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Programming 2 Homework - Arduino/C++ Intro

For programming homework, we will begin the activities in class and use them to go over and reinforce the pre-lab content.

For this homework assignment, you will need your Sparkfun Inventor's Kit or other approved kit.

WARNING:

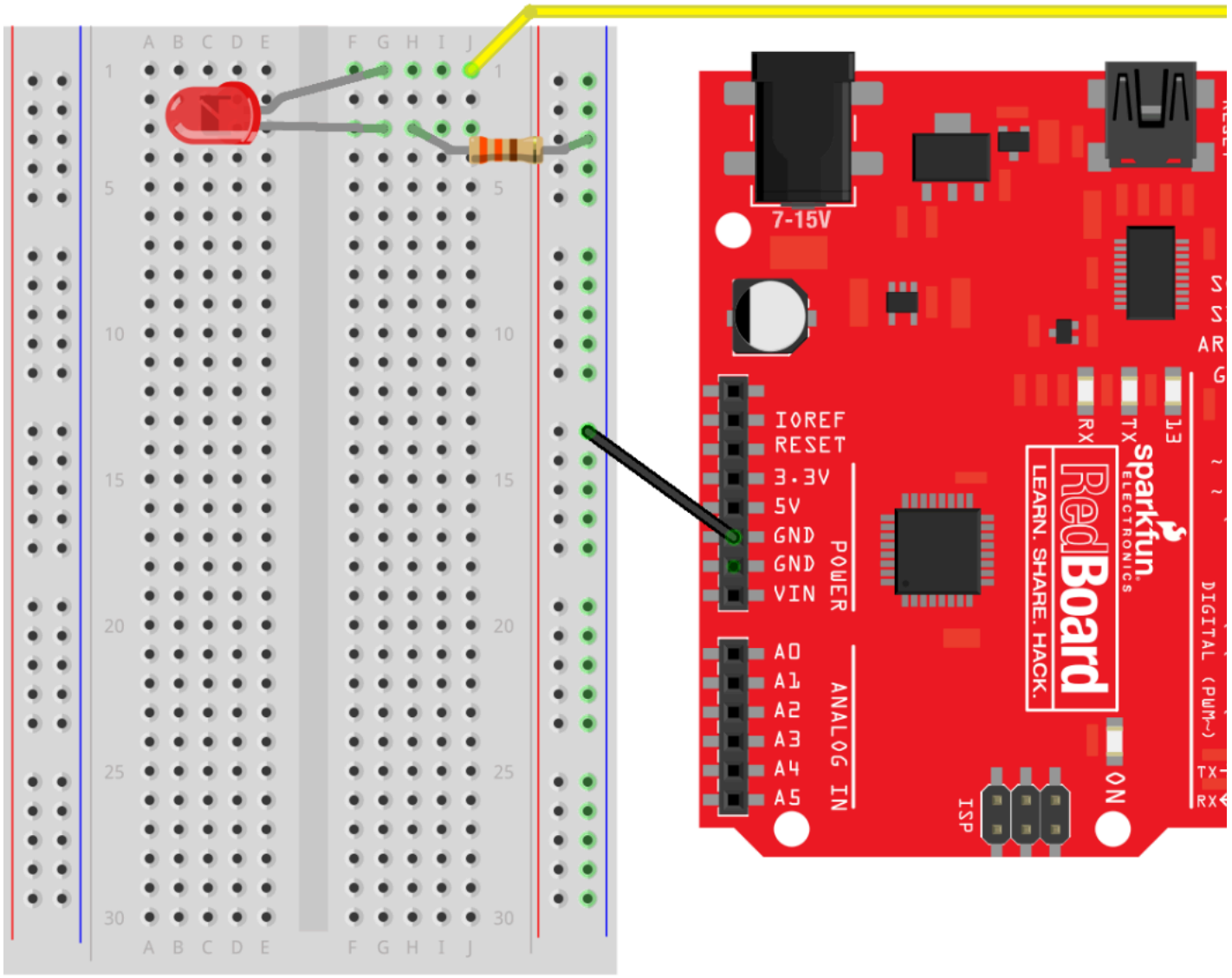
When making adjustments to your circuit, it's best practice to disconnect it from power and double check your wiring before re-connecting it. The Redboard is fairly robust but this will minimize the risk of causing it any damage.

P2H1: A Timelord's Hearts

This part is to build upon our prior Arduino experience and extrapolate it to meet a new goal.

Build the Circuit

Build the following circuit:



- Connect **Pin 13** to the **Anode** pin of the **LED**
- Connect the **Cathode** pin of the **LED** to one side of a **330 Ohm resistor**
- Connect the other side of **330 Ohm resistor** to **GND**

SAFETY CONCERN!!

We are going to now begin working with the circuit. There is a safety practice you should get in the habit of first. At the voltages we're working with, it is less about harm to you but rather to your computer, microcontroller, and the rest of the hardware. This also applies for larger voltages when they can cause you harm.

- WHENEVER YOU ARE BUILDING YOUR CIRCUIT, DISCONNECT THE REDBOARD FROM THE POWER SOURCE.
  - This will be the USB cable throughout this assignment
- WHENEVER YOU ARE IN DOUBT ABOUT WHETHER YOU SHOULD BE WORKING WITH A POWERED CIRCUIT OR AN UNPOWERED CIRCUIT, DISCONNECT THE REDBOARD FROM THE POWER SOURCE.
  - This will be the USB cable throughout this assignment

Upload the code

- Open the built-in **Blink** example
  - Go to **File / Examples / 01.Basics / Blink**
- Save a copy as this part of the assignment
  - Include your title block
- Upload that code to the board

We should be familiar with this at this point. It's the same example as from the pre-lab and the circuit is similar although I purposely put the resistor on the other side of the LED to show that it doesn't matter which side it's on as long as it's in the circuit.

Modify the Code: Blink a Heartbeat

Use your understanding of this code snippet to modify the code to do the following:

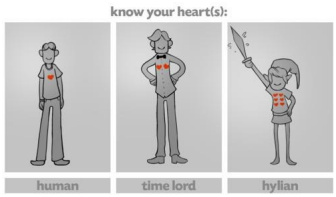
- Modify the code to mimic a heartbeat, blinking instead of making a sound
- Use the graphic below to help establish your timing. It represents two repetitions of loop().

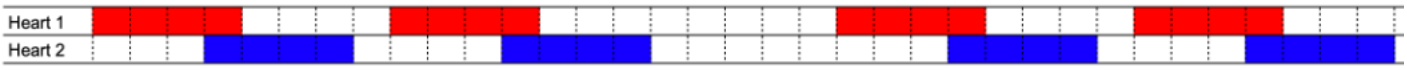
- This just shows the relative spacing of the 'beats.' Depending on how long each individual 'beat' is in your program, your 'heartbeat' may be faster or slower than others around you.
  - I have seen some very unhealthy heartbeats in this assignment so be aware that I am not looking for a specific timing.
- If you're having trouble figuring out the logic, think of each segment in the graphic as a short delay and the red when Pin 13 is set to HIGH and the white as when it's set to LOW.

Do not forget to include comments describing the changes you make.

Once you have that single heart beat going...

Add another LED to mimic a timelord's heartbeat. Try to match that pattern below.





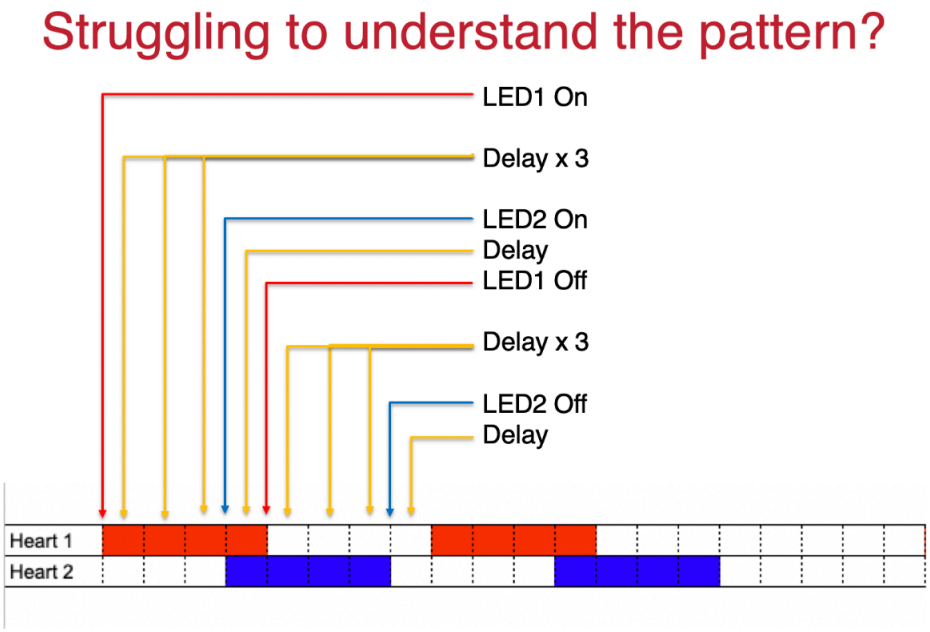
Once you have a working circuit that mimics a Timelord's heart beat:

- Record a video of your functioning circuit.
  - Don't forget to show your ID or face and the upload of the program
  - Describe what the circuit should be doing
  - Background noise is not an issue for the lessons. Others in class will be recording, talkng, etc so don't worry about it.

Behavior Demo

Video

Please visit the textbook on a web or mobile device to view video content.



This graphic may help to better illustrate the pattern you're going for

End of Part 1

Make sure that you use save as... to create a copy of your modified code and use the proper naming convention. Don't forget to update the title block to reflect this assignment.

- The Raw Code – The .ino file
- The PDF of your Code – In the .pdf file
- Image of your circuit - In the .pdf file
- The video of your working circuit – The .mp4 file
    - There will be chatter around the room. Do your best to speak audibly for your video. It will end up picking the noise of the room. We can not help that for the in-class activities and the TAs are aware of this issue.

P2H2: Future Projects

Explore the internet and find an Arduino based project that interests you. You may use resources like SparkFun.com and Instructables.com to find existing projects but you must be synthesizing/altering 1 or more to come up with your own idea.

Write up a short report that:

- Explains what the project would be
  - Should be significantly challenging and unique, as in not something you'd expect to be doing in the next Arduino lesson or maybe not even during this semester
- How it would work
  - Include a flowchart showing how it would logically function and interact with external inputs and outputs, that includes any human inputs or data collection
- Create a rough parts list of components that you would need to implement it
  - With prices and links from places like Sparkfun, Adafruit, or Amazon
- Identify the skills and concepts you would need to acquire to successfully implement this
  - Cite some possible sources for this
  - Ex: You'd need to learn I2C, so you might do a google search or search SparkFun tutorials and identify https://learn.sparkfun.com/tutorials/i2c/all as a place you could learn about that.

Clarifications/Requirements:

- Short means approximately 500 to 1000 words of text.
  - Use images as necessary to illustrate your ideas.
- Cite your sources using IEEE standards
- YOU CAN NOT JUST COPY AN EXISTING PROJECT. You must make changes and clearly state what those changes are and why they make it your unique idea.
  - Unique doesn't mean 100% unique, just enough change to have make it your own
- Part 2 is theoretical. You don't need to implement it. This is just about exploring the idea space made possible with microcontrollers and identifying the new knowledge you'll need to achieve those ideas.

For an idea of the type of complexity expected, think along the lines of some of these:

Video

Please visit the textbook on a web or mobile device to view video content.

Video

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Some of these may be complex but this isn't about what you can achieve now, but what you think would be interesting to achieve someday and thinking about what skills and knowledge you will need to learn and acquire to get there.

Submission Requirements:

Part 1

- Raw code - .ino file
- .pdf
  - Code Printout
  - Circuit Image
- Video file - multiple formats accepted
  - Show ID
  - Show upload
  - Showcase/describe functioning circuit

Part 2

- **Short** report with flowchart (pdf)

Rubric

P2H1: A Timelord's Heartbeat

35% Total

- Circuit
  - 10% - Circuit Correct
- Code
  - 5% - Runs without errors
  - 5% - Appropriate Commands
  - 5% - Commented throughout and cleanly
- Video
  - 2.5% - Introduction describes the circuit
  - 2.5% - Introduction describes function
  - 5% - Circuit runs as described

P2H2: Future Projects

65% Total

- 10% - Identified a challenging project
- 20% - Explains clearly how it works
  - Using a flowchart
- 15% - Create a rough parts list
  - Prices and links included
- 20% - Identifies needed skills and concepts