Application Notes

ECE 480

Team 8

Whirlpool Dispenser Cup Contents Detection

Solar Panel and rechargeable battery

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The energy cost is very important task in our life today. Most of electricity is coming from thermal power plant. Thermal power generation not only release the greenhouse gas like CO2 (carbon dioxide) but also release some pollution gas like SO2 (sulfur dioxide). The most important is that thermal power generation uses much fossil energy like coal and oil and there are not too much fossil energy left in our planet. So we need to use some clean and renewable energy source like solar in our project. Figure 0 is the Thermal Power Plant of Michigan State University.

Figure 0. Michigan State University Thermal Power Plant
In our project, we have to power up the whole dispenser cup and the microcontroller. However different part requires different voltage to work. So we plan to use a 9 volt battery and design a circuit to output in 9 volt, 5 volt and 3.3 volt. The circuit is show in the figure 1.

![Power Supply Diagram](image)

**Figure 1.** Power supply.

We plan to use solar recharge our 9 volt battery. So we bought a solar cell as shown in the figure 2.

![Solar Panel](image)

**Figure 2.** Solar panel
To connect the solar panel to the battery we designed a circuit showed in figure 3.

![Circuit Diagram]

Figure 3. circuit design

When the voltage of battery is higher than solar panel, the current will flow from the battery to solar panel so we use a diode to only let the current flow from solar panel to battery. When battery is full, the solar panel will still work, in case of solar panel burn itself, we add a Zener diode in our circuit.

However, after we test the our solar panel, we found that the result is not ideal. The solar panel is not as sensitive as we thought, it need the light to be very focus on the panel to produce the power. If we use another laser pen or something to power up the solar panel, it will be even more cost than just use a battery. So we change our plan. There are some one dollar calculators sold in the supermarket. As shown in the figure 4.
The one dollar calculator has very sensitive solar panel. In addition, they have some button size battery. So we can use their idea into our project. We bought 10 one dollar calculators because they are really cheap and we take apart the calculators and get out the solar panel and battery. We plan to replace the battery in the figure 3 and figure 2 as a bunch of button size of battery and replace the solar panel as a bunch of solar panel getting from one dollar calculators.

For the microcontroller outside of dispenser cup will be powered by the ALU or computer. Since we use the USB port to communication between computer and transceiver, and the USB port provide the power to transceiver which means the computer will directly power up the transceiver. Since the transceiver does not cost too much energy compared to the computer, it
will be fine. Figure 5 shows the microcontroller embedded in the USB port. It is designed in Michigan State University in Dr. Xi Ning’s micro robot lab by Weihan Yan and Jianguo Zhao.

Figure 5. Microcontroller embedded in USB port

Actually it is just the microcontroller embedded with FTDI. So we can use the FTDI to connect with our microcontroller with computer. It can not only power up the microcontroller by computer but also can let the microcontroller communicate with the microcontroller. Figure 6 is the FTDI from sparkfun.com

Figure 5. FTDI from sparkfun
So finally, we will use the computer and to power up the microcontroller outside of dispenser cup through the USB port and we will use the solar panels and button size battery from one dollar calculators to power up the whole dispenser cup system.