The Airfyer

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Abstract—**This project implements an air fryer with all the functions of a real one. The controller supports key functionalities, including start/stop, time setting, temperature adjustment, and a reset feature, enhancing user control and customization during the process.**

I. INTRODUCTION

In the era of smart home appliances, the intersection of Verilog programming and culinary technology has given rise to an innovative Verilog-based air fryer controller. This project explores the seamless integration of LEDs, switches, buttons, VGA, and a 7-segment display to create a cutting-edge cooking experience. With a focus on user interaction, the controller introduces functionalities like start/stop, time setting, temperature adjustment, and reset, providing users with unprecedented control and customization. The following project delves into the details of this sophisticated air fryer controller, showcasing how Verilog programming elevates the capabilities of traditional kitchen appliances.

II. BUTTONS

Three built-in tactile buttons are used for direct manipulation of the air fryer's temperature settings. Specifically, pressing the "BTNU" button, connected to pin M18, will increment the temperature shown on the screen by 5 degrees each time it's pressed, allowing the user to easily increase the cooking temperature. In addition, the "BTND" button, connected with pin P18, serves to decrease the temperature by 5 degrees, providing a simple method for the user to lower the temperature as needed. And the "BTNC" button, connected to pin N17, acts as a reset function; pressing it will restore the temperature display to the default value, the load minutes and seconds set by the switches, effectively resetting the cooking session.

III. SWITCHES

Thirteen switches determine the timing inputs of the air fryer. The six left-hand side of the switches denoted as [15-10], are assigned to adjust and control the timing in minutes. Simultaneously, the six right-hand side of the switches representing [5-0], provide a finer control of the timing in seconds. An additional switch positioned at [7] manipulates the start and stop time, offering a comprehensive time-setting capability.

This arrangement of thirteen switches ensures a user-friendly and efficient means of customizing the timing parameters for an optimal air-frying experience.

IV. LEDs

All sixteen LEDs are being used in the project. Three modes control the LEDs. The modes correspond to the temperature. In mode, 200 degrees, five LEDs [4-0] are shown. In mode, 300 degrees, ten LEDS [9-0] are shown. In mode, 400 degrees, sixteen LEDS [15-0] are shown. By default, ten LEDS are shown in the middle.

V. 7 SEGMENT

Our project integrates all eight 7-segment displays. Each 7-segment serves a specific purpose. The first LED is dedicated to signaling the operational mode of the air fryer. The first three 7-segments are allocated to display the selected temperature ranging from 200 degrees to 400 degrees. The remaining four 7-segments are dedicated to conveying the cooking time in minutes and seconds. The countdown timer utilizes a 1 Hz clock to produce a 1-second delay. This functionality allows users to easily track the progress of the cooking process, facilitating efficient time management. The allocation of these LEDs across the 7-segment display ensures that users can effortlessly interpret and adjust crucial parameters during the air frying process. This visual representation enhances the user interface and contributes to the overall efficiency and user-friendliness of our Verilog-based air fryer controller. The modular design of the 7-segment display system facilitates future enhancements and adaptations, ensuring the versatility and longevity of our culinary technology solution.

VI. VGA

The incorporation of VGA functionality into our air fryer project aims to elevate user interaction by providing real-time visual cues that reflect the device's operational state. When the air fryer is activated, a distinct yellow box appears on the VGA display, signaling its "on" status. Conversely, when the air fryer is powered off, the VGA display transitions to a calming grey tone, offering immediate visual feedback about its inactive state. The countdown timer is represented on the VGA display. During an active timing phase, a vibrant

green LED materializes, providing users with a clear visual indication of the ongoing process. In contrast, when the timer is paused or the air fryer is stopped, the VGA display shifts to a bold red color, effectively communicating the paused or inactive state. During periods of inactivity or absence of specific actions, the VGA display assumes a default state, featuring a sleek and unobtrusive black background. This minimalist approach ensures that the interface remains uncluttered when not conveying critical information, contributing to a visually appealing and user-friendly design.