

Problems

Problem 1

In this problem, you will work on implementing a simple tone generator utilizing Timer, PWM and External Interrupt modules and use a keypad, a speaker, and 7SDs.

- Connect a keypad to your microcontroller, pick a block of notes, and assign a tone for each key on the keypad.
- One of the keys should be silence (rest).
- Tones will be played using PWM by changing the period at 50% duty cycle.
- Design an amplifier, and connect a speaker with adjustable gain using a pot.
- When a key is pressed, the relevant tone should play indefinitely.
- Connect your 7SD to display the tone that is being played. You can display the frequency being played. (440, 480, ...) OR you can display the tone being played (A4, B4, C4, ...).

Problem 2

In this problem, you will be working with reading and logging MPU6050 IMU sensor data utilizing Timer, DC, and UART modules and use MPU6050, and 24LC512 EEPROM.

- Write your 12C routines to read / write multiple data. You should have four functions: single read, single write, multi read, multi write. Multi read and write deal with multiple bytes.
- Write a data structure to hold the sensor data.
- To ensure the data is correct, send your results over UART to PC with You should read all sensor data and send them all as the example below:

1 AX: 0 . 12 , AY•. 0 . 53 , . 1 . 32 , . . .

- Sample the sensors every 10 ms, and write the data values to EEPROM. You should first start with writing and reading single bytes. Once the operation is completed successfully, work on your way to write and read multiple bytes.
- EEPROM and MPU6050 should be sharing the same 12C bus. Check the IMU board for pull-up resisitors. If it includes pull-up resistors, you should not need to add another set of pull-up resistors.
- Once you press an external button, data collection should start, and once it collects 10 seconds of data, it should stop, and an LED should light up to display data is ready on EEPROM.
- When the LED is on (meaning there is data on the EEPROM) pressing the button will transmit all the data over UART to your PC.
- You can optionally save this to a file and/or plot your results using Python or Matlab.