

Task C [30 points] Answer the follow questions:

1. Explain how the light level sensor is being calculated to determine if the light level is high, medium, low, or non-existent.

On the hardware side, the light sensor sends electrons to the capacitor in an amount proportional to the amount/brightness of light being received by the sensor. The capacitor has a limit on the amount of electricity it will store before releasing or dumping it. So as the light sensor reads light, it repeatedly fills the capacitor, which empties when full, and then begins to fill again. The more light there is to be read by the sensor, the faster the capacitor will fill (in a very short period of time), and the less light there is, the slower it will fill (and take a longer period of time).

On the software side, we interpret these light readings by measuring the amount of time it takes for the capacitor to fill. So under bright light conditions, we will get a smaller number, while under dim light conditions, we will get a much larger number (ie. The amount of time it took for the capacitor to fill under those lighting conditions). We can then send some output to the user to indicate whether the light conditions are low (if we get a large number), moderate (for a middle-range number), or high (a smaller number), and output accordingly.

2. Envision a situation in which a light sensor would make a good tool and describe how the sensor circuit and software could be modified to address the situation.

A situation that jumps to mind for me, as someone who does some photography, is the use of light sensors in cameras. Broadly, cameras use light sensors to read the brightness of the image in the frame, and then either communicate that light reading to the user, who can then adjust the shutter speed and aperture to accurately capture the right amount of light in the image (in the case of a manual camera), or automatically adjust the aperture/shutter speed in order to get the right amount of brightness in the image (in the case of an automatic camera).

In order to implement this usage of light sensors, we could keep the circuit relatively the same, though we could remove the LED component used in this assignment. On the software side, instead of having a few designated ranges of reading values for “low,” “moderate,” and “high” light conditions, there would be many smaller ranges, to align with all of the possible combinations of aperture/shutter speed, and the program could then output the best combination to use to the user (or the camera itself).