# CAB202 ASSESSMENT

# MICROCONTROLLLER

# ASSINGMENT

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**INTRODUCTION**

This report is a documentation for the designated task given in CAB202. The task includes the invention, design, implementation and demonstration of a working prototype of a microcontroller-based product.

The invention that has been explored is a game called "Whack-The-Box" which is a spin-off of the classic arcade game, Whack-A-Mole. The audience of this game would be people who have played the exam in the past and are interested in a bit of nostalgia or for anyone interested in a having the experience of a classical game.

**GAME DESIGN AND FUNCTION**

The game starts with an introduction to the game and asks the user to adjust the level of difficulty which is controlled by an analog input. After which the level of difficulty is displayed, and the LCD screen proceeds to the contents of the game. The screen has four boxes and each box is labelled with a character next to it. The buttons are arranged in the same order as the boxes shown in the screen. An arrow randomly pops up next to a box and the LED corresponding to it lights up and the player can press the button to score. The game has a counter called whack score and has a limit of ten correct whacks. The reaction time for each whack is counted. If the players misses a whack it will be displayed on the screen. Once the player has completed the objective of the game, which is to press the button as fast as they can. The reaction time will be displayed on the serial monitor.

# SCHEMATIC DIAGRAM

The schematic diagram displaying the circuit used has been displayed below.
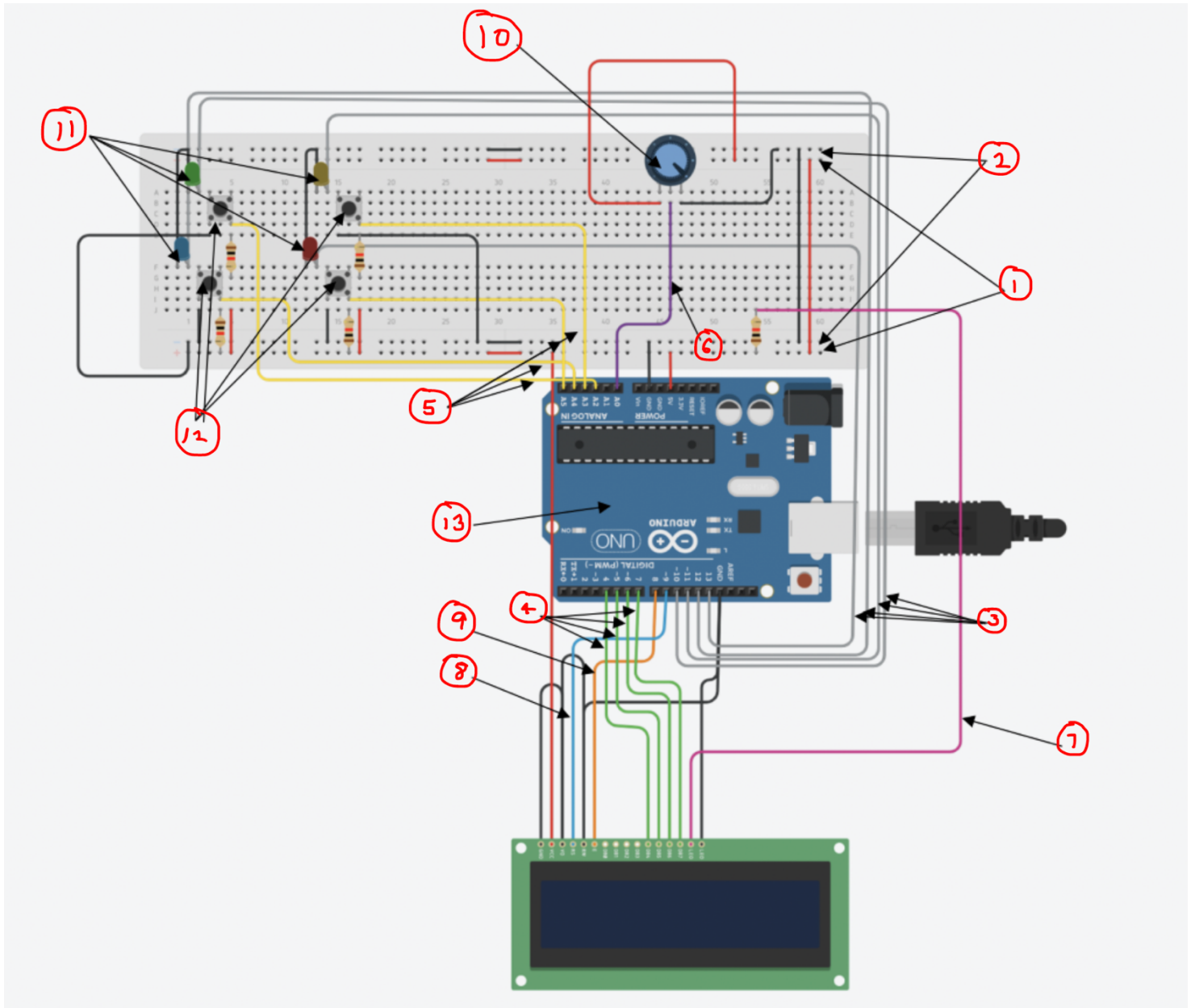
## WIRING FOR THE ARDUINO

The wires have been color coded as shown in the above diagram for its specific function.

1. Red wires are connected to the power supply from the Arduino and carries 5V. This is connected to the positive terminal of the breadboard powering up the '+' lines.

2. Black wires connect the components to the ground (GND terminal). This is connected to the negative terminal of the breadboard grounding the '-' lines.

3. The grey wires connect the anode of the LEDs to the pins in the Arduino board. (PB2, PB3, PB4 and PB5).

4. The green wire connects the data input pins in the Arduino to the LCD screen (DB4, DB5, DB6 and DB7 to PD4, PD5, PD6 and PD7 respectively).

5. The yellow wires connect the 2a terminal of the switches to the switch pins (PC2, PC3, PC4, PC5)

6. The purple is a standalone connection that connects the wiper of the potentiometer to PC0

7. The pink is also a standalone wire that connects "LED" pin (left) on the LCD screen to a resistor and then to power.

8. The blue wire connects the RS (register select pin) to PB1 in the Arduino board

9. The orange wire connects the enable pin of the LCD screen to the PB0 pin.

10. Potentiometer

11. LED's

12. Switches

13. Arduino Board

**DEMONSTRATED LEARNING OUTCOMES AND SPECIFICATIONS**

For this task certain specifications and learning outcomes that were expected. They are as follows,

a. Digital I/O – switch

This outcome was achieved as four switches were used which acted as the "whack" when the button was pressed.

b. Digital I/O – interrupt-based debouncing

The button "A" which is connected to PC2 in the Arduino has been debounced. Debouncing has been done such that each button press is measured as only one button press and makes the circuit more efficient.

c. Digital I/O – LED

Four LEDs have been used which were connected to the PORTB and to the ground terminal.

d. Analog Input

A potentiometer has been used for the analog input which is connected to the + terminal , the wiper to the PC0 pin and to the ground terminal.

e. Analog Output (PWM) – hardware-based; OR software-based "bit-banging"

LED 4 which is connected to PC5 has been used for the PWM which regulates the brightness from low to high throughout the game.

f. Serial I/O – hardware based; polling OR interrupt mediated

After the player has completed the game a message is printed out in the serial monitor with the player's reaction during his gameplay.

g. LCD – simple text display; OR: bit-mapped graphics, including sprites, line or pixel art

h.  Timers – other than debouncing or PWM

   The "timer2" was used to calculate the reaction time which is the time elapsed from the

   led being lit up and the time the player presses the button.

## FUTURE RECOMMANDATIONS, CRITICAL EVALUATION AND CONCLUSION

The theoretical design satisfies all criteria. When practically simulated on tinker cad however the

serial I/O does not work as intended as there was a error in the implementation of timer2 to

calculate the reaction time.

The second error in this design is the LED 4 which has the PWM criteria keeps regulating the

brightness throughout the game. (While it satisfies the criteria, it decreases game performance)

This can be fixed by either using a separate LED or stopping the PWM after the initial displaying

of the game

 Another recommendation is  for the game to be set such that for every button press it will to

follow a pattern/rhythm where it would play out the modern hip hop song "The Box" by Roddy

Rich and the player would play whack a box according to that.

**Tinker CAD link**

https://www.tinkercad.com/things/1kWXIYu6cZN-copy-of-copy-of-t11-lcd-hero-adventure-

student-

copy/editel?tenant=circuits?sharecode=IVhZyboeVCafO4691gJFHPl6n7Vd8i0gYholKw_pb6o

**Video presentation on YouTube link**

https://youtu.be/N2IW1mgnzbg

# APPENDIX – Extension Letters and medical

**QUT**

You recently submitted a request to QUT. This request is now closed. If needed, this enquiry can be reopened within the next 30 days. Thank you for your enquiry.

**Subject**

**EN01 10496262 Kaluarachchi, Don Misura Minduwara - CAB202 Assignment Extension (EXT) [Science and Engineering Faculty]**

Response By Email (Jasmine) (08/06/2020 03.43 PM)

Dear Don Misura Minduwara,

Your request for an Assignment Extension has been **approved**. The details of your extension are provided below:

Unit: **CAB202 (2)** - Microprocessors and Digital Systems
Assignment Title: Microcontroller Assignment
Original Submission Due Date: 05-Jun-2020
Revised Approved Submission Due Date: 12-Jun-2020

Please submit your assignment using the normal submission process as outlined in your unit's Blackboard site.

You are required to attach a copy of this email when submitting your assignment as it is confirmation of your approved extension.

If you do not submit your assignment by the extended due date your work will not be marked and you will receive a grade of 1 or 0% against the assessment item.

Book an individual session with a success coach or specialist educator (study skills, language and writing support, STEM skills) to get back on track with your studies. Find out more about other the academic support available at qut.to/academicsupport.

If you wish to discuss this further, please quote your reference number:  200603-001627.

Kind Regards,
Jasmine
Student Support Services

Cornwall Street Medical Centre

Dr Dona Ratnaweera
Ground Floor, 20 Cornwall Street
Woolloongabba 4102
Ph: 0733461122 Fax: 0733461146

# *Medical Certificate*

03/06/2020

THIS IS TO CERTIFY THAT

## Mr Don Kaluarachchi

has a medical condition and unfit for normal duties from **02/06/2020** to **12/06/2020** inclusive.

Thank you for your consideration.

Dr Dona Ratnaweera
MBBS FRACGP
*4311653F*