

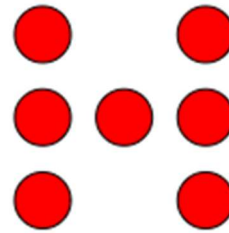
Dangle Die PCB – Assignment

We have spent the week researching, and now we will formalize the requirements into an assignment.

This assignment is due Friday October 28th, 2022 – by the end of class (9:15am)

Original Requirements

- At least seven LEDs arranged to look like a die:
- A 2032 coin cell battery
- An ATTiny85
- One push button
- One two-position switch (ON-OFF switch)
- Associated resistors
- One mounting hole for slipping in a wire/string
- All in roughly one-inch square



Clarifying those requirements now that we have researched and prepared our project:

- You can choose whether or not to Charlieplex all the LEDs, or simply Charlieplex 6 LEDs and have one connected directly – but you must Charlieplex at least 6 LEDs.
- This assignment does not include function code for the dice-roller, but rather only requires enough code to demonstrate the functionality of your wiring. This code will not be marked, but the demonstration of functionality will (more on this later)

Deliverables (what you need to submit)

- **Improper submissions will receive a penalty. If in doubt, please clarify.**
- If you are not in a position to record a video, ask for assistance.
- You are to submit ONE EMAIL THAT CONTAINS THE FOLLOWING (see appendix for example)
 - A link to a video of your TinkerCAD circuit demonstrating its functionality
 - A link to a video of your breadboarded circuit demonstrating its functionality
 - Videos uploaded to Google Drive, and the shared link pasted into the email
 - A PDF document that has screenshots of
 - Your TinkerCAD circuit
 - Your Breadboard
 - Your schematic
 - Your PCB
 - An OSHPark screenshot of your uploaded board
 - Your KiCAD schematic file
 - Your KiCAD PCB file

Since we are actually planning to manufacture this board, the following real-life restrictions must be followed:

- **Be sure to set the following tolerances before you begin creating your PCB**
 - Once at the stage you are importing parts onto your PCB, be sure to set the following setting
 - File → Board Setup → Design Rules
 - → Net Classes
 - Default clearance of 0.3mm
 - → Constraints
 - Copper to edge clearance: 0.5mm
- All corners must be rounded with at least a 2mm radius
- Silk screen characters with a text height of less than 1mm will be unidentifiable
- Courtyards may overlap, if physically possible (need to verify with your parts!)
- Silk screen may be cut off by board edge, holes or pads
 - But do your best to avoid it
- The two-position switch MUST ride the board edge in order to expose the actual switch to the user.
- **Failure to follow these constraints will result in a mark deduction.**

Here are the components you must use within the schematics editor:

- ATTiny: ATTiny85-20S
- Battery: Battery_Cell
- LED: LED
- Mounting Hole: MountingHole
- Push Button: SW_PUSH
- Resistor: R
- Two-position switch: SW_SPDT

Here are the footprints you must use within the PCB editor:

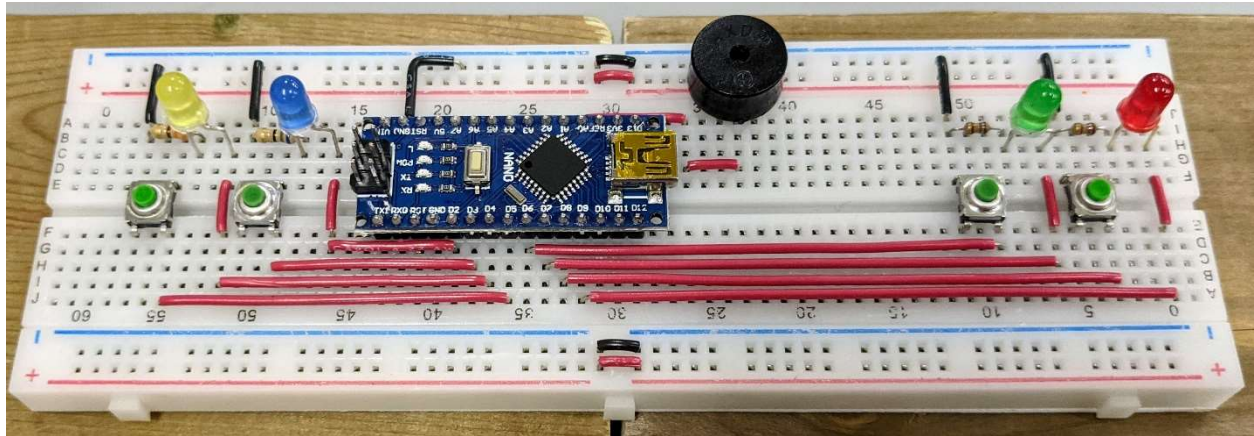
- ATTiny: Package_DIP:DIP-8_W7.62mm_Socket_LongPads
- Battery: WCSS-Footprints:BATT COIN 20MM (BH-67D-5)
- LED: WCSS-Footprints:LED_3528_HandSolder
- Mounting Hole: MountingHole:MountingHole_3mm
- Push Button: Button_Switch_THT:SW_PUSH_6mm
- Resistor: Resistor_THT:R_Axial_DIN0207_L6.3mm_D2.5mm_P7.62mm_Horizontal
- Two-position switch: WCSS-Footprints:SW_SPDT_SMD

Marking Guide

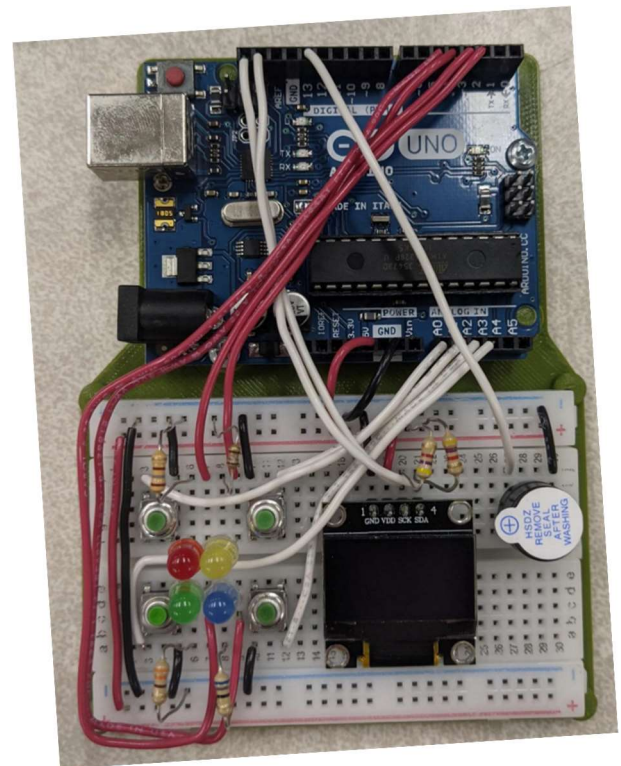
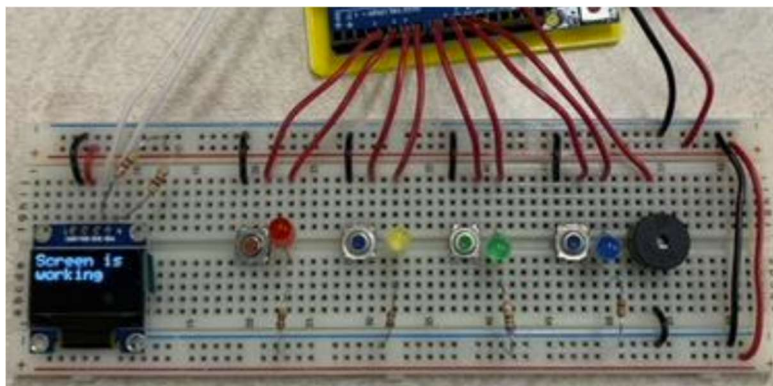
Expectation	R	1	2	3	4
TinkerCAD	Prototype has significant errors	Prototype has some minor errors	Prototype is fully functional	Prototype is fully functional, all wiring is visible, no double use of breadboard holes	Prototype is fully functional, cleanly wired and thoughtfully laid out
TinkerCAD Demo	No demo, or is unusably ambiguous	Buttons and lights seem connected with some functionality	Lights are clearly lit up and button produces change in behaviour	Clearly demonstrates that each light is uniquely accessible, and that the button can be read by the ATTiny	Button is used to cycle between individual lit LEDs
Breadboard	Significant difficulty tracing wires and/or difficult layout choices.	Breadboard wiring is traceable – some oversized or overlapping wires. Layout is still thoughtfully arranged.	Breadboard wiring is still easily traceable and clean, but some overlapping / unstraightened wires	Board has clear wiring with minimal / purposeful overlap. All connections are clearly visible with fairly straight wires.	Board is exceptionally clean in design and layout. All wiring is very clear, wires are straight with very little / no overlapping.
Breadboard Demo	No demo, or is unusably ambiguous	Buttons and lights seem connected with some functionality	Lights are clearly lit up and button produces change in behaviour	Clearly demonstrates that each light is uniquely accessible, and that the button can be read by the ATTiny	Button is used to cycle between individual lit LEDs
KiCAD Schematic	KiCAD schematic has significant errors in design	KiCAD schematic is functional and not missing any connections	KiCAD schematic is functional and connections are clear	KiCAD schematic is mostly clear and well laid out	KiCAD schematic is clear and very well laid out, including helper text and graphic lines as appropriate
KiCAD PCB Layout	KiCAD PCB layout is missing key components and / or has other significant problems	KiCAD PCB layout is mostly functional with at most two concrete problems.	KiCAD PCB layout has functional layout	KiCAD PCB layout has convenient layout that keeps the user in mind.	KiCAD PCB layout has convenient layout that keeps the user in mind. Good use of space. Insightful placements.
KiCAD PCB Wiring	KiCAD PCB Wiring has unconnected components	KiCAD PCB Wiring has all connections wired.	KiCAD PCB Wiring has is properly connected and no copper pour islands	KiCAD PCB Wiring also minimizes long traces and vias	KiCAD PCB Wiring also strives for symmetry where possible
KiCAD Silk Screening	Silk Screen presents a significant barrier when placing parts	Silk Screen is mostly clear and readable, with part labels discernable	Silk Screen took care to align all labels conveniently and avoided clipping	Silk Screen includes functional pieces, name, course code	Silk Screen goes beyond level 3 to include graphics to enhance the board
KiCAD Design Rules Check	DRC reports more than two errors and/or many warnings that need addressing	DRC reports no more than two errors, and few warnings that need addressing	DRC reports at most one error and few warnings that need addressing	DRC reports no errors and only a few warnings that need addressing	DRC reports no errors and no warnings other than appropriate overlaps
PCB Size	<div> <div></div> <div></div> <div></div> <div></div> <div></div> </div> <div> <div>> 1800 mm²</div> <div>1600 mm²</div> <div>1400 mm²</div> <div>1200 mm²</div> <div>< 1089 mm²</div> </div>				

Appendix A: Breadboarding Exemplars

Level 4++



Level 3



Appendix B: Example Email

Hey Mr. Emmell,

Here is my Dangle Die assignment.

Please find the two videos here:

TinkerCAD Demo: https://docs.google.com/presentation/d/12i74b-6XBspVFIZoe77RK_rQ-QmkEMyniwzCxTr2ZFk/present

Breadboard Demo: https://docs.google.com/presentation/d/12i74b-6XBspVFIZoe77RK_rQ-QmkEMyniwzCxTr2ZFk/present

Please find everything else attached:

Emmell-Project-Screenshots.pdf

Emmell-Project.kicad_sch

Emmell-Project.kicad_pcb

You rock,

Student Name