COMP2121 Project

Description:

In this project you will develop a microwave emulator system to be used on the AVR development board.

The emulator will need to accept input from the controls, manage the countdown timer, and simulate the various mechanical systems.

Your system should satisfy the following requirements. Marks will be allocated amongst the points listed in the following section. More marks will be given to more difficult features.

The project is to be completed in your assigned lab groups.

Core requirements: (80%)

Modes

The microwave has four main modes:

- 'entry' - This is the default mode that the microwave starts in. In this mode the cooking time can be entered, and menus can be accessed to configure the microwave.
- 'running' - In this mode the microwave is active and cooking food.
- 'paused' - In this mode the microwave is part-way through cooking food.
- 'finished' - This mode is entered after the cooking has been completed.

Group name

Your implementation must display your group name (eg 'B3') in the bottom-left corner of the LCD when in the entry mode. **If your project does not display the group name you will not be marked.**

Time display

When in the 'entry', 'running' or 'paused' modes the cooking time should be displayed on the top-left corner of the LCD in the format 'mm:ss' with leading zeros. If no time has been entered yet then no time should be displayed. E.g. 1 minute 15 seconds should be displayed as '01:15'.

Number keys

When in the 'entry' mode, the keypad number keys are used to enter a cooking time in the format 'mm:ss'. The updated time should be displayed as more digits are entered. At most four digits should be accepted, and further key presses should be ignored.

E.g. the minimum time is 00:01 (1 second)

E.g. the maximum time is 99:99 (99 minutes and 99 seconds)

If a number key is held down, only one digit will be entered.

Start button

The '*' button on the keypad is used as the start button. When in the 'entry' mode, the start button will cause the microwave to start running for the amount of time that has been entered. If no time has been entered, the microwave will run for 1 minute.

When in 'running' mode, the start button will add 1 minute to the microwave's current cooking time.

Stop button

The '#' button on the keypad is used as the stop button. When in 'entry' mode the stop button will clear any current entered time.

In the 'running' mode, the stop button will pause operation.

More/Less buttons

When in 'running' mode the 'C' and 'D' buttons will add or subtract 30 seconds, respectively.

Turntable rotation

The current position of the microwave turntable should be displayed in the top-right corner of the LCD at all times, using one of the ASCII characters '-', '/', '|' or '\' to show the rotation.

While the microwave is running, the turntable should rotate at 3 revolutions per minute.

Each time the microwave is started, the turntable should rotate in the opposite direction to the previous run.

Magnetron activity

When the magnetron is active, the electric motor should spin at approximately 100 revolutions per second.

When running, the power level should determine what portion of each second the magnetron is active for. At 25%, the magnetron should be on for the first 250ms of each second and off for the rest. At 50% the magnetron should be on for the first 500ms of each second and off for the rest. At 100% the magnetron should be on constantly.

Running mode

While in 'running' mode, the magnetron should be activated (in accordance with the power level) and the turntable should rotate. The time remaining should be displayed on the LCD as it counts down. When the time reaches zero the microwave should enter 'finished' mode.

Pause mode

When the stop button or open door button is pressed while the microwave is running, the microwave time countdown will pause and the turntable and the magnetron will be stopped. The 'pause' mode can be exited by pressing the start button to resume operation or pressing the stop button to cancel operation and return to the 'entry' mode.

Finished mode

When the microwave finishes cooking, the LCD should display the text 'Done' on the first line and 'Remove food' on the second.

The microwave should stay in this mode until either the open door button or the stop button is pressed. When either is pressed the microwave should return to 'entry' mode.

Open and close buttons

The left push button is used as the open door button, and the right push button is used as the close door button. When the door is opened the microwave should pause immediately if running, as if the stop button had been pressed. While the door is open the microwave should not accept any input from the keypad. Pressing the open button while the microwave is open or the close button while it is already closed will do nothing. The microwave should be closed by default.

Open/closed display

The microwave should display the open/closed state in the bottom-right corner of the LCD at all times, using the letters 'O' or 'C' to represent open or closed.

The top-most LED should be lit when the door is open.

Power level selection

When in 'entry' mode, the 'A' key is used to select the power level. When pressed, the microwave should display the text 'Set Power 1/2/3' and wait until the '1', '2', '3' or '#' key is pressed. The '1', '2' and '3' keys should select power levels 100%, 50% or 25% respectively. If the '#' is pressed the microwave should return to 'entry' mode.

The current power level should be displayed on the lower 8 LEDs. E.g. 50% power should be displayed with the bottom 4 LEDs on and the next 4 off.

Advanced Features (20%)

Finish Sounds

When the microwave finished cooking, it should beep three times, for one second each. There should be a one second of silence between each beep. The beeps should stop playing immediately if the microwave leaves 'finish' mode.

Key Sounds

Each key-press should generate a short (250ms) beep on the speaker.

You may generate the sound any way you want.

Display Backlight

When in 'entry', 'paused' or 'finished' mode, the LCD backlight be turned off if no keys have been pressed for 10 seconds, and turned back on when a key is pressed. When turning on or off the backlight should fade smoothly over 500ms. When in 'running' mode the backlight should be on continuously.

Submission Information

You will need to submit the following items:

1. A soft copy of your complete source (all .asm files). Your program should be well commented.
2. A hard copy of your user manual. The user manual describes how a user uses your microwave emulator, including how to wire up the AVR lab board. Make sure you indicate which buttons perform each action and how the LED and LCD displays should be interpreted.
3. A hard copy of the design manual. The design manual describes how you designed the microwave emulator system. It must contain the following components:
    a. System flow control. This component describes the flow control of the system at the module level using a diagram.
    b. Data structures. This component describes the main data structures used in the system.
    c. Algorithm descriptions. This component describes the main algorithms used in the system.
    d. Module specification. This component describes the functions, the inputs and the outputs of each module.

Overall, a person with knowledge about the subject and board should understand how your system is designed after reading this design manual.

Demonstration

You will need to demonstrate your working project to an assessor on **Friday of week 13**. Demonstration time slots will be determined closer to the due date.

You will need to submit the hard copies of the above documents during the demonstration. You will also need to bring a copy of your source code on a flash drive or similar.

Marking Scheme

This project is worth 100 marks. The marking scheme will be as follows:

- System Implementation (80 marks)
- Design Manual (10 marks)
- User Manual (5 marks)
- Coding style and commenting (5 marks)