Faculty of Engineering

Abdullah Gül University

Project Guideline
EE 213 Digital Design

Fall 2019-2020

OBJECTIVE

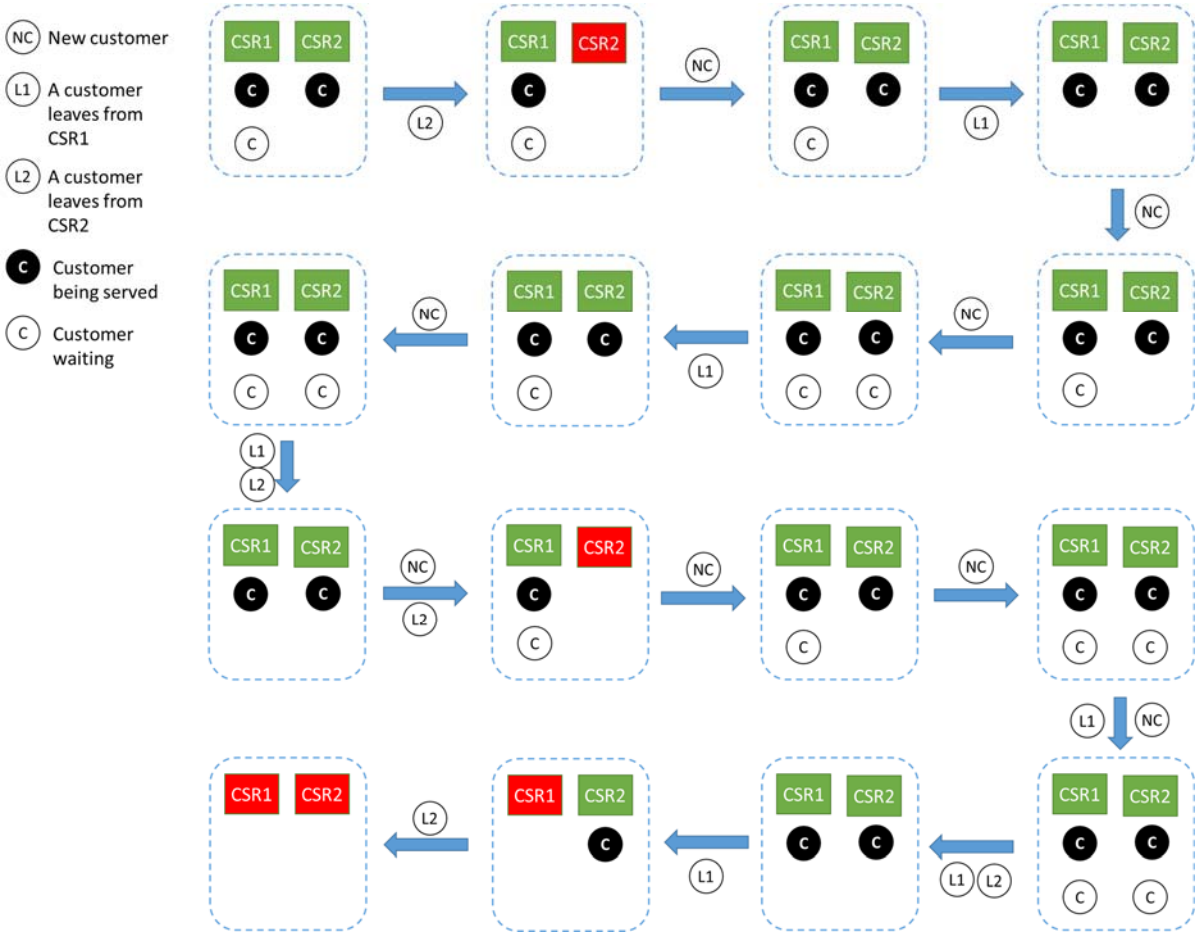
- To apply knowledge obtained through lectures and laboratory experiences to design digital circuits for real-life applications.
- To practice effective communication methods through demonstration.
- To develop skills necessary in working in a team.

GENERAL INFORMATION

- The project is to design and implement a queue management system.
  - Imagine a queue management system for a customer-relations department, especially one that carries out the task by phone calls. In real life, there can be dozens of customer service representatives (CSRs). In this project, we will limit the number of CSRs to two people.
  - Also, imagine there is one primary CSR (CSR1) whose sole job is to take phone calls from customers. The secondary CSR (CSR2) has another duty so that s/he starts to take calls only when the CSR1 has two customers in his/her charge.
  - Another constraint is that the maximum number of customers who are assigned to both CSRs at one point of time is 4 (i.e. 2 for each CSR).
  - Let's take an example, in which no customer finishes their businesses and leave the queue.
    - 1st new customer: CSR1 – 1 customer, CSR2 – 0 customer.
    - 2nd new customer: CSR1 – 2 customers, CSR2 – 0 customer.
    - 3rd new customer: CSR1 – 2 customers, CSR2 – 1 customer.
    - 4th new customer: CSR1 – 2 customers, CSR2 – 2 customers.
    - 5th new customer: CSR1 – 2 customers, CSR2 – 2 customers.
    - 6th new customer: CSR1 – 2 customers, CSR2 – 2 customers.
    - We will imagine that from the 5th new customer, the system will take the call-back number to return the call in the future.
  - Let's take another example, in which customers who finish their businesses hang up and leave the queue.
    - At the beginning there are three customers (2 for CSR1 and 1 for CSR2).
    - No new customer comes; one customer leaves from CSR2.
      CSR1 – 2 customers, CSR2 – 0 customer
    - One new customer comes; no customer leaves.
      CSR1 – 2 customers, CSR2 – 1 customer
    - No new customer comes; one customer leaves from CSR1.
      CSR1 – 1 customer, CSR2 – 1 customer
    - One new customer comes; no customer leaves.
      CSR1 – 2 customers, CSR2 – 1 customer
    - One new customer comes; no customer leaves.
      CSR1 – 2 customers, CSR2 – 2 customers
    - No new customer comes; one customer leaves from CSR1.
      CSR1 – 2 customers, CSR2 – 1 customer
    - One new customer comes; no customer leaves.

CSR1 – 2 customers, CSR2 – 2 customers

- No new customer comes; two customers leave, each from CSR1 and CSR2.
  CSR1 – 1 customer, CSR2 – 1 customer
- One new customer comes; one customer leaves from CSR2.
  CSR1 – 2 customers, CSR2 – 0 customer
- One new customer comes; no customer leaves.
  CSR1 – 2 customers, CSR2 – 1 customer
- One new customer comes; no customer leaves.
  CSR1 – 2 customers, CSR2 – 2 customers
- One new customer comes; one customer leaves from CSR1.
  CSR1 – 2 customers, CSR2 – 2 customers
- No new customer comes; two customers leave, each from CSR1 and CSR2.
  CSR1 – 1 customer, CSR2 – 1 customer
- No new customer comes; one customer leaves from CSR1.
  CSR1 – 0 customer, CSR2 – 1 customer
- No new customer comes; one customer leaves from CSR2.
  CSR1 – 0 customer, CSR2 – 0 customer
- This scenario is illustrated in the following diagram.



- From this scenario, one can see that a customer who is already being served does not move to another CSR.

        - Also, one can see that when there is a vacancy in CSR1's queue, a customer waiting in CSR2's queue moves to CSR1's queue.
    - Major inputs
        - NC: new customer comes (pushbutton)
        - L1: one customer leaves from CSR1 (pushbutton)
        - L2: one customer leaves from CSR2 (pushbutton)
        - Assumptions:
            - ✓ At most one customer comes during one clock cycle.
            - ✓ At most one customer leaves during one clock cycle from each CSR.
    - Slow clock cycle: 0.5 Hz
    - System should have a RESET switch which returns the system to the original state.
    - Major outputs
        - Slow clock (in order to synchronize the input entering)
        - Active status of CSR1 and CSR2 (LED)
        - 7-seg display (D3-D2-D1-D0, Dn means nth digit)
            - ✓ Mode 1
                - D3: Current number (0, 1, or 2) of customers at CSR2.
                - D2: Current number (0, 1, or 2) of customers at CSR1
                - D1-D0 (2 digits): Total number of customers who came, including who could not enter the queue.
            - ✓ Mode 2
                - D3-D2 (2 digits): Accumulated number of customers **served** by CSR2
                - D1-D0 (2 digits): Accumulated number of customers **served** by CSR1
            - ✓ Mode 1 and Mode 2 are selected by a switch.

DEMONSTRATION

- Demonstration will take place in the lab in front of the instructor team.
    - Date: **Dec. 30, 2019**
    - **Prepare a PPT file** that includes your state machine diagram and a circuit diagram (it can be divided into multiple slides for better visualization). Upload this file to Canvas before your demonstration. (10 pts out of 100 pts)
    - Questions will be asked for everyone in the team, individually. Your comprehension level will be determined based on this Q/A session, and a weight will be decided for each member, such as 1.0, 0.9, 0.8, and so on. Your demonstration point will be multiplied by this weight.
    - No late demonstration will be accepted.

POLICIES

- A group is expected to consist of two members (except for special cases). You should form your own group.
- All members of a project group have to contribute equally throughout the project. **It is mandatory for everyone in the group to attend the demonstration.** If you fail to attend the demonstration without a prior approval, you will lose **50%** of the demonstration point.
- If a student has issues with their project partners, s/he has the responsibility to inform the instructor as soon as possible.
- A project should be demonstrated by using a Basys3 board. A board can be rented out for the purpose of carrying out the project (one board per one project group). You should see the TA to rent a board. After signing a form, it will be rented out to you until the demonstration date. You will not receive your project grade until you return the rented board.