Sensor Report

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Radio Frequency / CdS Transmitter and Receiver

Introduction-

In my robot, the golf caddy, a circuit was necessary in order to detect whether the ball had been hit off the tee or not. Two problems had to be solved here.

1. Detecting if the ball had left the tee
2. Relaying status of ball back to robot

Solution to problem #1:

CdS cells act as variable resistors whose resistance is based on the light that is shown on them. In this lab, I used plastic hollow golf tees similar to those used at driving ranges. Because of this, I was able to place the CdS cell inside the tee and allowed the resistance to obtain one of two values; that of the ball being on the tee, covering the CdS cell and when the ball is removed, flooding the tee with light. The contrast between the resistance values in various settings is described in figure 1*.

	Resistance (Ohms)
Golf Ball on Tee – CdS cell covered	81.6k
No golf ball on Tee – CdS cell flooded	2.1k

Figure 1: Contrasting Resistance in various CdS Conditions

*Note that these values are individual based on the location and is only being shown to emphasize the difference in magnitude.

Solution to problem #2:

In order to relay the status of the golf tee back to the robot, a RF transmitter was used. The transmitter works by basically sampling the input pin and relaying the value

that is on the pin back to the receiver which is attached to the robot. This works well and better than most other methods for transmission because RF allows for signals to be sent without line of sight being achieved (unlike laser, IR, and ultrasonic). Another benefit to RF is the fact that the transmitting distance is much higher than that of other conventional methods. Figure 2 shows the pin outs for the RF transmitter. In particular, pin 2 is connected directly to the source that is to be transmitted.

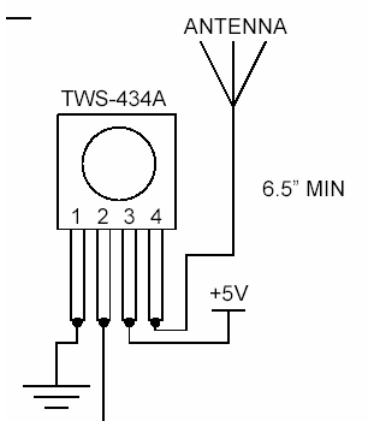

Figure 2 – TWS-434A RF Transmitter Module

One of the specifications of the RF Transmitter is that it is able to detect signals between half a volt above and below the applied power voltage to the circuit. Thus if 5 volts are used to power the transmitter, then a range of 4.5-5.5 volts on the input line will trigger a high pulse to be sent. This is an extremely beneficial feature for this application as it allows for multiple states to be controlled by voltage levels on the pin that are not necessarily digital (0, 5V). Thus, a simple voltage divider circuit can be setup that allows the voltage to swing between the two values.

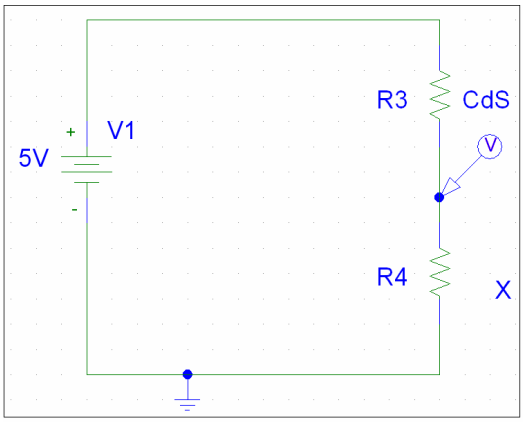

Figure 3.Simple Voltage Divider

Figure 3 shows a simple voltage divider with R3 representing the CdS cell and X representing the added resistor value. The voltage marker shows where the RF transmitter would sample. If the added resistor is similar to the lower value of the CdS cell then both voltage values will be less than half the supply level. In order to achieve proper voltage values to trigger the transmitter, the added resistor must be around the same value as the high end of the CdS resistance values. It would even be preferable if this value was above the max end of the CdS cell.

Pricing Information

TWS-434A RF Transmitter Module

Cost per sensor: $8.95

Reynolds Electronics (http://www.rentron.com)

RWS-434 RF Receiver Module

Cost per sensor: $8.50

Reynolds Electronics (http://www.rentron.com)