

University of Cape Coast  
College of Agriculture & Natural Sciences  
School of Physical Sciences  
Department of Computer Science & Information  
Technology

End of First Semester Examination  
2022-2023 Academic Year  
April 2023

CSC321: Embedded Systems

Duration: 3 hours

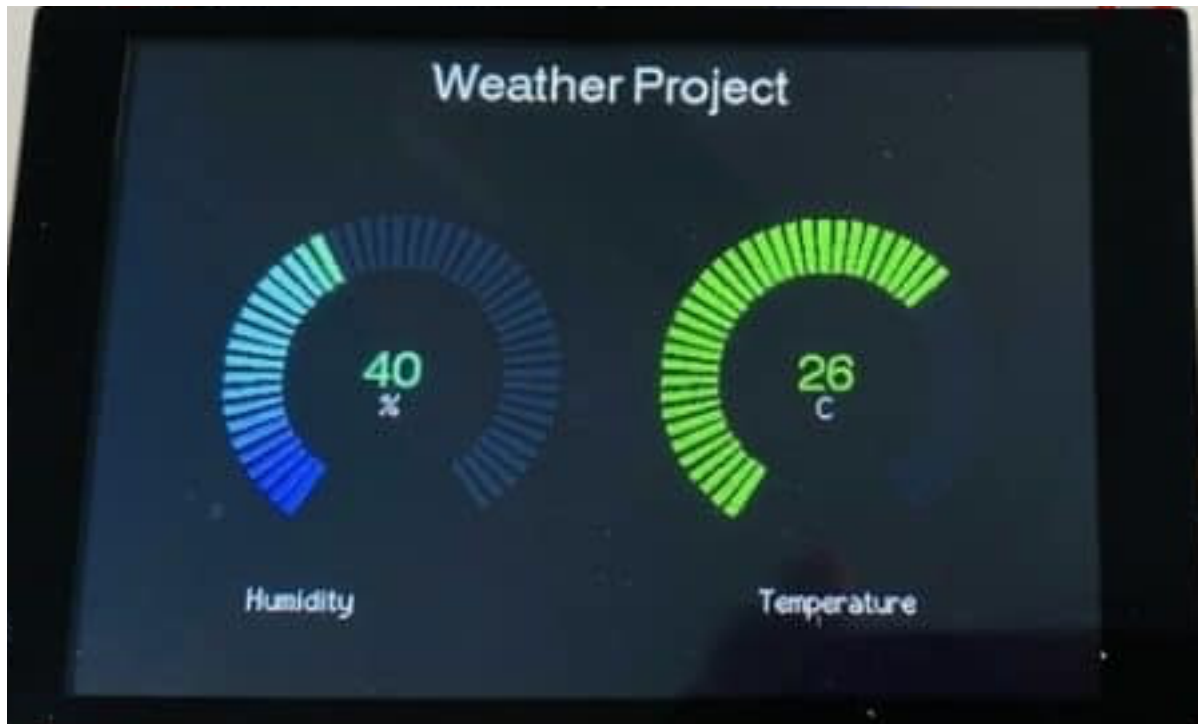
*Instruction: Answer all questions on your PC  
The question can be accessed on Desktop/Exams/CSC321-Question.pdf// Sample  
Libraries for this exam are found in the Desktop/Exams/Libraries directory.  
All Solutions are to be saved in the Desktop/Exams/Solutions directory*

## Devices



- **[SHT30:]** Sensirion SHT30 is relative humidity and temperature sensor.
- **[TFT Display:]** Screen for displaying images and creating user interfaces.
- **[ESP32:]** Micro-Controller: performs as a complete standalone system or as a slave device to a host MCU.
- **[Rotary Encoder:]** A rotary encoder is a type of position sensor, that measure rotary movements and displacement and can either be absolute or incremental. A rotary encoder is an electromechanical feedback device used to provide information on position, speed, count or direction
- **[ DC Motor:]** A class of rotary electrical motors that converts direct current electrical energy into mechanical energy.
- **[Slide Potentiometer:]** A slide potentiometer module is an electronic component that is used to measure the position of a sliding object, such as a slider or knob, and convert that position into an electrical signal. It consists of a resistor with a sliding contact, moving along a track on the module. As the contact moves, the resistance changes, and the voltage output from the module changes correspondingly.
- **[Wemos 7 Color RGB:]** The 7-colour RGB LED Shield is a hardware module designed by WEMOS, which features seven individually addressable RGB LEDs in a circular arrangement. The shield is designed to be compatible with WEMOS D1 mini boards and can be easily connected to the GPIO pins of the board.

- **[TCS3200 Color Sensor:]** The TCS3200 is a color sensor module that can detect and measure the intensity of light in different colors. It has an 8x8 array of photodiodes that can detect light in the visible spectrum. The module also includes an on-board LED that can be used to illuminate the object being measured. It communicates with a microcontroller via a 3-wire interface and can be used in a variety of applications, such as color detection and sorting, color mixing, and color calibration.
1. (a) Create a function called ***motorSpeed*** that takes in a rotary value and adjusts the speed of a motor accordingly. The rotary value ranges from 0 to 100, with 0 representing the minimum speed and 100 representing the maximum speed. Your function should increase or decrease the speed of the motor as the rotary value changes. [15]
  - (b) Create a function called ***changeDirection*** that detects when the rotary is pressed and changes the direction of the motor. Your function should use the ***motorSpeed*** function to ensure the motor maintains the same speed when changing direction. [20]
  2. Using the TCS3200 sensor and TFT1.4 display module, write a Python script that performs the following actions:
    - Set the frequency divisor to 20%
    - Calibrate the TCS3200 sensor using a black and white reference.
    - Continuously read the RGB values from the TCS3200 sensor.
    - Map the RGB values to a colour and display the colour as a circular ball on the TFT1.4 display.
    - The circular ball should have the following
      - Width of ball = 4
      - Initial position of ball  $x = 6$  and  $y = 6$
  3. (a) Create a function ***i2cAddress*** to return the i2c demical address of the sht30. Note: ***Do NOT use existing functions*** [5]
  - (b) Write a program that displays the temperature and humidity values from the sht30 to the TFT1.4" display as shown in the figure. [25]



4. Write a python script that uses the Slide Potentiometer Module to control the brightness of the red, green, and blue LEDs on the Wemos 7 RGB LED Shield. When the potentiometer is moved to the left, the brightness of the blue LED should decrease and the brightness of the red LED should increase. When the potentiometer is moved to the right, the brightness of the red LED should decrease and the brightness of the green LED should increase. Finally, when the potentiometer is in the middle position, all three LEDs should be set to maximum brightness.