

# Lecture 7

## Obstacle Avoidance Sensor, Battery Power Supply, and Debugging

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# Overview

- Debug Techniques
- IR Obstacle Avoidance Sensor
- Batter Power Supply Circuit

# Debugging

- Use incremental development approach: test as you go – Don't write all code before testing!
- Hardware debug: use multimeter to verify voltage levels at switches/buttons/LEDs
- Debug with simulator and onboard:
  - Add Breakpoints, use watch window and memory window to keep track of variable values and memory location contents.

# Basic Debug Skills

- Step over code in Keil debugger – if jumps unexpectedly to error handler then investigate further.
- Determine if code works correctly up to a certain point(breakpoint).
- Determine if a functionality works correctly – GPIO Ports, SysTick, Interrupts, State Machine.
- Verify interrupts are firing by setting breakpoints in interrupt handler and triggering the appropriate interrupt.

# Basic Debug Skills

- Run code that is known to work and verify it still works.
- Swap out switches/buttons/LEDs.
- Remove switches/buttons from circuit – connect directly to GND or VCC.
  - Technically need resistor to limit current.
- Rewrite chunks of code without looking at currently written code.
  - Look at sample code from slides, textbook, etc. instead.

# Basic Debug Skills

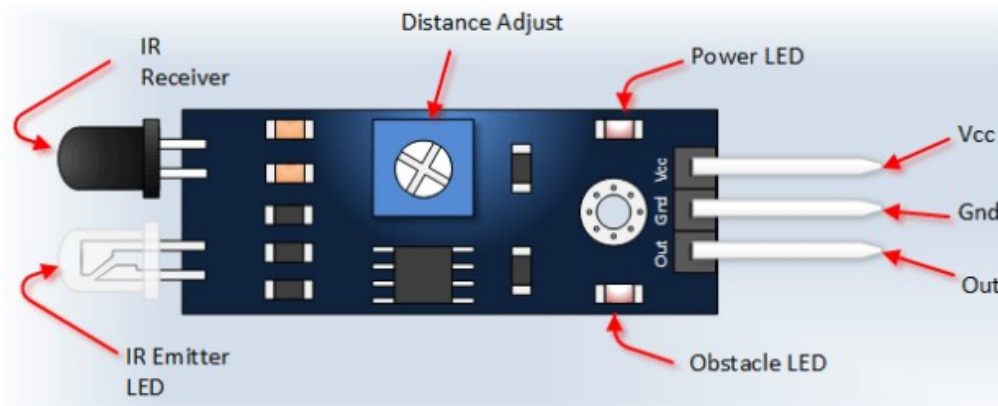
- Edit variable values in Watch window while at breakpoint.
- Change initialization code to start in a different initial state.
- Hard code input values to test state transitions.

# IR Obstacle Avoidance Sensor

Pin, Control Indicator	Description
Vcc	3.3 to 5 Vdc Supply Input
Gnd	Ground Input
Out	Output that goes low when obstacle is in range
Power LED	Illuminates when power is applied
Obstacle LED	Illuminates when obstacle is detected
Distance Adjust	Adjust detection distance. CCW decreases distance. CW increases distance.
IR Emitter	Infrared emitter LED
IR Receiver	Infrared receiver that receives signal transmitted by Infrared emitter.

Can use the **5 V DC** supply from **LaunchPad**

**Effective distance range**  
**2 ~ 30cm**; **detection**  
**angle 35°.**



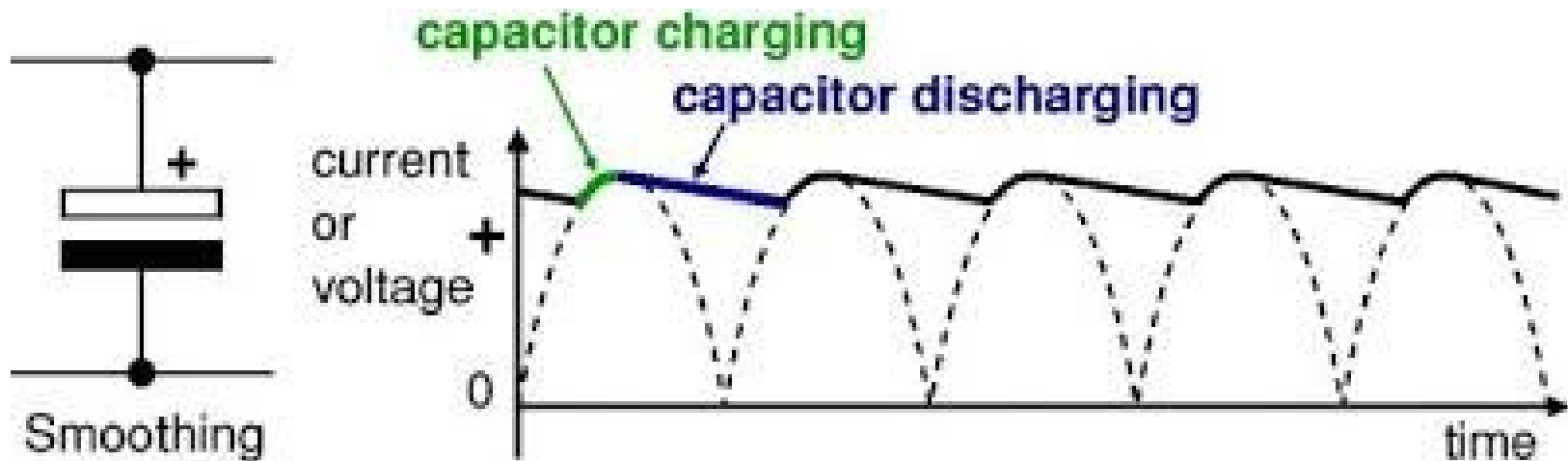
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- The diagram illustrates a parallel plate capacitor. It consists of two vertical, parallel, light blue rectangular plates. The left plate is labeled  $Q+$  and has five red '+' signs along its left edge. The right plate is labeled  $Q-$  and has five blue '-' signs along its right edge. Between the two plates is a gray rectangular region labeled 'Dielectric'. Above the plates, the text 'Conductive Parallel Plates' has two arrows pointing to each plate. To the right of the capacitor, the text 'Electrical Charge' has an arrow pointing to the negative plate. The capacitor is connected to a battery at the bottom. The battery is represented by a long vertical line on the left (positive) and a shorter, thicker vertical line on the right (negative), with a '+' sign on the left and a '-' sign on the right. Below the battery is the label 'Voltage  $V_C$ '. To the right of the capacitor, there is a standard circuit symbol for a capacitor, consisting of two parallel horizontal lines, with the label 'Symbol' below it.



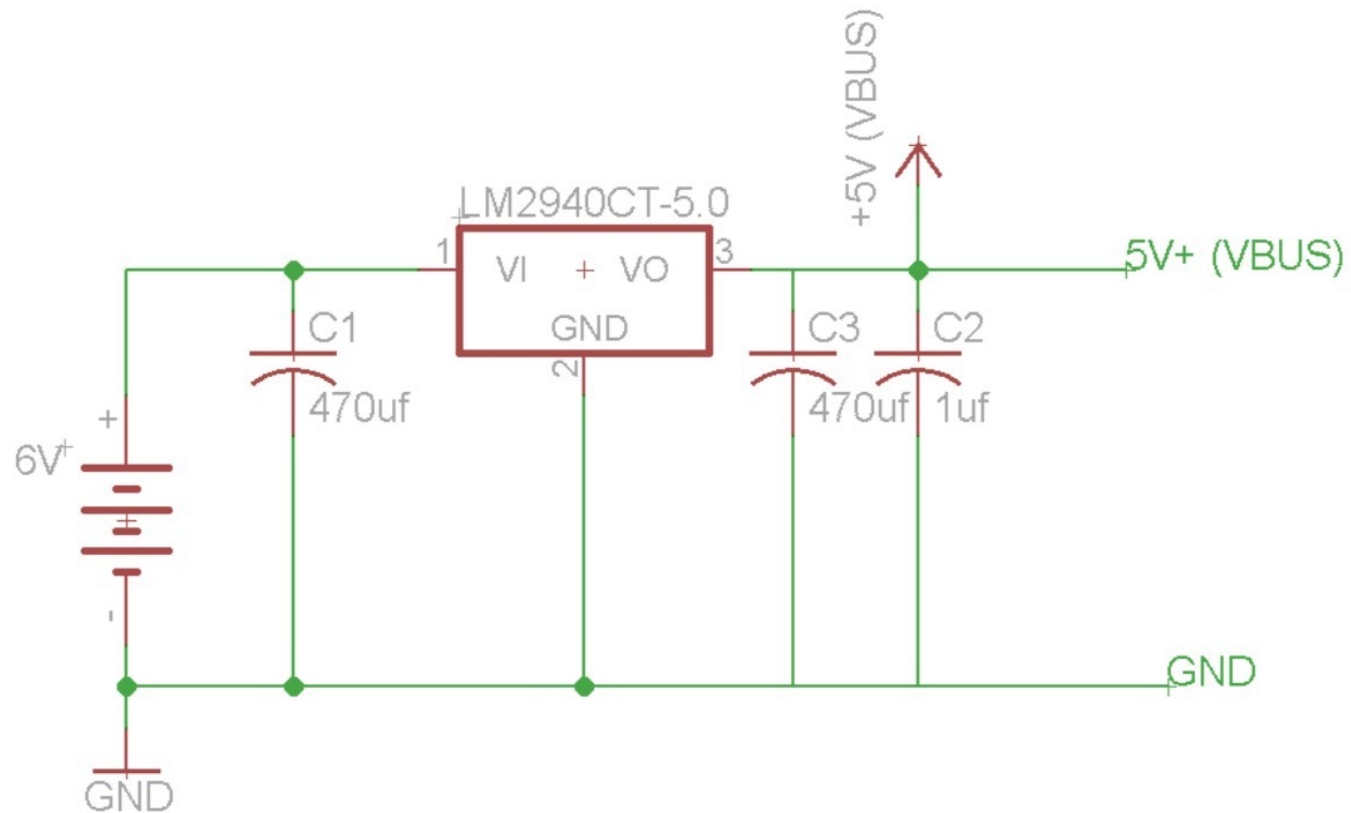
# How Capacitor Provide Clean Power



A filter capacitor smooth down ripples and fills up the voltage "notches" or gaps by discharging its internal stored energy. Thus, the circuit connected to it can receive a clean DC supply voltage.



# Battery Power Supply

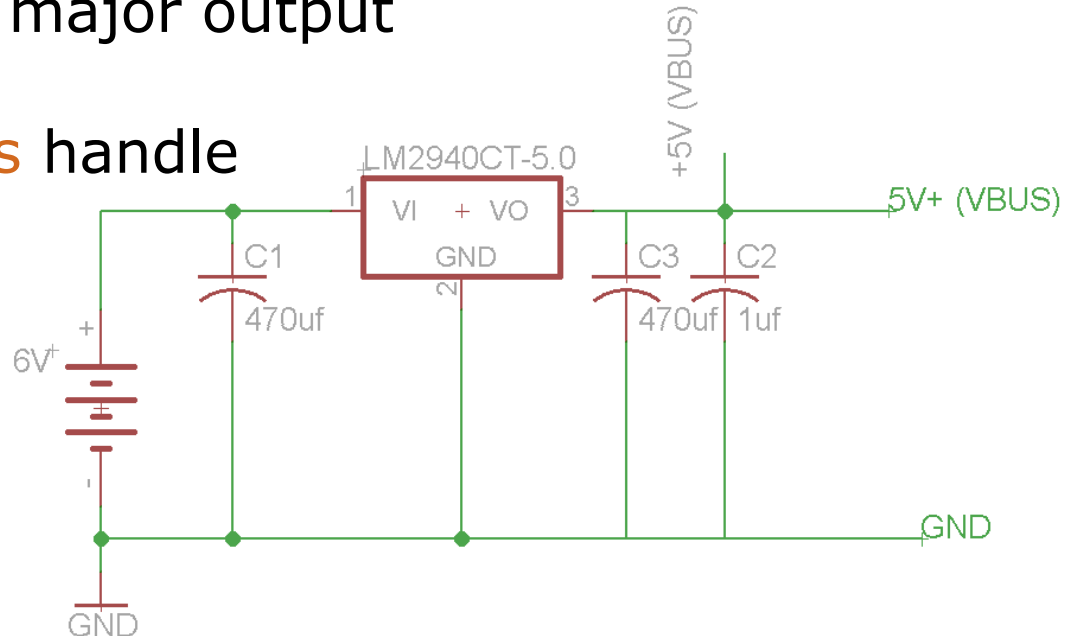


# Building Your Own Power Supply Circuit



- ❑ If the 5V regulator output is not stable, we can increase the capacitance at the input/output of the regulator. Ex: increase C3 in the following figure to a higher capacitance.
- ❑ Why two capacitors in parallel?  
**Big capacitors** handles low frequency ripple and main noise and major output load changes.

**Small capacitors** handle high frequency noise and fast transients.



## Reference

- IR Obstacle avoidance sensor: <https://www.youtube.com/watch?v=gRtdcxOXojo>