Capacitance Meter using Arduino

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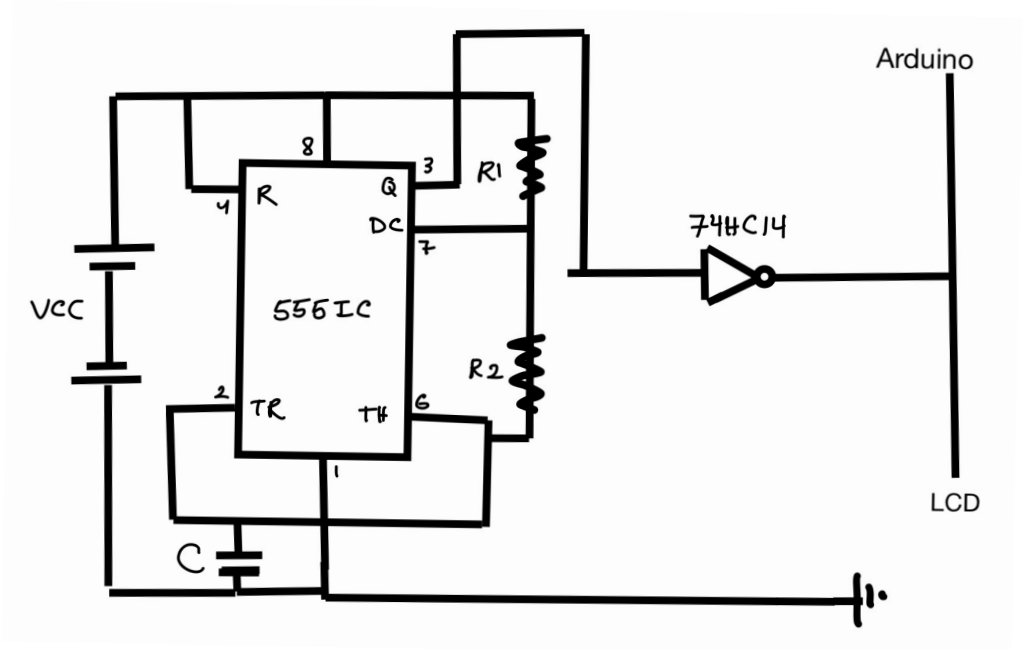
Abstract:

For the final project I intend to build a capacitance meter using Arduino. This capacitance meter will measure the capacitance of capacitors using Arduino Uno, NOT gate, and 555 timer IC square wave generator. This capacitance meter will measure capacitance in the range 10 nano F to 10 micro F.

Components:

- Arduino Uno
- 555 timer IC based square wave generator
- IC 74HC14 Schmitt trigger gate
- 2 1K ohm resistors, 10K ohm resistor
- 100 nano F capacitor, 1000 micro F capacitor, 100 micro F capacitor
- 8x8 LED matrix (1088AS) to display the capacitance
- power supply (5v)

Circuit Diagram:



Above you can find the circuit schematics for the capacitance meter. The LED matrix is interfaced with the Arduino and displays the capacitance measured. To the Arduino we connect the 555 timer IC, and to the 555 timer IC we connect the capacitor whose capacitance wish to be measured. The main purpose of the 555 timer IC to is to connect the capacitor to the digital world (Arduino) by feeding the Arduino with a square wave signal whose frequency is representative of the capacitance in target. Because the Arduino Uno used is extremely sensitive. We connect The Schmitt trigger gate between the Arduino and the 555 timer IC to ensure that the signals fed to the Arduino are accurate. Only rectangular wave signals are fed to the Arduino.

Circuit Explanation:

The Schmitt trigger used provides an OUTPUT depending on the INPUT voltage. If the INPUT voltage level is bigger than the THRESHOLD voltage level of the Schmitt trigger, the OUTPUT is HIGH. If the INPUT voltage level is lower than the THRESHOLD, the output of the gate is LOW. The Uno was chosen to be used because it has the function *pulseIn.* This function measures the time for which HIGH or LOW level is fed to the Arduino in micro seconds. Adding these times together will give the time period, and the frequency is obtained by inverting the period. And from the frequency we are able to calculate the capacitance using the formula:

$$F = \frac{1}{T} = \frac{1.44}{(R1 + R2 * 2) * C}$$