infrared) Motion Sensors
- 3 Red LED Lights (for Living Room, Kitchen, Bedroom)
- Photoresistor (Light Sensor)
- 2 Pushbuttons (Manual On/Off)
- 3x 1 k $\Omega$  Resistors

## Key Features

1. **Automatic Mode**
  - Lights turn on automatically when motion is detected
  - Considers ambient light levels
  - Lights turn off after 30 seconds of no motion
2. **Manual Mode**
  - Manual on/off buttons for all lights
  - Override automatic system control
3. **Voice Control Mode**
  - Serial command-based control
  - Multiple commands for individual room lights
  - System status reporting
  - Pause and resume functionality

## Functional Modes

- **Automatic Mode:** Default operation using motion and light sensors
- **Manual Mode:** Direct control via physical buttons
- **Voice Control Mode:** Serial command-based control

## Command List

1. Turn on all lights
2. Turn off all lights
3. Turn on living room light
4. Turn on kitchen light
5. Turn on bedroom light
6. Turn off living room light
7. Turn off kitchen light
8. Turn off bedroom light
9. Switch to automatic mode

10. Show system status
11. Pause system
12. Resume system
13. Set light threshold

## Configuration Parameters

- **Light Threshold:** Adjustable (0-1023)
  - Determines minimum light level to trigger lights
- **Motion Timeout:** 30 seconds
- **Debounce Delay:** 200 milliseconds

## Technical Implementation

- Uses EEPROM to store light threshold settings
- Implements state machine for system modes
- Utilizes interrupt-like polling for sensor readings
- Provides periodic system status updates

## Potential Improvements

1. Add wireless control (WiFi/Bluetooth)
2. Implement more granular light intensity control
3. Add temperature and humidity sensors
4. Create mobile app integration

## Troubleshooting

- Ensure proper sensor connections
- Check serial monitor for system messages
- Verify Arduino IDE and library compatibility