

Mr. Stark Needs Some Lights!



Okay, you all know that I try to bike into work any day that it is safe to do so. I typically leave between 6 and 6:30am, depending on how much stuff I have to do in the morning. Before daylight savings time I would leave for WRHS and it would be pitch-black outside. I mean like stars shining and inky black roads kind of dark. Suffice to say that I need something to make drivers aware that I am on the road and not in a 2-ton bike-smooshing machine (also called car). I have been riding my bike to work for 8 years and have put over 8,000 miles on my electric bikes. The picture above is my newest creation. It actually is the original frame I have used for seven years (inset photo) with a much bigger battery, bigger motor, and a fancy paint job with other bells and whistles. My previous bike had a very poor lighting system overall and even a few drivers who happen to teach here at WRHS told me pretty bluntly so. So I got myself one of those super reflective coats that looks like I am working on a bridge repair crew. This definitely does the job but only when folks and their light beams are in range of me and my bike. I need something that lets them know that I am way up ahead of them. It would also be nice to let them know that I am turning into a lane with some sort of turn signal. Indicator lights and turn signals on both the front and the back will be needed. I am challenging you to create the circuit for my bike! There are some parameters that need to be met and I will discuss some of the information with you during class too since I am your client.

Parameters for Design

1. Must include indicator lights that either stay lit up or flash rapidly (or both) for both the front and rear of the bike.
2. Must include turn signals that flash for both the front and rear of the bike
3. Bike voltage will range between 58.8v and 45v but do the limitations of TinkerCAD you can build for the high end voltage of 58.8 (we'll talk about what to do with the variations in voltage later on)
4. Must include switch for the indicator lights (front and rear controlled by one switch)
5. Must include two switches for the turn signals that control left and right turn signals for both the front and rear of the bike

Bonuses:

- Can you make the indicator lights and the turn signals the same set of LEDs so that the LEDs that turn on the indicator lights will then flash when you want them to act as a turn signal?
- Can you arrange each component on a separate breadboard to simulate a pcb and put things in order of how they would be placed on the bike?
- Can you include brake lights that are activated by a switch from either the left or right brake handle?
- Can you create a circuit for a front headlight that is operated by the same switch that turns on the indicator lights?
- Can you include a photoresistor for the front headlight and indicator lights that will turn on the lights when the ambient light levels drop low?
- Can you design the case / containing unit for the bike's rear lighting system using TinkerCad, Solidworks, Fusion360, or another 3D rendering program?
- Can you replace your loop-d-loop wire connectors with some solid core wire that properly fits your electrical device to the breadboard(s) making it fit into the smallest space possible?

In this case, I am your client and I will be adopting all of or at least part of the design you have created. Like I mentioned in parameter #3, there is one piece of information / equipment that we need to discuss to compensate for the variation in voltage as the bike uses up energy to move. So, we would have to add this piece into the puzzle, but you are at least creating the basic format for the lighting system. If I choose your design to be my lighting system I will give you complete credit in the Instructable that I write up for this bike (most likely it will be seen by over 60K people). I will then get some help from the class to develop the cases / containing units for the lighting system using Fusion360 / Solidworks (they will be 3D printed).

Submit Your Work:

Please submit your final TinkerCAD design along with some notes on how you expect your design to work (you can include these right in TinkerCAD with the **notes tool**). You will need to click on the "Send To" button to share it with me. Attach this link to the assignment. No need for a screenshot.

The Pitch:

One last challenge to throw at you if you have any time remaining. Engineers typically work on one side of the product development process, design and manufacturing of the product. Sales are usually left to the salespeople but in this case I want you to be the whole package; product developer, electrical engineer, product engineer, and salesperson. If you were to pitch this product to your client (that would be me) how would you do it in a way that would make sense to the client? Maybe you could create a small cardboard model of a bike and connect your circuit to the bike to show how it would function in a real world application? Show how it would be mounted on the handlebars or how the lights are activated by specific switches. You will likely have to use some solid core wire to run your lights to the furthest reaches of your bike.