The Great Vehicle Automatic Gearbox
Final, graded work with limited time

Hardware (exhaustive) :
- Arduino (UNO)
- Resistors
- Breadboard
- 2 Push buttons
- LCD Screen I2C
- 1 Potentiometer
- Servomotor

🎯 **Goal**: Build an automatic gearbox for a vehicle. Simulate speed, acceleration, brakes.

📝 **Grade**: Call the teacher to grade your work. When you have finished, upload your .ino file to DVO.

📚 You can call the teacher at your will to validate one or multiple exercises. At the end of the session it will be impossible to validate the exercises.
The grade is individual.

You can talk with your neighbours, but:
- Keep the volume low to not disturb others
- Be mindful of your neighbors, don't penalize them by asking too many questions/taking too much of their time
- Work on your code alone, with your own way (no copy pasta)

You can leave the class when you have finished.

The exercises are incremental, each exercise is a feature of the "Automated Gearbox" system. They must be implemented on the same setup, in the same code.

It is recommended that you first read the entire assignment before starting.

BONUS A bonus will be given for:
- Clean code (explicit variable names, concise and clear comments etc…)
- Codes with no delay()
- Clean wiring
- Smart solutions (avoid screen flickering, debounces on inputs etc…)

## 1. Shift gears, up and down (2 pts)

- Connect 2 buttons
  - One button changes selected gear to higher gear
  - One button changes selected gear to lower gear
- Gear is an integer from 0 (included) to 6 (included)
- Print selected gear in Serial console

2. Physically "change gears" (3 pts)

- Wire a servomotor
  - imagine it is tied to a steel cable going to a gearbox
- The servomotor goes from 0° to 180°, by 30° steps. One step per gear (Gear 0: 0°, Gear 1: 30°…)

3. Display selected gear (3 pts)

- Display the selected gear on an LCD screen using I2C protocol
- The gear number is prefixed by "G", on the lower-left corner
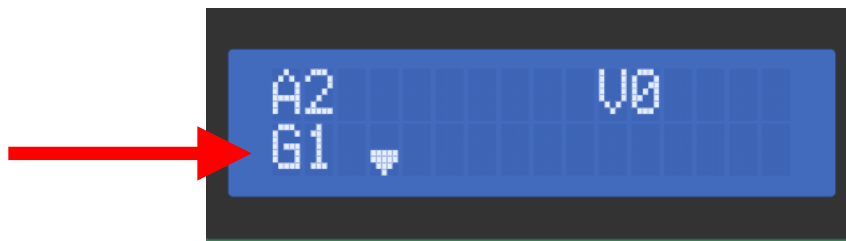
4. Acceleration and Brake systems (5 pts)

- Add speed value, from 0 to 60 km/h, starts at 0
- Add a potentiometer to simulate acceleration and brake pedals: at the left-most position, the acceleration is -10km/h/s, at the right-most position the acceleration is +10km/h/s
- Each seconds, compute speed by adding the acceleration value
- Display the speed on the LCD display (red arrow)
- Display the acceleration on the LCD display (green arrow)
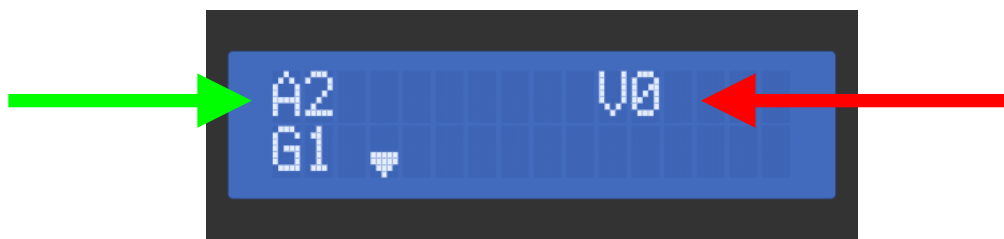
5. Gear recommendation (5 pts)

- Implement a gear recommendation system. When on the wrong gear, the system advises to "shift up" or "shift down"
- Gear-Speed relations is as follow
  - G0: 0 to 3 km/h
  - G1: 3 to 10 km/h
  - G2: 10 to 20 km/h
  - G3: 20 to 30 km/h
  - G4: 30 to 40 km/h
  - G5: 40 to 50 km/h
  - G6: 50 to 60 km/h
  - **Advice**: Use an int array of size [7] to store a gear->speed conversion
- Display gear recommendation on the LCD screen with a "UP" arrow or a "DOWN" arrow (https://arduinogetstarted.com/faq/how-to-use-special-character-on-lcd)

6. Lock speed evolution on wrong gear (2 pts)

- Prevent acceleration when the wrong gear is selected
  - ⚠️ do not prevent braking, it would be dangerous