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ECE110 Honor Lab
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Final Report
The design of Intelligent Bicycle Light System

1. Introduction:

A. Problem statement

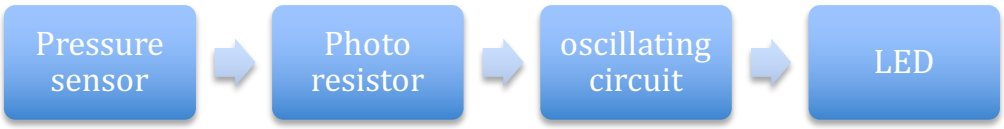
Here in Champaign, bicycles are popular yet not so safe, especially at night. People have their flickered headlights and a small rear light. However, if you actually see a person in bike, you are just a few meters from him. Even though there are currently flickered lights, they are not in a system–inconvenience comes from the separate parts of the lights: you need to install them and turn them on separately. We are now considering a true light "system". The lights around the bike are integrated with each other and only one button (in fact no button) control the entire system. Sensors make the system more intelligent–knowing whether it is daytime or at night; knowing whether you are riding or parking your bike. You do not need to worry about not being seen any more, just enjoy your ride!

B. Basic overview of purposed solution

Three main parts are designed in the circuit to control the lights separately. Photo resistor is designed as a switch of the entire circuit. During daytime, when sunlight is present, the photo resistor will shut down the circuit. At night the entire circuit is powered. With pressure sensor, the lights are turned on when someone is sitting on the seat and off when nobody is on the bike. The main circuit will produce an impulsive current to make the light flicker, which is easier to be noticed by drivers and pedestrians when the surrounding is dark.

2. Design

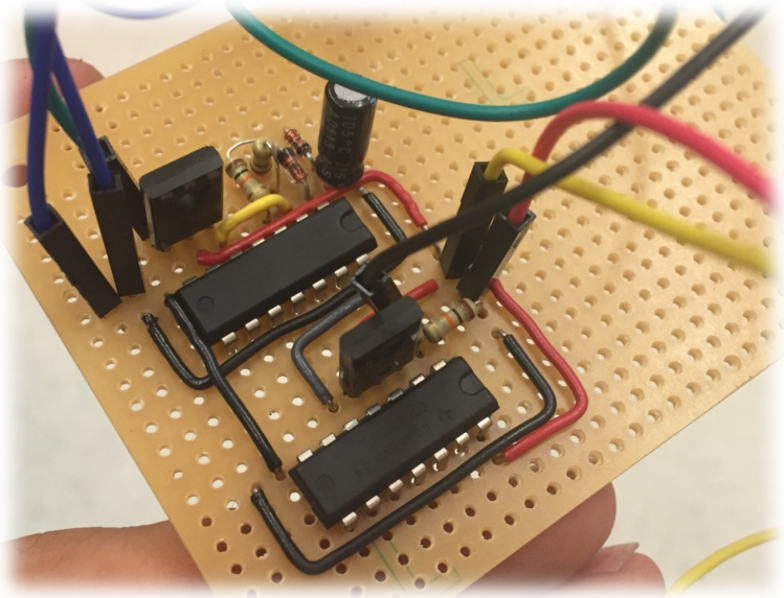
A. Block Diagrams



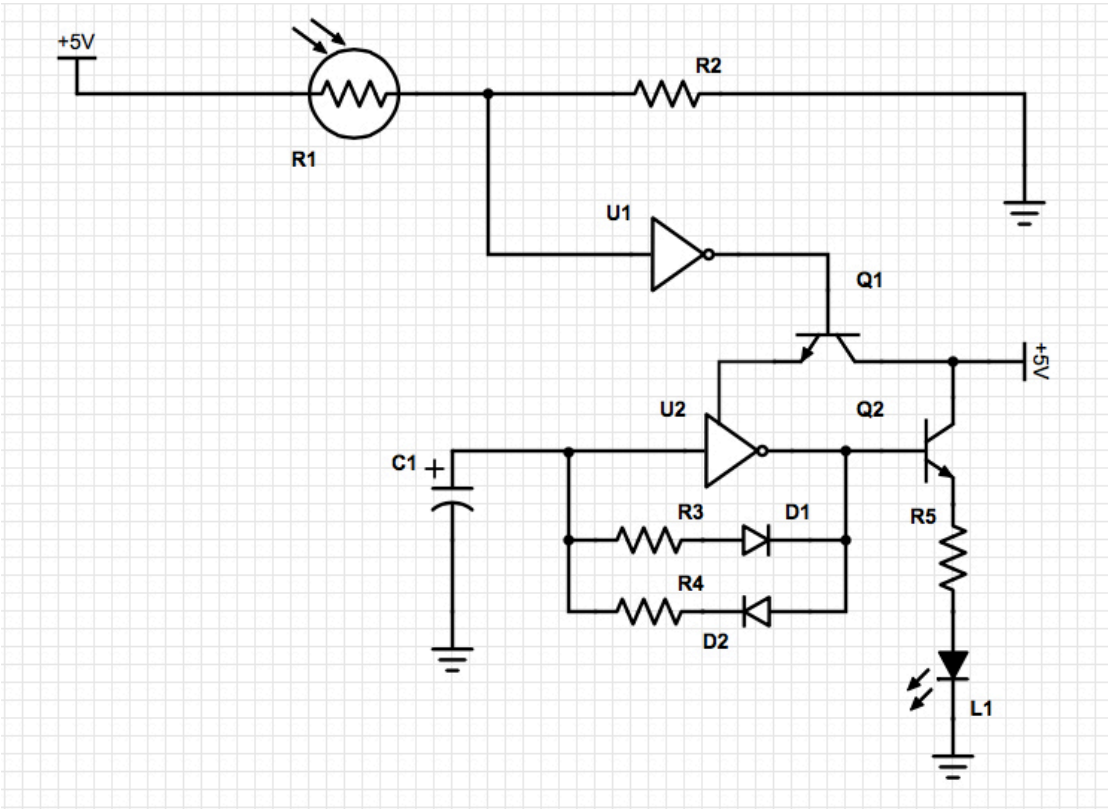
B. Written Descriptions of Blocks

The pressure sensor controls the overall light system. A sensor or a simple button located under the seat, the pressure sensor would be closed if somebody sits on the bicycle and rides, thus allow a secondary switch, the photo sensor to work. The photo sensor, mainly detecting light in the environment, control the oscillating circuit. During daytime, when the environment is bright, the photo resistor has a very low resistance. Through a voltage-divider circuit, we make light off during day and on during night. The oscillating circuit provides impulses to make the light flashing and more noticeable to drivers.

C. Drawings/Pictures of device



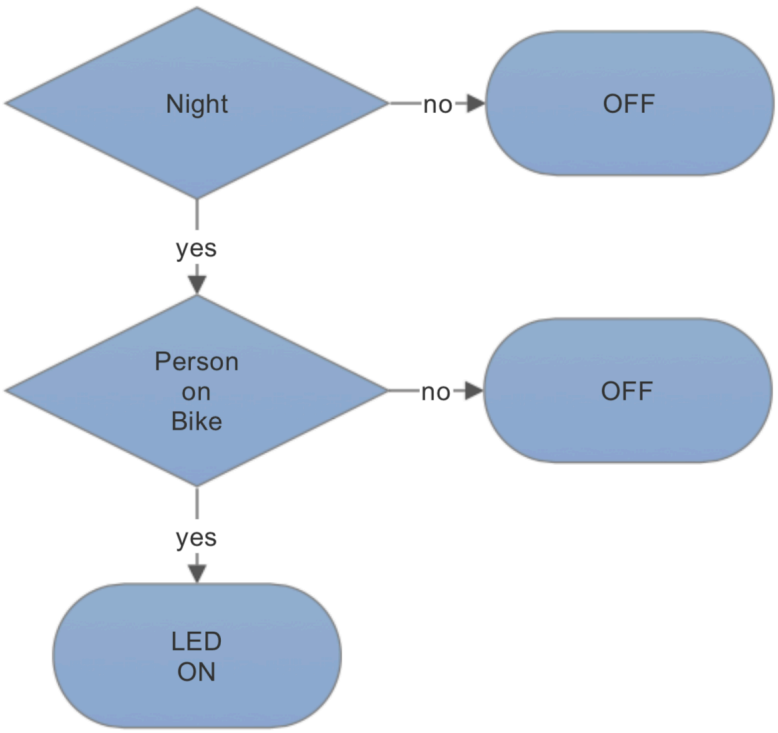
Main board



Circuit Diagram

D. Flow chart of software

(we do not apply software)



3. Results

A. Present Results

At present, we are able to control the LEDs and flickering effect based on the light in the environment: at night, the LEDs light up and during daytime they turn off. We have not successfully combined this part of the system to the pressure sensor part, which acts as another switch of the system.

B. Qualitative Analysis of results

The light and the brightness-detecting circuit work quite well. At night, at a certain point when the environment is dark enough, the light flashes as we designed. The oscillating circuit also works with our designed duty cycle very stably and sustainably.

C. Quantitative Analysis of results

Currently, with the regulation of two transistors, we make the output voltage at 5v with a duty cycle of 5%. In fact, in reality, we are planning to use 9v battery for power. As a result, we may need other minor adjustments to the connection of the LEDs. We are going to connect two LEDs in parallel so that each of them could receive 4.5v of voltage. The voltage divider circuit for the pressure sensor may be replaced by a button so that we don't have to use the 30MOhm resistor.

4. Future Work

The LEDs need 5V to turn on. In order to integrate the pressure sensor circuit into the system, we should make sure that when people of different weights sit on the seat, the pressure sensor circuit could give a constant 5V output to light up the LEDs.

On the other hand, during the final demo, some other ideas were pointed out by professor, TAs and other students: First, we could use a simple switch to replace the pressure sensor, which is much easier to do. Second, we could attach pressures to the handles to supplement the pressure sensor because when people ride bikes, sometimes they do not sit on the seat or they do not grasp the handle so that multiple sensors on

multiple positions increase the practicability and intelligence of the system.

5. Conclusion

A. What worked?

The oscillating circuit works very well since it can generate very stable square wave that drive the LEDs. After we left it open for one night, its stability and sustainability is further proved. The photo resistor circuit also work pretty well since it does not require much energy to operate and the sensitivity of it could be adjusted by changing the value of only one resistor.

B. What did not work?

The pressure sensor circuit could not give out enough voltage to turn on the LEDs since the voltage divider circuit does not work as we previously expected. So we currently have not combined the two parts together. Now we think of replacing the voltage divider circuit together with the pressure sensor with a simple button to simplify this part in order to make the circuit stable and effective.

C. What did we learn?

To discover a problem, we should always start with the observation of daily life. Those problems in daily lives are subjected to solutions and they are good opportunities to apply our knowledge.

To solve the problem, we should start with the division of complex systems. By dividing the seemingly intricate problem into many parts, we solve them one by one by designing sub-circuits. In the end, we simply join them together and reach our goals.

Through this entire project, we learnt the basic functions of electronic elements such as BJT, inverter and photo resistor. In addition, we learnt how to draw electric circuits using software. With our continuous effort in improving the circuit and develop new application of the circuit, we will exploit this simple circuit to its maximum potentials.