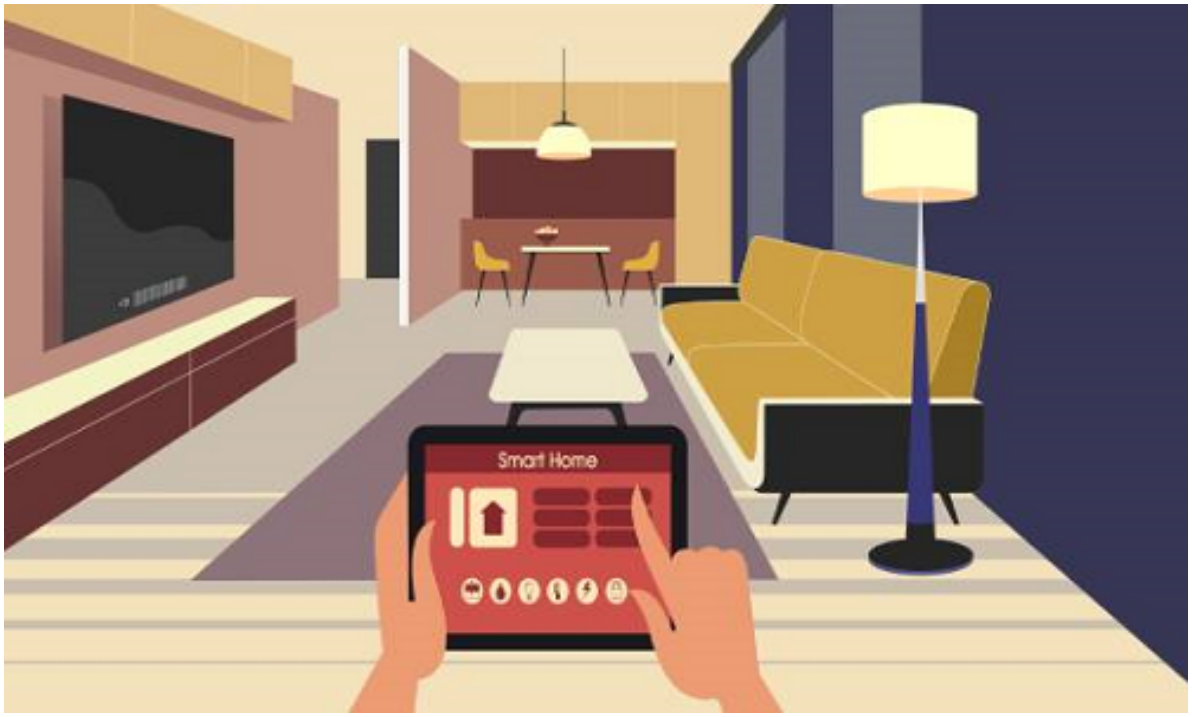
ECEN 5813 - Principles of Embedded Software

Home Automation using KL25Z



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Proposal

The objective of this project is to create a home automation system with KL25Z. The home automation system will allow the user to interact through command prompt with the device, pass commands to control various parts of the home.

Overview

The KL25Z development board comes with LEDs on-board. An SHT21 temperature and humidity sensor will be interfaced with the KL25Z through I2C. The primary goal of this project is to create a simple home automation system. The user can input commands to board and the board is going to take that input, process it and provide an appropriate action or an output. The current planned commands are:

- Change LED color
- Check the room temperature
- Check the room humidity

The KL25Z also comes with an on-board capacitive touch sensor. This touch sensor will be used to increase or decrease the intensity of the LEDs.

The KL25Z's onboard timer will be used to set schedules by the user to set up time when the LEDs can be turned off after a given period.

The results from this project will demonstrate a basic functionality of home automation and this system can be expanded further to realize bigger products such as the Alexa and Google Assistant devices.

Requirements

The primary requirements for this projects are:

- The procurement of SHT21 sensor on a breakout board
- Hardware interfacing KL25Z with SHT21
- Implementing communication from SHT21 to KL25Z through I2C
- Reading temperature and humidity from SHT21
- Implementing a command prompt for the user to provide inputs

- Using PWM to control the LEDs on KL25Z
- Configuring capacitive touch sensor to receive input from user
- Setting up timer on KL25Z to track schedules given by user
- Maintaining the system state machine when the device is running

Functionalities

Some of the core concepts and functionalities used are:

- UART controller
- Command processor
- Interrupt handling
- Timer functionality
- PWM
- I2C
- Circular buffers
- State machines
- GPIO lines
- Testing

Testing

The project will primarily use manual tests to ensure the correctness of the functionality. The command processor will be tested for both valid and invalid commands. Unit tests will be developed for testing of individual functionalities.

Testing of LEDS:

Manual Tests will ensure if the led color changes based on the user input.
It also ensures that the LED intensity is changed according to the capacitive touch.
It also ensures if the LED turns on and off based on the schedules set by the user.

Testing Temperature and Humidity sensor:

In order to test the temperature sensor, I would use the Hairdryer to check if the temperature sensor senses a higher temperature than room temperature. Cooling fan will be used to test the temperature drop below the room temperature.
To test the humidity sensor, I would measure the humidity in a room which is preheated and a room where the humidifier is turned on.

Complexity

The goal of this project is to make use of most of the technologies we have covered over 7 assignments. It includes both hardware and software complexity. Concepts like UART, Command Processor, Interrupt handling, Timer functionality, PWM, Circular buffer, State Machine, GPIO, testing has been covered in parts for assignments. Complexity is involved in bringing them all together. Additionally, I would be interfacing a temperature and humidity sensor and get the values through I2C. This is not covered as part of previous assignments. It would be a great learning experience. Maintaining the state machine to handle the user inputs and perform the specific functionality with the minimum delay is important over time.

References

https://www.farnell.com/datasheets/1780639.pdf