

Course Name: Digital Electronic Circuits

Course ID: 10636332

Topic: Final assignment

Date: 15<sup>th</sup>/12/2022

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**General rules:**

- You can work in teams of two:
  - You can choose to work individually without a group.
  - If you are working in a group, then use any student ID from the group.
  - Each team member to submit his/her circuit/report/video/... to Moodle, the submission should be identical for both team members.
- No report is needed for this assignment: discussion is expected.
- The duration of this assignment is 10 days (25<sup>th</sup>/Dec/2021)
- 2.5% penalty for each delay day: maximum of 7 days late.

## Option 1: Hardware based

- You are required to build an alarm system which detects high levels of specific input from one of the following sensors:
  - 0) Temperature
  - 1) Gas/fire
  - 2) Light
  - 3) Infrared sender/receiver
  - 4) Ultrasound
  - 5) Pressure/Touch
  - 6) Humidity
  - 7) Water Level Sensor
  - 8) Flex Sensor or Touch Sensor
  - 9) Sound Sensor or Movement (PIR) Sensor
- The last digit of your student ID will specify which sensor you work with.
- Convert the analog output of the sensor to a digital signal (if it is not automatically converted by an available module/output): H=alarm, L=no problem
- Connect the digital output to a 555 timer to generate a signal of 600Hz frequency which is then connected to a buzzer/speaker.
- You would need a 5V power supply for this project
  - You can use a 5V regulator connected to a battery (1x9 volt battery or 2x4.5 rechargeable batteries): <https://www.electronicshub.org/understanding-7805-ic-voltage-regulator/>
  - Use any other 5V source you might have.
- Submission:
  - 1-minute video demonstration of your working circuit, and explanation of how the circuit works (maximum 1 minute)
    - Or a small report explaining your work instead of the video.
  - Block/circuit diagram of your circuit using your favourite drawing tool: pen and paper, power point, CAD tool (tinkercad, KiCad, Proteus, ...etc)

## Option 2: LTSPICE simulator based

- You are required to demonstrate a 10 bit voltage switched DAC discussed in lectures using LTSPICE.
- Assume digital voltage levels are 0V for LOW and 5V for HIGH.
- In the voltage switched R-2R DAC, use R to be the last three digits of your student ID + 1000. For example, if your student ID is 1189876543, then R value used will be  $543+1000=1543$  ohm.
- Demonstrate your DAC circuit using a counter input from 0 – 1023 with increments every 1 microsecond.
- The final analog output voltage range should be between 0 and +5 Volts, hence you would need an inverting amplifier in the final stage of your circuit.
- You are free to choose any operational amplifier available in LTSPICE
- **Submission:**
  - 1-minute video demonstration of your working circuit, and explanation of how the circuit works (maximum 1 minute)
    - Or a small report explaining your work instead of the video.
  - You must submit the LTSPICE circuit files