

## Project 3: “Annoying” Alarm Clock

- Project 3 contents
- Questions left for you
- What do we inherit from before?
- Suggested implementation steps

## Announcements

- Every group (not everyone) receives a robot kit.
- Please see [Mr. David Ramos](#) in Evans 127.



## Project 3 Content

- Goals of this project:
  - Review the concept of interrupt
  - Learn how to use multiple interrupts
  - Learn analog to digital conversion
- Minimal Hardware:
  - PIC32 Kit board, PmodSSD\*2, Pmod Keypad, Pmod microphone, Pmod IR sensor, cables
- Inputs:
  - Keypad, Microphone, IR Sensor
- Outputs:
  - Two external PmodSSDs displaying the clock or the alarm
  - Two on-board LEDs 1 & 4 showing the modes of the device

## Alarm Clock Functions

### Still five modes:

- Mode 1 - Initial
  - Clock = 00:00. Alarm = 06:00.
- Mode 2 – Set Alarm
  - Use keypad to program the clock.
- Mode 3 – Set Time
  - Use keypad to program the alarm.
- Mode 4 – Display Time
  - Display the current time.
- Mode 5 - Alarming
  - Flash SSDs and LEDs to indicate that time equals alarm time.

## Alarm Clock Functions

- In the alarming mode, there are three ways to stop the alarm
  - Yell to the PmodMIC (e.g., saying “shut up”);
  - Press and hold buttons “C” and “D” exclusively;
  - The alarm has flashed for 15 seconds (i.e., the clock time has increased by 15 minutes).

## Differences between Projects 1 & 3

### Project 1

- Time range 00:00 – 23:59
- Use on-board buttons to set alarm and clock
- Clock frequency  $\approx$  5Hz

### Project 3

- Time range 00:00 – 11:59
  - Use IR sensor to differentiate day and night
- Use keypad to set alarm and clock
- Clock frequency = 1Hz exactly
  - Need to use Timer interrupt to control it

## Input Devices

- Microphone
  - Connected to an analog port, value checked through ADC
- IR sensor
  - A digital input, need to calibrate it
- Keypad

Modes	0-9	C	D	E
Initial Display time	--	Set alarm	Set clock	--
Set clock Set alarm	Input digit	Clear	Delete	Enter
Alarming	--	Stop alarming Display time		--

## Outputs

Modes	7-seg display	LEDs 1&4
Initial	Clock Value	00
Set Alarm	Alarm Value	10
Set Time	Clock Value	01
Display Time	Clock Value	11
Alarming	Clock Value + Flashing	Flashing

## Frequency Control

- In previous projects, our setting of the frequency of counting/LED blinking is very inaccurate.
- In this project, however, the clock incrementing frequency needs to be exactly 1Hz (1 second for each period).
- How to achieve?
  - Timer interrupt
- Questions left for you
  - How to configure timer interrupt?
  - How to test the frequency?
  - How to handle multiple types of interrupts?

## Overview

- What do we inherit from before?
  - From Project 1 – Alarm clock
  - From Project 2 – Keypad, CN interrupt, Timer interrupt (Project 2 template)
- What are new?
  - How to handle multiple interrupts
  - How to configure ADC for microphone
  - How to calibrate IR sensor and read it

## Suggested implementation steps

1. Based on your project 1 alarm clock, use keypad as input
  - Make sure keypad, CN interrupt, and displays are working properly
2. Use timer to precisely control clock speed
  - Make sure multiple interrupts work properly
3. Use IR sensor as a condition for alarming
4. Use microphone as a condition to stop alarm

## Next two lectures

- Wed 4/16: Sampling and ADC
  - Reading assignment:
    - Reference manual Section 17
    - Textbook Chapter 11
- Fri 4/18: Timer
  - Reading assignment:
    - Reference manual Section 14
    - Textbook Chapter 5