Electronic Instrumentation

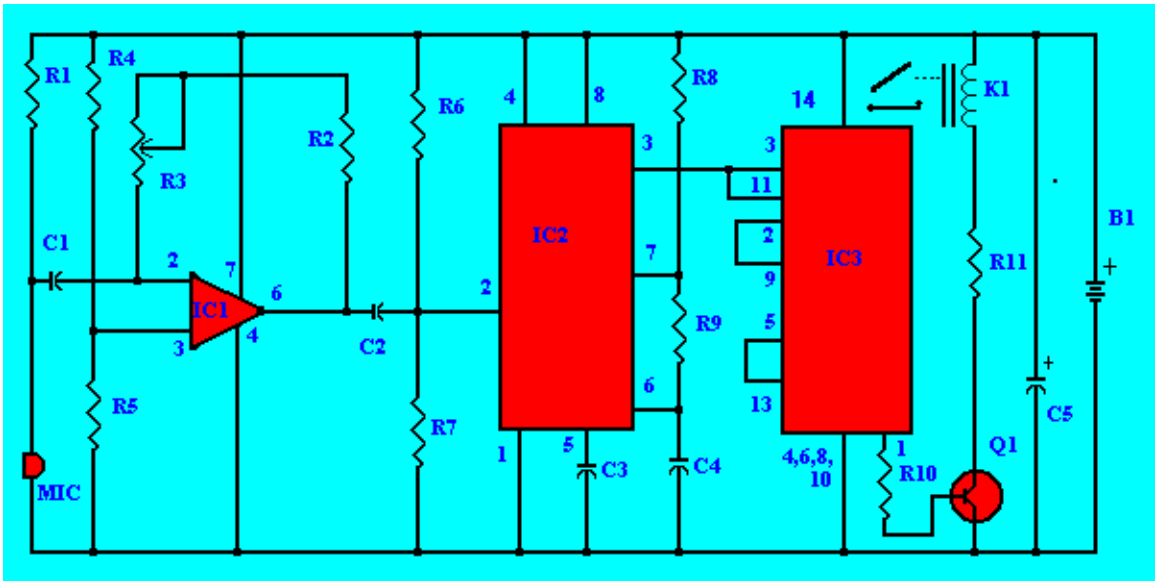
Name _____ **ENGR-4300 Fall 2000** **Section** _____

Project 4

The Clapper

Project Report (25 points)

Due 8 December



Clapper Circuit Diagram

IC1 = 741 OP AMP IC2 = 555 TIMER IC3 = 4013 DUAL D FLIP FLOP Q1 = 2N2222 NPN C1, C2, C3, C4 = .1 UF DISC C5 = 47 UF ELECTROLYTIC R1, R2, R4, R5, R10 = 10,000 OHMS R6 = 150,000 OHMS R7, R9 = 100,000 OHMS R8 = 1 MEGOHM R11 = 220 OHMS R3 = 100,000 OHM TRIMMER POT.	B1 = 9 VOLT BATTERY K1 = SPST REED RELAY 5 VOLT DC COIL MIC = ELECTRIC MICROPHONE

Clapper Components

In this project, each group is to build a *Clapper* circuit similar to the one shown above. This figure is taken from the two websites:
http://www.ee.byu.edu/~kbsmith/eet315/f1998/reports/r2/
and http://home.maine.rr.com/randylinscott/dec97.htm

Since you will have to build a clapper with the parts we have available, you will have to make some modifications in this circuit. Most of the parts listed above are available in your parts kits. There are also some parts available in the studio; some of which you can keep and some we would like you to return. The parts you can keep include any resistors you might need, a 2N2222 transistor (which you should already have from Exp 10) and

the CD4013 Dual D-Type Flip Flop or a SN7474 Dual D-Type Flip Flop. You should also have a microphone and a relay in your parts kit. The microphone is a Panasonic WM-54BT and the relay is a Siemens T7NS5D-05 (formerly Potter and Brumfield). (Note that the parts you have should be these or a close equivalent.) The basic specs for these devices can be found in the Digikey catalog (paper copy in the studio, electronic at http://www.digikey.com), with additional information available at http://www.me-au.com/miccap.html, http://www.panasonic.com/industrial_oem/electronic_components/pdf/wm52b.pdf http://www.siemens.com/ec/ecr/

A prototype of the clapper was built using a 9 volt battery for power and both D-Type Flip Flops. It could be made to work properly with either flip flop. However, the 7474 was a little easier to make work, so that is the one you should use, if possible. The 4013 was easier to wire up, since it was included in the original circuit. The components you have available work at two different voltages, so you will likely have to provide both 9 and 5 volts to your circuit. In the prototype, this was done by adding a 5 volt voltage regulator which steps down the 9 volts to 5 volts. Since using two voltages is the easiest way to build the circuit, you should plan to put the 5 volt components on one side of your board and the 9 volt components on the other side. The components in the original circuit all work at 9 volts. The microphone we will use does not want more than 2.5 volts (see spec sheet). The relay circuit (from Exp 10), including the transistor, operates at 5 volts, as does the 7474. Please note that the 741 op-amp is not powered in the usual manner. It is connected to +9 and 0 volts, rather than ±15 volts.

Finally, note that to work properly, the R (reset) and S (set) pins for both of the D-Type Flip Flops in the 4013 are tied LOW (ground). The input signal from the monostable multivibrator is fed to both CLK (clock) pins. $\overline{Q1}$ (not Q) is connected to D2 and Q2 is connected to D1. Q1 is the output. The 7474 is set up in the same manner, except that there is no R or S pins. Rather, it has pins called $\overline{PRE}$ (not preset) and $\overline{CLR}$ (not clear). If you look at the function (truth) table for this device, you will see that these 4 pins must be tied HIGH. Whichever device you choose to use, be sure that you include a copy of the truth (function) table and show that you have it connected properly.

Introduction (2 pt): Introduce and describe the goals of the project.

What exactly will the clapper do when it is working correctly?
What will it turn on and off? *You should choose something you want to switch with the relay.*

Design (5 pts): Describe your project design, how it works, how you came up with this particular design. Include a complete schematic that you can use to build the circuit.

Describe the modifications you have made to be basic design to make it work with the materials at hand. Describe the function of each part of the circuit. *There are at least six parts to this circuit.*

Testing (5 pts)-- Show that your design functions as expected with experimental data.

Test the function of each part of the circuit by measuring and recording the signals you observe at the input, the output and between each section.
Have your experimental data signed by a TA or instructor.

Performance (4 or 6 pts) – How well does it work?

Demonstrate to a TA or instructor that your *Clapper* does indeed work.

Clapper Works with 2 Claps for On and 2 Claps for Off _____ (6 pts)
or Clapper Turns On and Off with Some Other Sequence of Claps ____ (4 pts)
TA/Instructor _____ Date _____
(Each group will get credit for one or the other but not both circumstances.)

Appendix (1 pt): Include any background materials you used in the preparation of your design.

Personal Responsibilities (1 pt) -- A short paragraph should be written describing what each group member did to develop and implement the final design.

Creativity (0-2 pts) – Any creative approaches to implementation or in the final design will be rewarded with up to 2 additional points.

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Project 4

Please list the names of all group members. A TA or instructor will initial a participation box each class day you attend and participate in this project. When you have completed the goals of the project, have a TA or instructor initial under completed. If you are unable to attend class for any reason, you can make up the work during an open shop time. The maximum participation grade is 5 points.

Student Name	Participation	Participation	Participation	Completed	Date	Pts

Be sure that you have all of your experimental data signed by a TA or instructor. Also, read this document very carefully and make sure you have done everything you have been asked to do. It is a good idea to highlight each of the tasks listed so you don't miss any.

Introduction: (Circuit Model) (2 pts) _____

Design: (Mods and Functions) (5 pts) _____

Testing: (Test each section of circuit) (5 pts) _____

Performance: (How well does it work?) (4-6 pts) _____

Appendix: (1 pt) _____

Personal Responsibilities: (1 pt) _____

Creativity: (0-2 pts) _____

Total (20 pts) _____

Names:

1. _____

2. _____

3. _____

4. _____

Grade: _____ **(Out of 20)**