Initial Testing Notes(8/22/2017):

Shawn and I have tested a few of the most common types of light bulbs to see which have characteristics that suit being in a VLC system. We tested each light bulb by supplying a 120 volt ac power to each one when in use, and tested the VLC system’s protocol at different communication speeds (20 ms, 15 ms, 10ms). Our relay’s data sheet says that 10ms is the limit to what it can do, and since the human eye can see up to 60 frames per second(around 16 ms refresh) we were hoping that once we got to this speed the information transfer would not be visible. However the communication was visible; we have two hypotheses for this. The first being that either our relay’s switching speed is slower than anticipated, which seems to be supported due to the fact we don’t hear any audible increase in the coil switching sounds when we up the speed any greater than around 15ms. And secondly that the bulb themselves are somewhat limited in their switching speeds, in the sense that a bulb has some delay in heating up or cooling down when it’s power level changes. We lean more towards the first hypothesis as we have seen other VLC projects use light bulbs at levels where the information transfer was imperceptible to the human eye. However our bulbs are standard hardware store bulbs, and we are not sure whether the other projects used specialty bulbs. An LED bulb, for example, has some regulatory circuitry built in and so the change at which the bulb’s luminosity changes could be dependent on that circuitry and therefore different LED bulbs may have different delays when changing their luminosity. That is why we cannot completely discount the second hypothesis.

We didn’t expect much variation between the types of the light bulbs, but were surprised by our results. We found each bulb had different ‘lead in’ times. By lead in times we mean that some bulbs when exposed to such high switching speeds did not immediately turn on, and instead took some time to ‘warm up’ before they started visibly sending bits. Here are notes on the three bulb types we tested:

**Traditional 60 watt:**

**-no visible lead in time**

**-brightness suffered at high switching speeds**

**LED bulb:**

**-about half a second lead in time, maybe a quarter of a second(will need to time)**

**-best switching speeds of any bulb type, its brightness remained strong at high switching speeds and It was the closest bulb to having it’s data transfer be imperceptible. Its main drawback is the lead in time; we believe this to be due to the circuitry in the LED requiring time to power up**

**Fluorescent bulb:**

**-the worst lead in time, around one and a half seconds**

**-good at high switching speeds. Almost as good as the LED but not quite there. Sometimes it’s brightness would randomly drop a byte that switched it’s state a lot**

Our final thoughts are that we will do research to see if there are any specialty bulbs, look into the advantageous of solid state relays over normal relays with regards to switching speed, and plan out whether it will be worth it to design our own specialty bulb with its own special regulatory circuitry designed with VLC systems in mind to aid our future testing efforts.