RTES Year 2 Semester 2

Take Home Arduino Assignment due date 5/5/21

Instructions Part1 (20%)

1. Your assignment is to build and program a STOP/GO system like you see when there are roadworks on the road.
2. There are 2 sets of lights, one at either in of the road and traffic is only allowed flow in one direction at a time.
3. There is a light sequence (in this case 6 sequences) as you find in traffic lights and there is also a time sequence for each light sequence. The chart below shows the light sequences and the day and night timing for each sequence.

	Light Set A				Light Set B			Day Timing		Night Timing
1	green	black	black		black	black	red	min 2sec max 10sec		min 2sec max 30sec
2	black	yellow	black		black	black	red	2 sec		2 sec
3	black	black	red		black	black	red	2 sec		2 sec
4	black	black	red		green	black	black	min 2 sec max 10 sec		min 2sec max 20 sec
5	black	black	red		black	yellow	black	2 sec		2sec
6	black	black	red		black	black	red	2 sec		2 sec

4. You will see from the chart that the only two sequences for which timing changes is when either direction is Green.
5. The Green light is on for longer at night than day, you just don't need to change lights as quickly at night because there is less traffic. A photo transistor will sense the light level and will automatically switch the system to night mode when light fades. You can select the light level at which to switch.
6. The lights also contain traffic sensors. If a vehicle approaches a red light and there is nothing coming from the opposite side which has green, it will shorten the length of the green sequence. That is why you have a min and max time for green. E.g in sequence 1 above Set A is green for between 2 and 10 seconds. This means that A will be green for a minimum of 2 seconds and will change after 10 seconds regardless of traffic. However, if there is no traffic approaching A and there is traffic at Set B then the green light will off sooner than 10 seconds, but it will stay on for a minimum of 2 seconds.
7. If there is traffic in both directions. I.e both traffic sensors on then the sequence will not be interrupted.
8. If there is no traffic in either direction i.e both sensors off, then the sequence will not be interrupted.
9. There is also a daylight sensor. Which switches the sequence from day to night timing and vice versa?

Deliverables
1. Your Arduino kit with the circuit built as in the attached diagram. You must return the complete Arduino kit with all the components that were given out to you.
2. Your Arduino Uno with the code that you have written to control the lights loaded on it. When The Arduino is powered up the lights system should start.
3. Upload the code you wrote to Moodle.
4. Upload word document to Moodle explaining how you went about solving the problem and the logic behind the code you wrote.

Tips

1. Get the basic functionality controlling the lights working first, you will get some marks for this.
2. Add the light sensor that will be an analog input and you will need an alternative sequence for night time. Remember it is only the timing of the green lights that change.
3. Add in the switches that represent traffic sensors and add them as digital inputs.
4. Remember that in the sequencing it is only the timing of the green light in either direction that you have to control.
5. As you cannot interrupt a long a delay I would suggest that you would use a loop of several shorter delays.

Part 2 (7%)

(a)

 Describe the evolution of micro controllers. As part of your answer provide three features of this technology.

(b)

Describe the role of the oscillator and the impact it has on instruction cycle duration. Use examples where appropriate.

(c)

Compare and contrast the Von Neumann architecture to the Harvard architecture. Provide three features of each.

(d)

 Compare and contrast direct mapped cache to associative mapped cache.

(e)

Draw a block diagram of the Mega 328p processor

(f)

Draw a program memory map of the Mega 328p