

19CSE303 Embedded Systems Project Documentation



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Project Overview

This project implements two embedded applications using the STM32 microcontroller: a temperature and motion detection system, and a servo motor controller. The detection system monitors temperature, motion, and ambient light levels using various sensors, with LEDs indicating specific conditions. The servo controller adjusts motor angles from 0° to 180° using PWM signals, providing precise positioning.

Application 1: Temperature and Motion Detection System

The temperature and motion detection system uses sensors to monitor environmental conditions and triggers LEDs based on detected values:

- **DHT11 Sensor:** Measures temperature.
- **PIR Sensor:** Detects motion.
- **Light Sensor:** Monitors ambient light.

LED Indicators:

- **PC13:** Onboard LED, activated by motion detection.
- **PB9:** External LED, responds to ambient light conditions.
- **PC14:** External LED, blinks if the temperature exceeds a set threshold of 27.3 °C.

This system continuously reads the sensors and updates the LEDs based on the current environmental conditions.

Application 2: Servo Motor Control

This application controls the position of a servo motor through PWM signals generated by Timer 2 on GPIO PA5. Using the `Servo_SetAngle()` function, the servo motor's angle is precisely adjusted, allowing for control within a 0° to 180° range.

The motor's angle is set by calculating the necessary pulse width for each desired position, showcasing direct hardware control through register manipulation.

Components Used

- **Microcontroller:** STM32F401CCU6 Minimum System Board
- **Sensors:** DHT11 Temperature & Humidity Sensor, PIR Motion Sensor, Light Sensor
- **LEDs:** Onboard LED (PC13), External Indicator LEDs (PC14, PB9)

- **Servo Motor:** TowerPro SG90 Mini Servo (180° Rotation)

How to Build and Deploy

1. **Setup:** Use STM32CubeIDE or Keil uVision with STM32 libraries.
 2. **Compilation:** Compile the code and flash it to the STM32 board.
 3. **Execution:** Run the program on the STM32 board, observing the LED responses and servo motor movement based on sensor data.
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Images

