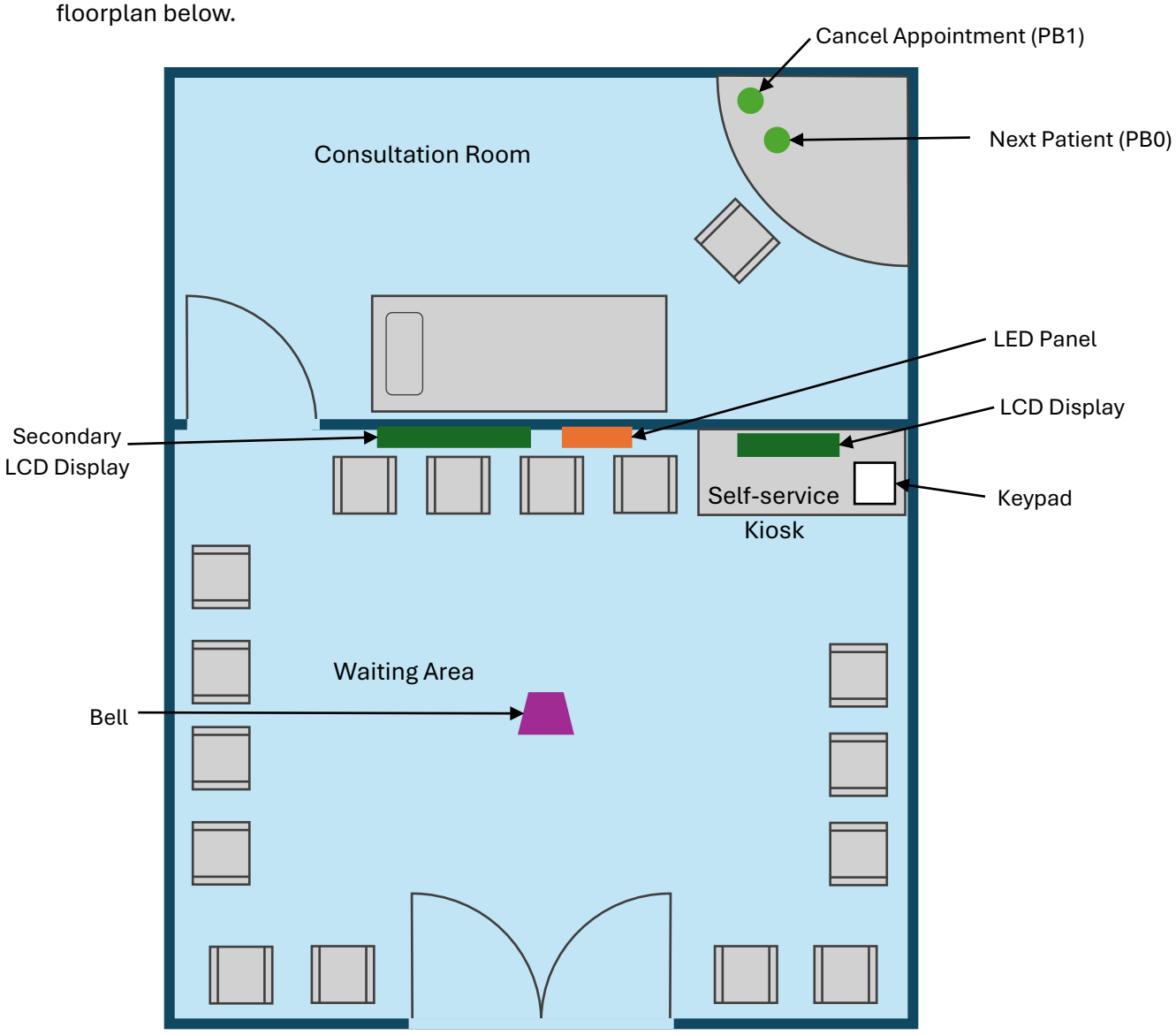
COMP9032 Project – Clinic Management Kiosk

T3 2024

Your company has assigned your group to develop a self-service kiosk to manage patients in a small medical clinic. The kiosk, along with its peripherals, is to be deployed as shown in the floorplan below.



Your company supplied you with a development board that is identical to your COPM9032 lab board, and you have been asked to work with your group to develop a prototype to show the client. The following functional details have been provided to you by your company.

1. The doctor will turn the system on when they open the clinic for the day and turn it off when they are leaving.
2. When a patient comes, the signs direct them to the self-service kiosk. The kiosk features an LCD display and a 4-by-4 matrix keypad, similar to the corresponding components on the development board. The patient interaction with the kiosk is as follows.

a. The patient presses the key 🄰 to start the process of *Adding* themselves to the patient queue. This key 🄰 press switches the operation mode of the kiosk from 'display' to 'entry'. In 'display' mode, any key pressed (except the key 🄰) should be ignored.
b. Upon entering 'entry' mode, the kiosk should prompt the patient for their first name. The first line of the display can be used for the prompt and the second line can be used to show the patient's input. The keys 2-9 on the keypad are used for accepting the patient input and they should function similar to the keypad on a classic mobile phone (https://www.youtube.com/watch?v=g3aLKEaSKns). Note that key nine has four letters: w, x, y and z.
c. The key 🄱 is used to *Backspace* the last character entered, while the key 🄲 is used to *Clear* the patient's entire input.
d. Once the patient enters their name, they press the key 🄳 to indicate that they are *Done* with the input. Then, the LCD display should show the patient a descriptive message with their patient number.
e. Finally, the patient presses the key 🄳 again to confirm that they have seen their patient number, causing the kiosk to switch from 'entry' to 'display' mode.

3. The LED panel is a wall-mounted led bar, a bigger version of the LED bar on the development board. The LED panel is used to provide the next patient with an estimated wait time and to direct the patients' attention to the secondary LCD display.
4. The secondary LCD display is a larger wall-mount LCD display. However, it is functionally identical to the LCD display on the kiosk and mirrors the same content, except when the kiosk is in 'entry' mode. In 'display' mode, both the LCD displays show the following content.
    a. The first row should display the text "`Next Patient:`".
    b. The second row should display the name of the next patient, aligned to the left of the display, and their number on the queue, aligned to the right of the display.

    When the kiosk enters 'entry' mode, the secondary LCD display preserve the content that is displayed on it.
5. The bell is used to draw attention of the patients to the secondary LCD display. It has three ring tones.
    a. Beep-beep – A 1 sec. ON and 1 sec. OFF tone
    b. Bip-bip – A 0.5 sec. ON and 0.5 sec OFF tone
    c. Bee...eep – A 3 sec. ON followed by OFF (once)

    The development board features a motor to represent the actuator in the bell. The bell produces sound when the actuator (i.e., the motor on the development board) is activated. To produce different ring tones, the motor can be activated according to the timing specified.
6. The doctor uses the Next Patient button to call the next (or the first) patient. On the development board, the Next Patient button is represented by the PB0 button. The functionality after the button press is dependent on whether there are patients waiting or not.
    a. If there are patients waiting, the Beep-beep tone is played for 10 seconds followed by the bip-bip tone. During this time, all the 10 LEDs in the LED panel also flashes in sync with the tone played by the bell. The bip-bip tone should continue until it is terminated by the next action of the doctor.

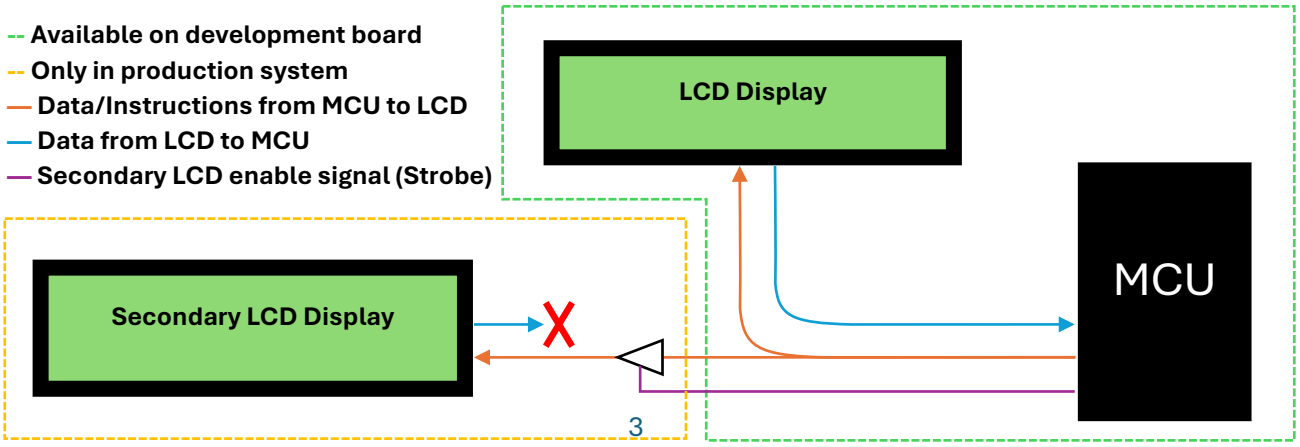
i. When the patient arrives at the consultation room, the doctor presses and holds the Next Patient button for one second to stop the tones played by the bell, stop the flashes generated by the LED panel and update the LCD display with the new next patient's details.
ii. If the patient does not arrive at the consultation room, the doctor presses and holds the Cancel Appointment button for one second, to cancel the appointment. This will produce the Bee...eep tone and the in-sync flash that last for 3 seconds. Afterwards, the LCD display will be updated with the new next patient's details and the behaviour continues as if the Next Patient button is pressed to call the newly displayed patient.
iii. If the kiosk happens to be in 'entry' mode when the doctor calls for the next patient, the kiosk should temporarily switch to 'display' mode while preserving the patient's input (and any progress associated with adding the patient to the queue). Five seconds after updating the LCD displays, the kiosk can return to 'entry' mode to let the patient continue enqueuing themselves.

b. If there are no patients waiting, then Next Patient button should not cause any change in the operation and the button press should be ignored.

7. The Cancel Appointment button press should only be accepted when the doctor is waiting for a patient to arrive at the consultation room.
8. When the doctor is not waiting for a patient to arrive at the consultation room, the LED panel displays the waiting time for the next patient. The usual consultation time is set at the time of delivering the self-service kiosk and for testing purposes, you are asked to take it as 20 seconds. The remaining time divided by the consultation time is scaled by ten (i.e., (*remaining time*/*consultation time*) × 10) to calculate the number of consecutive LEDs to turn on. Some examples are given below. The examples assume the consultation time is 20 seconds.
    a. If 20 seconds of the consultation time is remaining, all 10 LEDs are turned ON.
    b. If 15 seconds of the consultation time is remaining, LEDs 1-7 are turned ON.
    c. If 3 seconds of the consultation time is remaining, LED 1 is turned ON.
    d. If 1 second of the consultation time is remaining, no LED is turned ON.

Prototyping A Dual LCD Display Setup with A Single LCD

The development board does not feature two LCD displays. However, the electronics group of your company has come up with a solution to prototype the system with one LCD display. They are designing a splitter circuit, and they have provided you with the following sketch, illustrating how they intend to transform the LCD driver circuit of the development board to the dual LCD display setup in the production system.



The secondary LCD display often mirrors the LCD display on the kiosk. However, sometimes the secondary LCD display needs to ignore certain display updates that are only meant for the LCD display on the kiosk. Among the two functionalities, the expected functionality of the secondary LCD display is determined by the operation mode of the kiosk ('display' and 'entry').

When the kiosk is in 'display' mode, you can communicate with the LCD display on the kiosk as usual and by setting (to 1) the LED strobe signal on the development board, you can relay the same data/instructions to the secondary LCD display. Any responses from the secondary LCD display will be dropped. The electronics group of your company claims that the secondary LCD display will be in a busy state only when the LCD display on the kiosk is in a busy state and therefore, it is sufficient to know the state of the LCD display on the kiosk, before sending a command to the LCD displays.

When the kiosk is in 'entry' mode, you can communicate with the LCD display on the kiosk as usual and by resetting (to 0) the LED strobe signal on the development board, you can block data/instructions to the secondary LCD display.

Project Evaluation (Worth 25% Of the Final Grade)

Your group needs to develop the prototype of the above system using AVR assembly and you can make reasonable assumptions and take reasonable engineering decisions to complete your task. However, for significant enough concerns (or if you are in doubt whether it is significant enough), you are advised to talk to your tutor or ask on the course forum. This project will generate three assessable outputs: Project demonstration, source code and project report. Each of them will be assessed as follows.

Project demonstration (30% of the project mark): You will be presenting and demonstrating your prototype during your lab class in week 10. The assessment will follow the assessment style used for the labs. The presentation and demonstration should resemble an internal product delivery presentation in a company (what is the product, what can it do, what it cannot do, who did what, excerpts of code to explain any interesting design choices, demonstration). Your group will have 30 minutes to present and demonstrate your prototype.

Source code (40% of the project mark): You will be submitting your final source file archive via a give submission. You will be assessed based on the correctness, use of suitable techniques, modularity, readability and formatting.

Project report (30% of the project mark): You will submit a brief report detailing the functionality of your prototype. The report should resemble a product manual that would be sent to a client, detailing the functionality. It can start with a short introduction followed by step-by-step instructions to operate the prototype. You can include figures/illustrations and detail any limitations along with the steps. For assessment purposes you need to have the following as appendices: project timeline, a justification of design/engineering choices (for example, we used external interrupts for … because …) and a high level pseudo code detailing the overall design. The expected length of the report is 10 pages (including appendices).

In addition to the assessable outputs, you need to fill out a form, individually, indicating the contribution of your group members towards the project. The responses will be used to scale the marks proportionate to the contribution. The form will be circulated later.