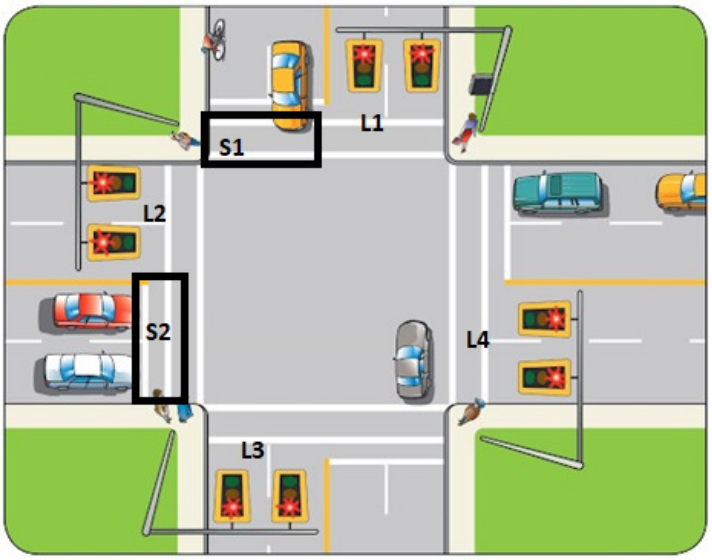
Traffic Lights Controller – Project Details (6% + 1% possible bonus)

Inputs on HMI: (buttons - latching) B1(System Turn On/Off), B2 (After Hours Operation), B3 (After Hours Automatic), B4 (Advanced Lights Enable), (sensors-momentary) S1(Sensor_at_L1), S2(Sensor_at_L2)

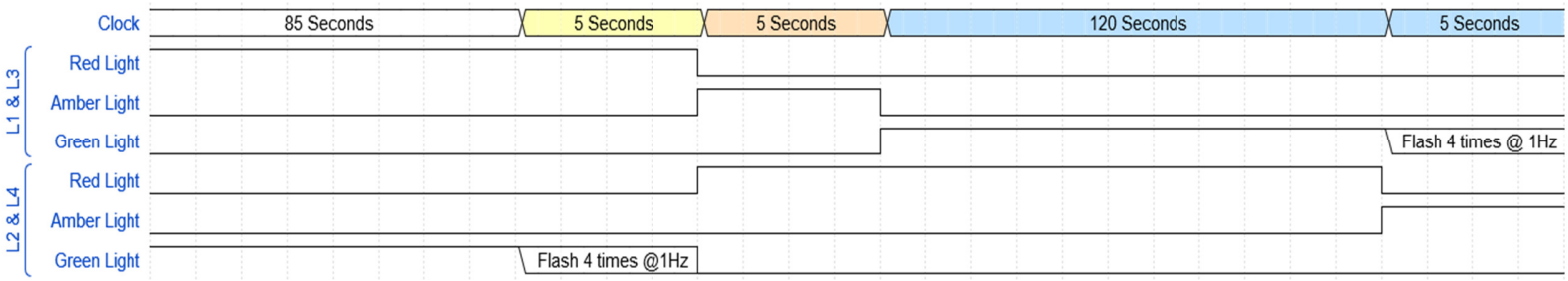
Outputs on HMI: 2 traffic light pairs for L1-L2-L3-L4 (total 8 traffic lights)

HMI Design: Feel free to name your buttons, labels as you like and use colorful design. Design the intersection and the traffic lights such that you follow the layout in the diagram below:



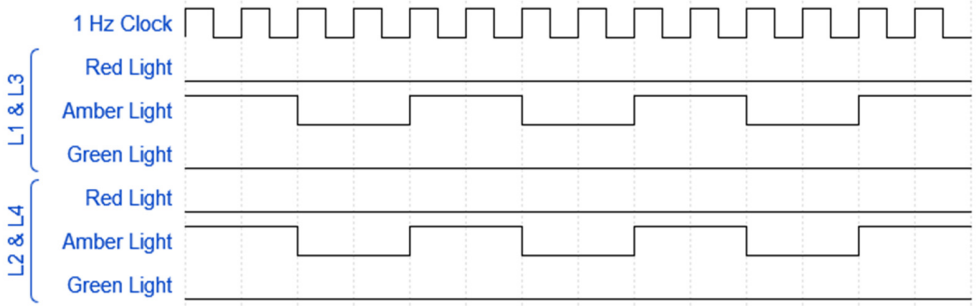
Part a) Normal Operation (3%)

For this part you need to design and implement normal operating conditions of the Traffic Lights Controller. When the system is on, B1=1, The behavior of the lights should be as shown in the waveform timing diagram below:



Part b) Afterhours Operation (1%)

It is desired that the system uses the button B2 (After Hours Operation) to go into the afterhours / off-duty mode. When B2=1, the lights should behave as the timing diagram below. When B2 goes back to zero, the operation of the traffic lights should go back to the Normal Operation cycle as described in Part a.



Part b- (BONUS +0.5%) Afterhours Operation – Fully Automated

To further enhance the Traffic Lights Controller system, switching to the afterhours operation mode should be done automatically by the system for hours between 03:00 and 05:40. This option should be enabled when B3=1 (After Hours Automatic).

Part c- Advanced Lights (2%) (Bonus 0.5%)

There are load (pressure) sensing sensors under the road of L1 and L2. If for example L1=1, then that means there is a car present at L1 and vice versa.

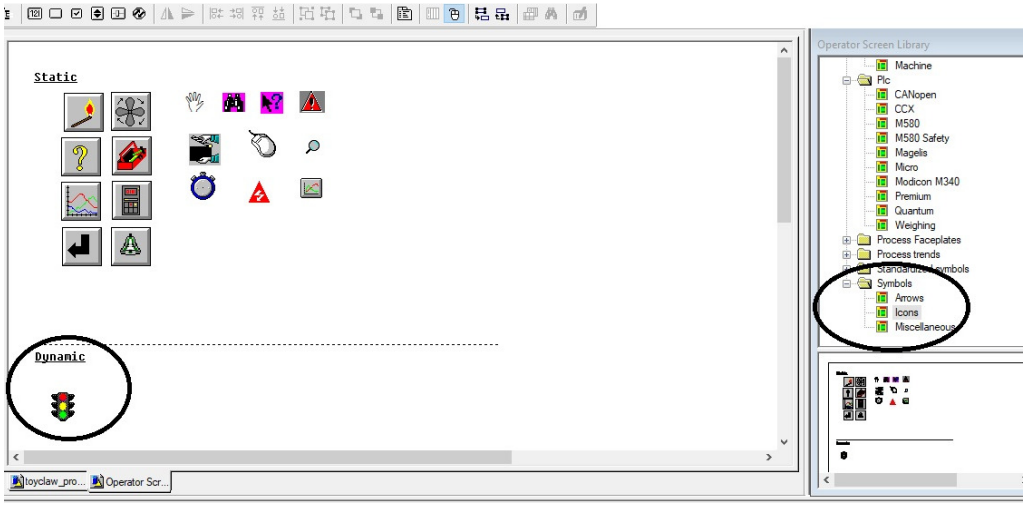
When B4=1 (Advanced Lights Enable), this mode should be active. When B4 goes back to zero, the operation of the traffic lights should go back to the Normal Operation cycle as described in Part a.

You need to implement the following functionality for when only B4=1:

- If L1 is showing red light, and S1=1 (meaning there is a car waiting at L1), and there has been no cars that passed from L2 in the past 40 seconds (S2=0 for >= 40s), then L1 should first transition to amber for 5 seconds, and then to green. L2 should transition to red light. Afterwards, normal operation should continue.
- Similarly, if L2 is showing red light, and S2=1 (meaning there is a car waiting at L2), and there has been no cars that passed from L1 in the past 40 seconds (S1=0 for >= 40s), then L2 should first transition to amber for 5 seconds, and then to green. L1 should transition to red light. Afterwards, normal operation should continue.

For Bonus +0.5% in part c: Find from internet, the brand, model name and datasheet of a sensor (S1 & S2) that would be proper for usage under the road for this traffic light intersection case.

Reminder: In Operator Screen Library, Under Symbols -> Icons, there is another traffic light that you can use. Make sure you do the grouping /ungrouping properly)



Toy Claw – Project Details (14% + 2% creativity bonus)

Inputs: B0 (Game Start Button - momentary), S0 (Input Coin OK - momentary), X2(-x_motion), X3(+x_motion), X4(-y_motion), X5(+y_motion), Other sensor inputs of your choice

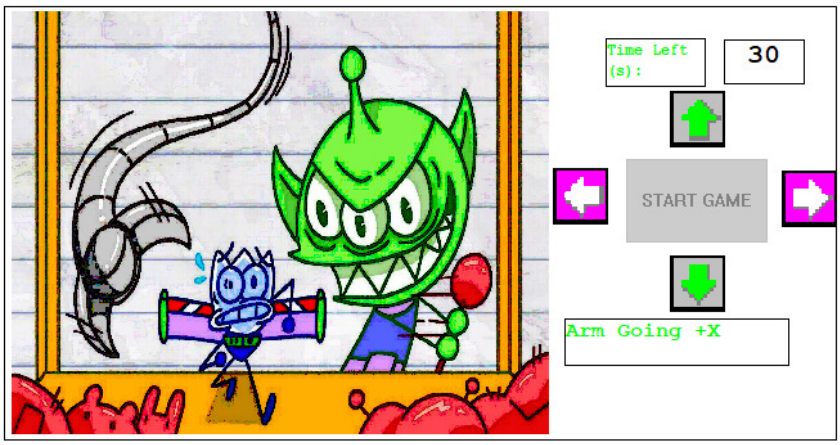
Internal Variables: Total_Number_of_Games_Played, Total_Number_of_Wins, Date_and_Time_of_Last_Win

Outputs: X_Motor_Right (x-axis Motor Going Right), X_Motor_Left (x-axis Motor Going Left), Y_Motor_Right (y-axis Motor Going Right), Y_Motor_Left (y-axis Motor Going Left), Z_Motor_Up (z-axis Motor Going Up), Z_Motor_Down (z-axis Motor Going Down), Gripper_Open (Claw Opens), Gripper_Close (Claw Closes)

HMI Design (3%):

- On your HMI, the following should be visible when the game is active:
  - Joystick buttons for all 4 directions
  - A button to start the game (i.e. make the claw go down)
  - A box showing the left over time in seconds
  - Game Over or Winner Message when Game is over
  - When the arm is moving, on the screen it should show one of the following on the screen:
    - Arm Going +X or Arm Going -X or Arm Going +Y or Arm Going -Y or Arm Going Up or Arm Going Down
- On your HMI, the following should be happening when the game is not active:
  - Joystick, Start Game button, time left box should all be invisible
  - Feel free to Display any message you want on the screen such as “Insert a Coin to Play” or make something flash to get attention

To give you an idea, here is what I came up with. Feel free to be more artistic.



Game Rules – Game Play (%6.5):

- When input coin is detected (S0 becomes a 1 momentarily), the game is activated
    - When the game is active, the Joystick should be displayed on HMI, otherwise it should be not visible
    - Player has 90 seconds to move the claw to their desired position, time left should be displayed on HMI
    - Pressing start button will activate the claw, when claw is activated it does the following motions:
        - Arm opens gripper for 1s, starts going down and closes for 1s when fully down, waits for 0.5s then
        - Then arm raises again, and then brings the toy (if any) to the delivery box in the corner. Waits for 1.5s before opening the grippers for 1s
    - If the player wins something, a "Winner" message should be displayed on HMI.
    - If the player does not win anything, "Game Over" message should be displayed on HMI.
    - After this sequence the game ends and the system is deactivated (i.e. joystick is not visible anymore, the claw can not move etc.)

Gripper Selection (%0.5):

- Find and pick a suitable gripper for this application. Please include the datasheet and pricing if you can. Price doesn't have to be the Turkish market price; E-bay/Amazon US pricing is fine.

Sensory Selection (%2):

- You are responsible for choosing the correct sensory for your design, you are free to choose any type of sensor as long as you give a good logical reason for it. But if you pick something like an automotive gyroscope for 10000$, you'll lose marks.
- First realize the desired operation, then figure out what sensory you need and where you would use them
- For the sensors you pick, please include the datasheets, and if possible include the price. Price doesn't have to be the Turkish market price; E-bay/Amazon US pricing is fine.

Animation Table (2%)

- Create an animation table showing the following internal variables with correct values:
    - Total_Number_of_Games_Played
    - Total_Number_of_Wins
    - Date_and_Time_of_Last_Win

Creativity Bonus Points (2%):

- On HMI, when Game is Active, feel free to display something cool when:
    - Game starts
    - Last 5 seconds of the game
    - When Start button is pressed
- On HMI, when Game is not Active, feel free to display something cool such as:
    - Messages on screen that change over time
        - "Come Win Toys" – "Try your luck" etc. be creative :).
- On HMI, when player wins something, create a celebration visual