

Utilization of Microcontroller Technology as A Food and Beverage Menu Ordering for Service at The Cafe

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Abstract

The cafe service system in this modern era still uses manual labor. This is less effective in terms of service speed and of course will increase operational costs due to the need for a large number of waiters. For this reason, an electronic food and beverage ordering device is needed. This is useful for speeding up the service process and also reducing service personnel, of course, also reducing operational costs. This research will present the use of the ESP 8266 module as a minimum system design for ordering menus on consumer tables. Input from the dining table containing the menu code and number of menus will be displayed on the LCD. Furthermore, data will be sent from ESP 8266 to the kitchen to mix food and drinks ordered by consumers. The data is also transferred to the cashier's PC, whereupon the cashier prints invoices for consumers. From the test results on the LCD can already display a menu of food and drinks. The cashier PC and kitchen PC have also displayed the food and drink data ordered. Cashiers can also print bills for consumers.

Keywords: ESP 8266, LCD, Keypad, apache, xampp

1. Introduction

The development of science and technology today is getting faster, especially in the field of electronics. This is due to the development of human civilization and culture towards a higher level. Where one encounters the use and utilization of modern and sophisticated technology, the goal is to achieve good, efficient and effective results in the fields of offices, industry, medicine, and the scope of the household. Advances in the field of electronics have contributed significantly to meeting human needs for speed, accuracy and convenience in all aspects of work. At this time, ordering food menus is still done conventionally, using human services to request menu orders from buyers, which can be replaced using ordering tools that can be used directly from the buyer's table. So that the efficiency and effectiveness of services can be fulfilled to the maximum. The order menu from this buyer can be known by the staff in the kitchen to immediately prepare menus that have been ordered via a PC, for this reason the researcher designed a Menu Ordering Tool for Service at Cafés by utilizing microcontroller technology. This tool is designed at each table to order food menus that are displayed on the LCD screen, then the food menus that have been ordered can be sent to the computer at the cashier, and print the ordered food menus.

2. Research Methodology

2.1. Research Forms and Data Collection Techniques

Discussion of the overall system design of the tools that will be made in this study. The design includes system design and manufacture of tools or hardware. In this process several methods are needed to smooth the process, including;

- a) Literature method, namely by collecting materials for theoretical studies by collecting data based on references from books or relevant sources.
- b) Correlation method, namely by collecting information from people who are more experienced in the field of research being studied.

2.2. Theoretical basis

Cafe is a cozy place to hang out or chat with friends/friends/family while enjoying drinks and food that has been provided on the menu. A café is usually designed to be very attractive and instagramable so that guests feel at home for long there. To add to the attractiveness of young people, it is not uncommon for a café to provide entertainment such as live music on Saturday nights or certain special days to accompany visitors for casual conversation with music [1]. The NodeMCU WiFi module is firmware LUA-based interactive Espressif ESP8622 Wifi SoC [2].

NodeMCU ESP8266 is a platformIoT-based which is open source. Consists hardware in the form of System On Chip ESP8266. Currently NodeMCU has experienced 3 times upgrades. The devices we use is NodeMCU version 3 (V1.0) where have better abilities than previous version [3]. NodeMCU ESP 8266 is a module that consists of NodeMCU and ESP 8266 microcontroller. On this board, NodeMCU and ESP 8266 are directly placed in one place so we don't have to buy them separately or assemble them again, ESP8266 is designed so that Wi-Fi is directly integrated, so that ESP8266 does not require a Wi-Fi module [4]. NodeMCU ESP8266 is an integrated chip designed to connect microcontroller with internet via Wi-Fi. It offers a complete Wi-Fi network solution and independent, which allows it to be a host or as a Wi-Fi client. ESP8266 has powerful on-board processing and storage capabilities, which makes it possible to be integrated with sensors and other special device applications via GPIOs with easy development and minimal loading time. High level of integration allows to minimize the need for external circuitry, including front-end modules, designed to fill minimal PCB area [5].

The ESP8266 wireless module is cheap Wi-Fi module with support fully for TCP/IP usage. this module Produced by Espressif Chinese manufacturer. In 2014, AI-Thinker third-party manufacture of this module take out the ESP-01 module, this module use AT-Command for configuration. Low price, low power usage and dimensions small modules attract a lot of developers to participate in developing this module further Far. In October 2014, Espressif get out the software development kit (SDK) which allows more developer to develop this module [6]. NodeMCU can be analogous to the Arduino ESP8266 board. In the ESP8266 tutorial series, embeddednesia has discussed how programming the ESP8266 is a bit of a hassle because it requires several wiring techniques and an additional USB to serial module to download the program. But NodeMCU has packaged the ESP8266 into a compact board with various features such as a microcontroller + access capability to Wifi as well as a USB to serial communication chip. So to program it, you only need a USB data cable extension, exactly the one used as a data cable and Android smartphone charging cable [7]. NodeMCU is an electronic board based on the ESP8266 chip with capabilities running the function of the microcontroller and internet connection (WiFi). There are multiple I/O pins so can be developed into a monitoring or controlled application for IOT projects. NodeMCU The ESP8266 can be programmed with the Arduino compiler, using the Arduino IDE. Physical form of NodeMCU ESP 8266, there is a USB port (mini USB) so that it will make programming easier. NodeMCU ESP8266 is a development derivative module from the IoT (Internet of Things) platform module ESP8266 family type ESP-12. Functionally this module is almost similar to the Arduino module platform, but what distinguishes it is specifically for "Connected to the Internet". For now the NodeMCU module There are already 3 types of versions, but the one used in this study is NodeMCU 1.0 (unofficial board) [8].



Keypads are often used as an input on several microprocessor or microcontroller-based devices. Keypad is an important part of an electronic device that requires human interaction. The keypad functions as an interface between electronic devices (machines) and humans or known as HMI (Human Machine Interface). This 4×4 matrix keypad is an example of a keypad that can be used to communicate between humans and microcontrollers. The 4×4 matrix keypad has a simple and economical construction or arrangement in the use of the microcontroller port [9]. Keypad is one type of input device in a microprocessor- or micro-controller-based electronics project. Keypads are usually used to enter numbers or letters and the like on electronic equipment. The keypad contains a number of buttons where the arrangement of the keys can be arranged using a matrix (matrix keypad) and without a matrix. For a button arrangement without a matrix, it will require as many input output lines as the number of buttons used, while to connect a matrix keypad to a microcontroller, a number of input output lines are needed according to the number of matrices used on a keypad [10].

The 4×4 Matrix Keypad is the buttons consist of 4 rows and 4 columns that function as data input. The matrix keypad is also a device that acts as an interface between machines and humans. Row side of matrix keypad is also called by name row1, row2, row3, and then row 4 The sides of the column are called col1, col2, col3, and col4 [11]. The 4×4 matrix keypad has the or constructionsimple arrangement and economical in use microcontroller port. Configure the keypad with The arrangement of this matrix form aims to microcontroller port savings due to the number key (button) that is needed a lot on a system with microcontroller [12]. A keypad is basically push button switches arranged in a matrix. Several switches can be linked together to form a keypad chain. The most frequently used arrangement is 16 switches which form a 4x4 matrix keypad. In this keypad arrangement there are 4 columns (C1, ..., C4) and 4 rows (R1, ..., R4); one leg of the switch will be connected to one of the columns and the other leg will be connected to one of the rows. Columns and rows are connected to the microcontroller ports. If the switch is pressed, it will connect the row and column connected to it. Row reading is done by making all columns are at logic low. At this time the port connected to the column will function as output and the port connected to the row will function as input. Reading is done by scanning (reading) every row and column [13].

LCD is a tool that functions to display a size or number, so that it can be seen and known through the crystal screen display. Where the use of LCD in this temperature logger uses an LCD with 16x2 characters (2 lines of 16 characters). LCD 16x2 has 16 pin numbers, where each pin has a symbol and also its functions. This 16x2 LCD is operational on a +5V power supply, but can also operate on a +3V power supply [14]. Liquid Crystal Display is a medium that is used to display the results of the output on an electronic circuit. The features contained in this LCD are: 16 characters and 2 lines or so-called 16x2 LCD, has 192 characters, has a programmed character generator, usable through 4-bit and 8-bit modes, can be used as a back light [15]. LCD (Liquid Crystal Display) is an electronic circuit used to display information or indicators given to the microcontroller. LCD is shown in Figure 4. LCD has been used in various fields, for example in electronic devices such as televisions, calculators, or even computer screens. In posting the LCD application used is a dot matrix LCD with a character count of 2 x 16. The LCD functions as a viewer which will later be used to display the working status of the tool [16].

Electronic display is an electronic component that functions to display numbers, letters or other symbols. LCD (Liquid Crystal Display) is one of the most commonly used electronic displays. LCD is made with CMOS logic which works by not producing light but reflecting the light around it towards the front-lit or transmitting light from the back-lit. The number of characters that can be displayed by a LCD depending on the specifications owned [17].

3. Results and Discussions

3.1. Block Diagram

In this research, it is made in stages, namely making block by block to facilitate the analysis of each part, as well as the whole system. The system design is divided into two parts, namely hardware planning and software planning. Block diagrams and general working principles are shown in Figure 1:

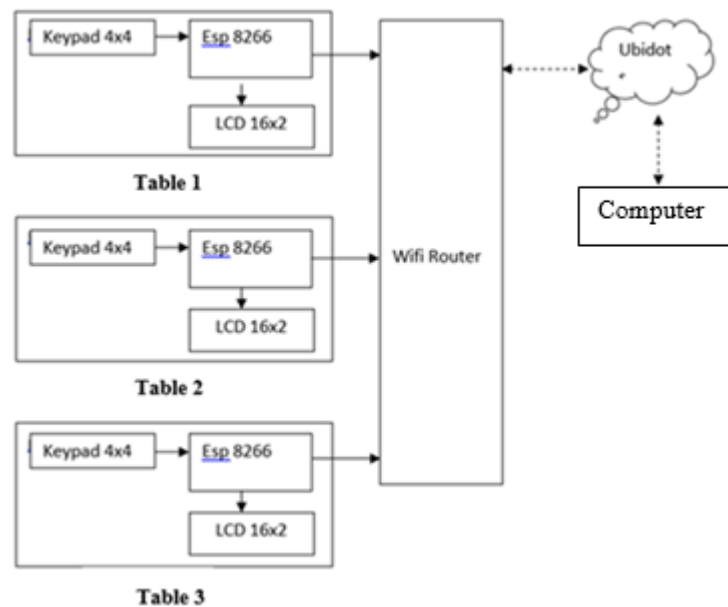


Figure 1. Overall Tool Block Diagram

The ordering process begins with the consumer entering the menu code to be ordered via the keypad displayed on the LCD. After the consumer presses the ENTER button on the keypad. The data is then sent to Ubidots as an IoT platform via a wifi router. Then the data will be displayed in a web browser on the computer. The computer displays the ordered menu and then calculates the total price that must be paid by the consumer. The total payment will then be printed out as a note for the buyer.

3.2. Keypad Design

In the keypad design here using a 4x4 keypad is used as input which functions to type food and drinks as desired. For keypad design, the relationship between the keypad pins and ESP 8266 is as shown in table 1.

Table 1. Keypad Configuration

ESP 8266	Keypad
D0	R1
D5	R2
D6	R3
D7	R4
D8	C1
D4	C2
D3	C3
Rx	C4

The circuit connection between the ESP 8266 and Keypad is as shown in Figure 2.

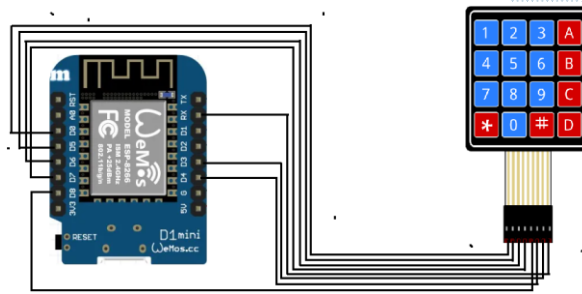


Figure 2. Keypad Design

3.3. LCD Design

The LCD (Liquid Crystal Display) component used in the design of this system is an I2C LCD with a size of 20X4. This LCD consists of 4 lines with 20 characters each line. In this system, the LCD is used as a monitor for reading sensor results. The relationship between the LCD pin and the ESP 8266 pin is shown in table 2.

Table 2. LCD Pin Configuration

ESP 8266	LCD
D1	SCL
D2	SDA

Meanwhile, the pin connection between the ESP 8266 and the LCD is shown in Figure 3.

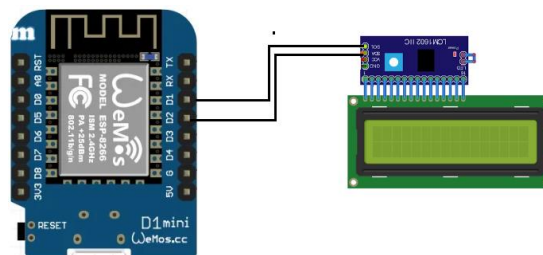


Figure 3. LCD Design

3.4. Buzzer Design WEB Server

The flowchart design for the WEB server is shown in Figure 4

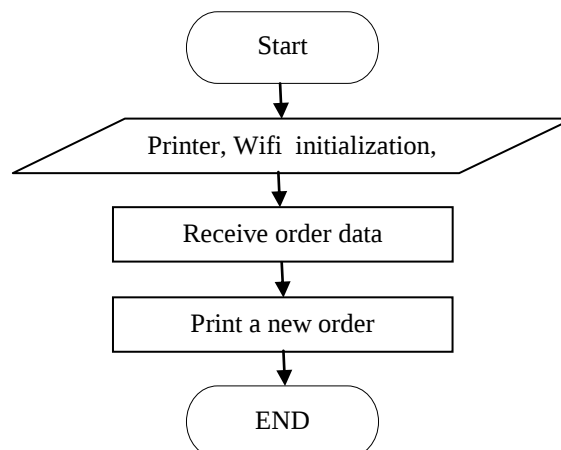


Figure 4. WEB Server Flowcharts

3.5. Customer

The flowchart design for customers is shown in Figure 5.

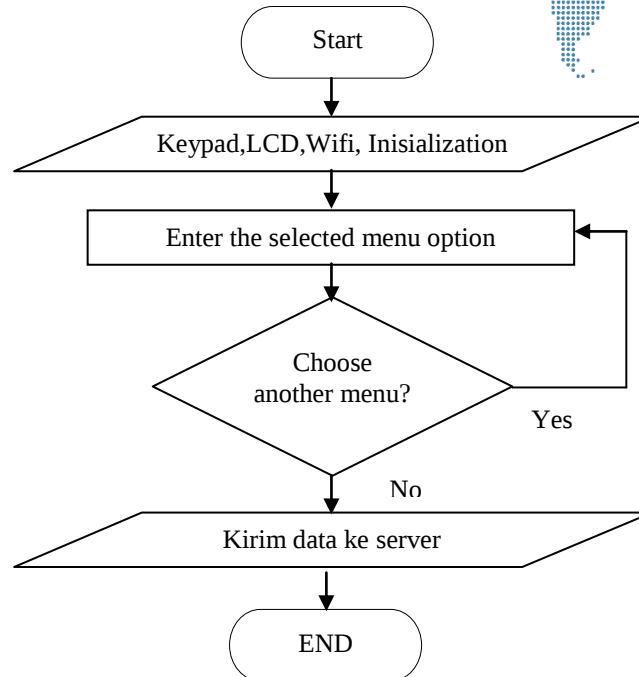


Figure 5. Customer Flowcharts

3.6. Database Testing on ESP8266

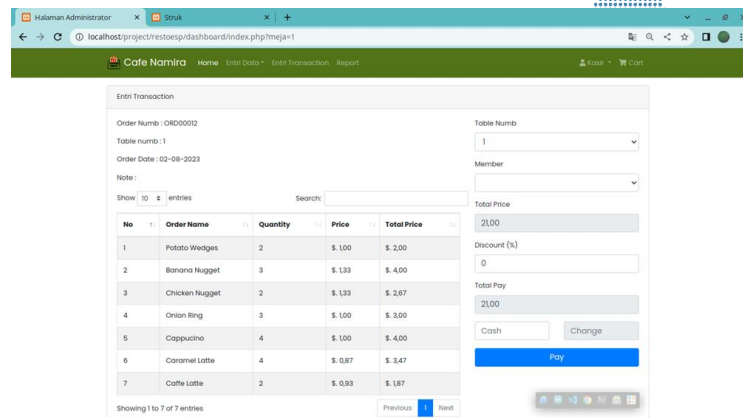
The program used is using the C++ language. The process of making the main program must be planned by taking into account the characteristics of the supporting hardware. Figure 6 below is a display of the main program menu displayed by the LCD.



Figure 6. Main Program Menu Display Visible on LCD

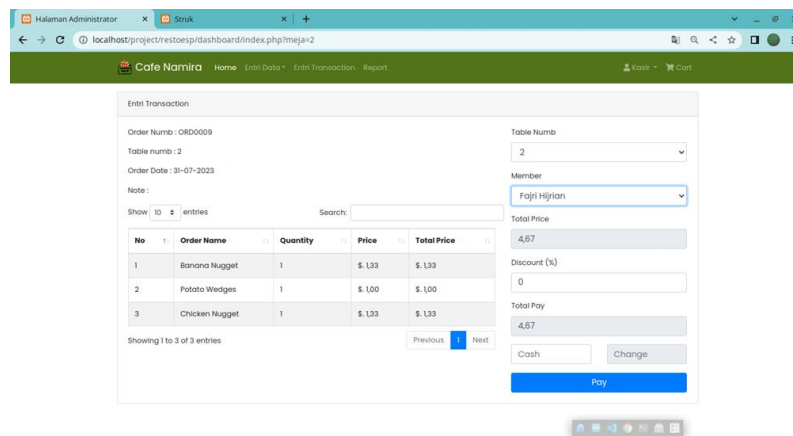
3.7. Database Testing on PC

The database that we will analyze below is based on WEB. The system from this database only processes calls. So the data that has been loaded before will be called using the code as index. For storing menu data, facilities from the Apache server are used, namely Xampp, which contains MySQL storage. The appearance of the existing database on the computer is shown in Figures 7, 8 and 9.



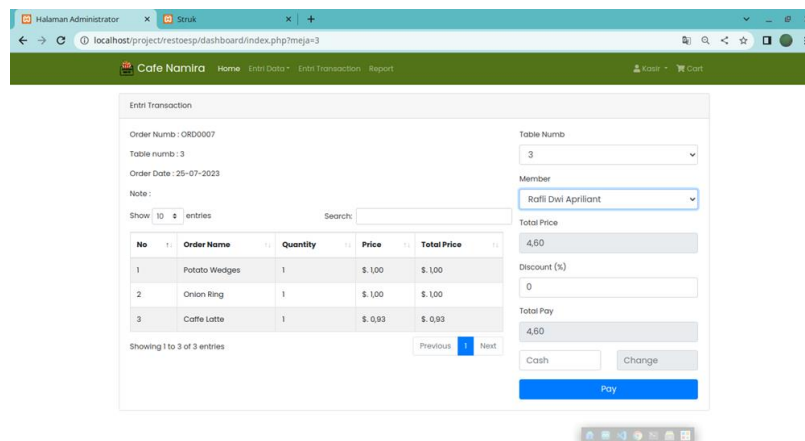
No	Order Name	Quantity	Price	Total Price
1	Potato Wedges	2	\$ 1,00	\$ 2,00
2	Banana Nugget	3	\$ 1,33	\$ 4,00
3	Chicken Nugget	2	\$ 1,33	\$ 2,67
4	Onion Ring	3	\$ 1,00	\$ 3,00
5	Cappuccino	4	\$ 1,00	\$ 4,00
6	Caramel Latte	4	\$ 0,87	\$ 3,47
7	Coffee Latte	2	\$ 0,93	\$ 1,87

Figure 7. Display of the Database form on the PC in Table 1



No	Order Name	Quantity	Price	Total Price
1	Banana Nugget	1	\$ 1,33	\$ 1,33
2	Potato Wedges	1	\$ 1,00	\$ 1,00
3	Chicken Nugget	1	\$ 1,33	\$ 1,33

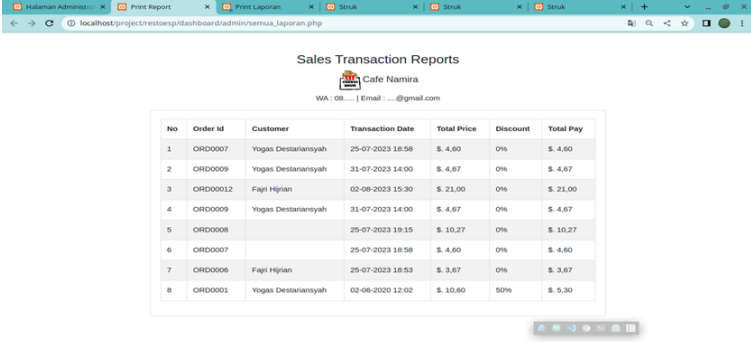
Figure 8. Display of the Database form on the PC in Table 2



No	Order Name	Quantity	Price	Total Price
1	Potato Wedges	1	\$ 1,00	\$ 1,00
2	Onion Ring	1	\$ 1,00	\$ 1,00
3	Coffee Latte	1	\$ 0,93	\$ 0,93

Figure 9. Display of the Database form on the PC in Table 3

In Figure 10. is a daily report of transactions that consumers ordered. The initial step is to click the report menu, all transaction data that consumers have made will appear. There is an all reports button. And for each item in the transaction there is a print button for the receipt.



No	Order Id	Customer	Transaction Date	Total Price	Discount	Total Pay
1	ORD0007	Yogas Destianisyah	25-07-2023 18:58	\$ 4,60	0%	\$ 4,60
2	ORD0009	Yogas Destianisyah	31-07-2023 14:00	\$ 4,67	0%	\$ 4,67
3	ORD0012	Fajri Hijnan	02-08-2023 15:30	\$ 21,00	0%	\$ 21,00
4	ORD0009	Yogas Destianisyah	31-07-2023 14:00	\$ 4,67	0%	\$ 4,67
5	ORD0008		25-07-2023 19:15	\$ 10,27	0%	\$ 10,27
6	ORD0007		25-07-2023 18:58	\$ 4,60	0%	\$ 4,60
7	ORD0006	Fajri Hijnan	25-07-2023 18:53	\$ 3,67	0%	\$ 3,67
8	ORD0001	Yogas Destianisyah	02-06-2020 12:02	\$ 10,80	50%	\$ 5,30

Figure 10. Transaction Database on PC

Figure 11. shows a printed note of payment that is ready to be billed to consumers.



Cafe Namira			
Date : 25-07-2023 06:58		Member : Nothing	
ORDER Numb : ORD0007			
Potato	1	\$ 1,00	\$ 1,67
Wedges			
Onion Ring	1	\$ 1,00	\$ 2,33
Caffe Late	1	\$ 0,93	\$ 0,60
Total Price		\$ 4,60	
Discount		0%	
Total		\$ 4,60	
Cash		\$ 4,67	
Change		\$ 0,07	
Thank You For Your Visit			

Figure 11. A printed Note of Payment

4. Conclusion

After designing and testing the tool, in the keypad test, when the keypad input is pressed, the output on the LCD displays the correct number. So that in testing this series of keypads the circuit is functioning properly and correctly. In testing the LCD when the keypad input is pressed, the output on the LCD displays the correct number. So that in testing this series of keypads the circuit is functioning properly and correctly. The test results of the ESP 8266 are in accordance with the design, the output can change logic 0 and logic 1. In this test it is found that the ESP 8266 circuit can work according to the program input. On Database Testing On the ESP8266, it has displayed text from the main program menu which is displayed on the LCD. In Database Testing on the PC, the calling process is carried out by clicking on the table number option, namely table 1, table 2 or table 3. The display on the PC monitor will display all consumer orders according to the table choices the chef/cashier chooses. For daily reports of transactions that consumers have ordered, obtained by clicking on the report menu, all transaction data that consumers have made will appear. For each item in the transaction there is a print button for the receipt. Used to request billing costs for orders for consumers. The 8266 series is used as a connecting medium between modules such as keypads and LCDs. The 8266 circuit is also used as a controller, because this is where the program is downloaded to manage all processes both on the circuit itself and on the PC.

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