Design and Construction of a Modified SMS-Based Electronic Notice Board

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Abstract. This research aims to design and construct an electronic notice as an alternative to the traditional signpost parting on walls and billboards by providing practical, reliable and proper information dissemination. They consist of the following units, the power supply, voltage regulators, GSM modules, microcontroller, LED dot matrix display board, counter and subscriber identity module (SIM). The power supply comprises a 240/9 v ac 50 Hz step-down transformer rectifier filter and voltage regulations. AT89852, a low-power, high-performance CM05 8-bit microcontroller with 8 k bytes in-system programmable flash memory, is used in this design. A constant five v de is required to power microcontrollers and their associated input/output channel. GSM Modern is a wireless device that works with a GSM wireless network. The counter circuit of the device used to achieve this type of counting is the 5-stage Johnson decade counter. It is a typical chip in the 74HC555, with ten decoded outputs that go high one at a time. The assembler used for this research is MLAB version 5.7, downloaded from the microchip website. This window-based integrated development environment (IDE) software supports the PIC and other microcontrollers. The project constitutes both the software and hardware section for successful implementation. Operation more focus was given to the contribution of the system hardware. For verification of proper functionality of the message board, variation tests carry out and their results. Each component was carefully tested, and hardware troubleshooting and software debugging were carried out. The message was sent, and it appeared and started moving from left to right.

In conclusion, by introducing the concept of wireless technology in communication, we can make our communication more efficient and faster with excellent efficiency, and the message can be displayed with less error and maintenance. This model can be used efficiently in establishments like colleges where in-order and special discounts can be displayed simultaneously at all branches. It is therefore recommended as a conventional model can say more than one message at a time LEDS have a limitation on size and a good number of characteristics. These can be replaced with large LED display boards, which not only catch bulb display attributes in a moving position one after another.

Keywords: Design; Construction; Power; Supply; Software.

INTRODUCTION

A notice board is essential in any institution, organization or public places such as bus stops, railway stations or parks. But its application in changing the information on it is tedious [1]. The modern digital electronic display board is becoming worldly acceptance recent, and its application in different areas of life, including educational institutions, public utility places and advertisement, due to the problem associated with the former methods of promotions such as the signpost and other forms, which makes the environment untidy [2]. Using the embedded system in communication has given rise to many exciting applications that ensure comfort and safety to human life [3]. Global System for Mobile Communication (GSM) has been recognized worldwide and accessed in more than 212 countries and territories. Global System for Mobile Communication (GSM) is optimized for duplex voice telephony. It is developed for the replacement of first-generation (2G) technology and third-generation (3G) technology [4].

The design and construction of a moving message display based on the microcontroller. A 9V dc supply is used to power the system and displays a steady scroll message that has been burned into the program, which cannot be modified at any time - the design and construction of a microcontroller-based scroll display [5].

The system uses hardware designed to interface between a 5x7 TFT matrix and the microcontroller with two cascaded counters, which can display only one character at any given time [6]. Design and construction of a moving message display utilizing discrete components; the system display unit employs LEDs; the circuit was set up so that each letter or character was set apart from the others, and decade counters were used to drive each letter, lighting the LED to display the note and subsequently a word [7].

Design and implementation of a moving message display based on a microcontroller. Given how information is currently being disseminated on campus, it is common for important notices to take some time to appear on notice boards [8, 9]. Most of the time, this latency is unnecessary and should be avoided. The currently used electronic displays are programmable and require regular reprogramming [10]. As a result, it takes work to relay information quickly, lessening the display boards' value. The display board programs itself with the aid of the incoming SMS with the required validation, making it wireless. A mechanism like that helps with timely distribution [11].

MATERIALS AND METHOD

Due to its modest size and tendency to take up less precious real estate in a building or on the street, the streamlined scroll display mode was selected for this project. Its distinctive form requires less power during installation, which results in significant energy savings. In addition, the programmable interface controller (PIC) is crucial to this project's ability to govern its entire operations. The instruction for showing a character in the display unit is one of these processes. The processing unit in the PIC will receive input from the GSM phone mobiles and process it by the program's specifications. The instruction program will decide the order of operations. The output will then be sent to the display unit through the GSM SIM module after being processed by the processor [12, 13].

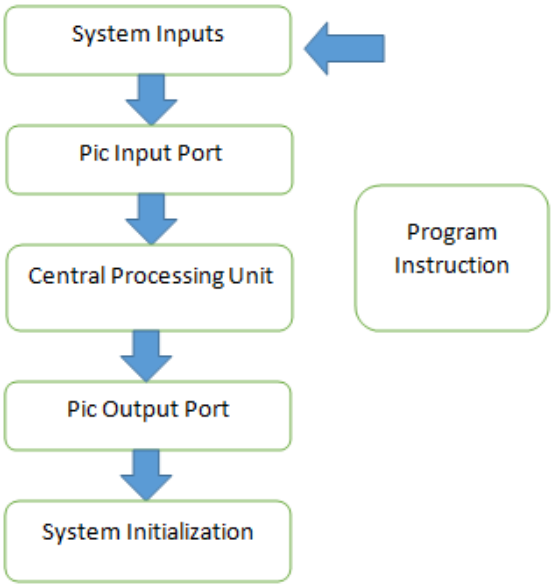

Figure 1 – PIC Process Diagram

Crucial Requirements of the Project are: 1) Power supply; 2) Voltage regulators; 3) GSM Module; 4) Microcontroller; 5) LED dot matrix display; 6) Counter; 7) Subscriber identity module (SIM). These are carefully depicted by block and central circuit diagram.

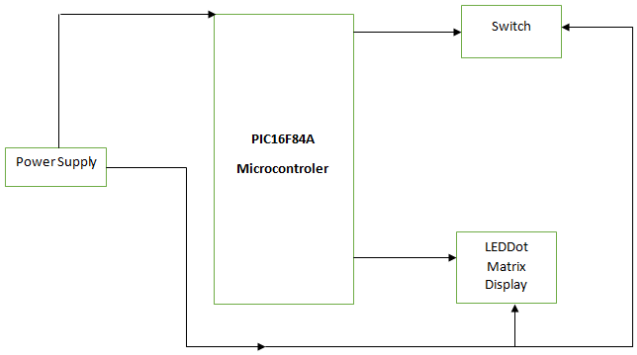

Figure 2 – System Block Design

The supply power unit consists of a 240/9V Ac 50 Hz down transformer, rectifiers, filters and voltages regulators, as shown below.

A constant 5 V dc is required to power the microcontroller and associated input/output channel. A regulator circuit is added to the DC output to keep the DC supply output. A regulator keeps the output constant even if there is a load, current, input voltage or temperature change. Maintaining the output DC voltage constant is called "Regulation."

For the design project, an IC regulator is used. The 7805 takes a maximum of 30 V at its input,

and safety delivers regulated or non-fluctuating 5 V at its output terminal. It has three terminals.

The microcontroller and its accompanying input/output channel need a steady supply of 5 V dc. A regulator circuit is added to the DC output of the DC supply to maintain stability. A regulator maintains a consistent result even when the load, current, input voltage, or temperature fluctuates. "Regulation" is the process of keeping the output DC voltage constant.

An IC regulator is employed for the design project. This device, known as the 7805, can accept up to 30 V as input and safely outputs 5 V that is regulated or stable. Three terminals are on it [14].

The microcontroller is the brain of the project design because it manages the activities of every other component. A microcontroller is a miniature computer on a single integrated circuit with a CPU core, memory, and programmable input/output peripheral [15]. The AT89s52 microcontroller is the one utilized in this design.

The AT89s50 is an 8-bit CMOS microcontroller with low power consumption and high performance with 8K bytes of internal programmable flash memory. The product is made with high-density memory technology from Atmel and has a pinout and an instruction set that comply with 8051 industry standards. Thanks to the on-chip Flash, the program memory can be updated in-system or using a traditional memory programmer. The Atmel At89s52, a monolithic device with an adaptable 8-bit CPU and in-system programmable flash, is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

The project requires a PIC controller with more than 16 input and output ports to accommodate: 1) Two input ports for the crystal oscillator; 2) Screen output ports for the display; 3) Two output ports for the counter; 4) To input ports for the GSM module; 5) Controls enable input port; 6) Controls enable output port. Besides all these, the controller must be programmable.

Therefore, the suitable microcontroller with the required characteristics is the PIC16F84A. It consists of storage memory, 16 input/output ports and a wide operating voltage of 2.0 to 5.5 V with a sink and source current of 25 mA, respectively. The data sheet will be incorporated in the appendix in due course. Below is the pin function of the microcontroller:

1) The pin of the PIC16F84A microcontroller has the following connotation.

2) Pin n0.1 RA2 second pin on port A has no additional function.

3) Pin n0.2 RA# third in on port A has no other function.

4) Pin n0.3 RA4 fourth pin on port A tO CLK1, which functions as a timer, is also found on this pin.

5) Pin n0.4 MCLR reset input and Vpp programming voltage of a microcontroller.

6) Pin n0.5 Vss ground of power supply.

7) Pin n0.6 RB0 zero pin on port B interrupt input is an additional function.

8) Pin n0.7 RB1 first pin on port B. no additional function.

9) Pin n0.8 RB2 second pin on port B no additional function.

10) Pin n0.9 RB3 third pin on port B no additional function.

11) Pin n0.10 RB4 fourth pin on port B no other function.

12) Pin n0.11 RB5 fifth pin on port B no other function.

13) Pin n0.12 RB6 sixth pin on port B ‘Clock’ line in program mode.

14) Pin n0.13 RB7 seventh pin on port B ‘Data’ line program mode

15) Pin n0.14 Vdd positive power supply.

16) Pin n0.15 OSC2 pin assigned for connecting with an oscillator.

17) Pin n0.16 OSC1 pin assigned for connecting with an oscillator.

18) Pin n0. 17 RA2 second pin on port A no additional function.

19) Pin n0. 18 RA1 pin on port A no additional function.

This is an array of LEDs arranged in a dot matrix (display device used to display information) technique with a dimension of 32x16 LEDs, i.e. thirty-two columns and sixteen rows to show 16 in the matrices, which make up the display section. But for a single character, a 5x7 LED matrix is used. They make up seven characters in the

display, as stated earlier a 5x7 dot matrix arrangement.

This circuit chooses one LED at a time from a column of LEDs. The 5-stage Johnson decade counter is used to perform this type of counting. The 74HC555 is an example of a typical chip with ten decoded outputs that go high one at a time. The number of output states is increased by cascading multiple 74CH555s because a single 74CH555 can only count from 0 to 9, and a count of 0 to 34 is needed to control the 35 columns of the 5x7 LED matrix display. Each 74CH555, in this instance, needs to share a standard clock line. The enabling pin, the 10th output of the 74CH555, and the clock's logic state are all coupled to the 10th counter output. When both reasoning states are high, it gives a result which prompts the counter to advance to both logic states are high. It provides a work which produces the counter to the advance to the next.

The GSM modem SIM800 is a complete quad-band GSM/GPRS solution in a GSM module which can be embedded in the customer's applications.

A GSM modem is a wireless gadget that connects to a GSM network. Similar like a dial-up modem, a wireless modem operates. Or a GSM cell phone, which needs a SIM card from a network operator to function.

Computers manage modems via commands. Both GSM and dial-up modems support a similar set of common standard orders. Just like a dial-up modem, a GSM modem can be utilized. GSM modems support an expanded set of AT commands and common AT commands. The GSM specifications define these enhanced AT commands. The extended AT commands allow for a variety of tasks: 1) Sending SMS message; 2) Monitor the signal strength; 3) Monitor the charging status and charge level of the battery; 4) Read writing and searching phone book entries; 5) Read the report and delete the SMS message.

MPLAB version 5.7 assembler, downloaded from the Microchip website, was used for this project. This integrated development environment (IDE) software that runs on Windows supports the PIC and other microcontrollers.

A project manager, a fully equipped editor, three working modes (editor, emulator, and simulator), a customized toolbar and critical mapping, and a Straus bar with project information are all included in this program.

You can edit your source files in MPLAB (either in assembly or 'C'). Additional attributes include debugging using: source file; absolute listing file.

The hex files were written into the PIC using this. This programming tool can be used to write programs for the PIC16F series, erase EEPROMs, and check already registered programs for problems.

The complete hardware mentioned above setup was dependent on PIC16F84A software. Running messages can be displayed on the 5x7 video screen. The words can still be read even though the "window" only displays seven letters simultaneously.

Data is put into 35 Ghost locations (11–33 h) for the Running Sign Routine, and this data is presented on the screen. The table's contents are loaded into the Ghost section one byte at a time. The 35 places are then output to the net via a procedure. The data I'm ghost is then shifted one place to the left, and a new byte is loaded into the 35th location (33 h). This gives the effect of a message scrolling across the screen from right to left. The program looks for "FF" and repeats the message.

The circuit functions like this: when any text is sent from a mobile, it is sent to the counter where it was displayed on the display unit (LED). The ULN2803 serves as a driver, which drives the message from right to left on the display unit. This will continue displaying and moving unless it is reset or put off.

The components for the implementation projects, as shown in the complete circuit diagram of Appendix 1, were tested using a multimeter before being assembled on the reader board, where they passed the tests with flying colours. Finally, the components were soldered onto the Vero board, which was verified to be functional.

When a text message is transmitted from a mobile device, the circuit sends it to the counter, displayed on the display unit (LED). The message is driven on the display unit from right to left by the ULN2803, which acts as a driver. This keeps moving and displaying until it is turned off or reset [16].

$$Error\% = \frac{\begin{matrix}\text{design time for the message}\\ \text{to reappear on display}\end{matrix}}{\begin{matrix}time\ for\ the\ message\\ to\ reappear\ on\ display\end{matrix}} \times 100 \quad (1)$$

RESULTS AND DISCUSSION

This work constitutes both hardware and software sections for successful; operation. More focus was given to the construction of the system hardware. The software is used to program the microcontroller to achieve logical decisions and control the scroll display operations. Besides, this software was used to monitor the system's operation as it is programmed. The circuit was built exactly the way it is in the circuit diagram.

Various tests were carried out, and their results verified the proper functionality of the message board. Each component was carefully tested, and hardware troubleshooting and software debugging were carried out. When the word is typed from the GSM mobile, it appears on the display. The message starts moving from right to left. A stopwatch was used to measure the time disappeared and appeared.

The result obtained to determine the accuracy of the moving message is tabulated below.

Table 1 – Table of Results

No	SS Sent	Result displayed
1	Hello	The message was displayed correctly.
2	There will be a school board meeting today: 20/10/2022, by 10 am	The message was displayed correctly
3	PHY4302 Class is going to hold on Monday, 23/10/2022 9:00 am	The message was displayed correctly
4	Each student should submit his/her registration form before 13/10/2022	The message was displayed correctly
5	GSM Electronic Notice Board	The message was displayed correctly.
6	PHY4331 Test is coming up on Saturday, 2nd October 2022	The message was displayed correctly

Tabulated in Table 2 are the measured voltages ad currents for the electronic circuit and the 4.5 VA transformer power supply section of the project.

Table 2 –Power Supply Test Results

Input		Output	
Voltage, V	Current, A	Voltage, V	Current S, mA
226 ac	2.19	8.8 dc	39.32

Below is the Table 3 for the timing for the message's response to re-appear according to the program and that of the project.

Table 3 – Delay Time Results

No	Displayed time for message re-appear at display (sec)	Time Messages Re-Appear on display, secs	%Error
1	1	0.94	6
2	1	0.92	8
3	1	0.91	9
4	1	0.93	7
5	1	0.95	5

From the result acquired above, it was seen that there was some divergence between the time planned for the moving message to re-appear and the observed time that the message reappears in the constructed moving message. Thus, the project is roughly 93 accurate; the variance may be attributed to losses while data travels from the main control to the display unit.

The prototype of the SMS-based display toolkit was efficiently designed. This prototype has facilitated integration with a display board, making it mobile. The toolkit accepts the SMS, which then stores it, verifies it, and displays it in the LED module. Each time an SMS is read, it is removed from the SIM, making a place for the following SMS. The major constraint incorporated is the display of one SMS at a time. This limitation can be removed by using bigger LEDs and extended RAM. The prototype can be implemented using commercial display boards. In this case, it can solve the problem of instant information on campus.

CONCLUSIONS

We can improve communication by introducing the idea of wireless technology. We can show the messages with fewer mistakes and upkeep requirements with better efficiency. This model can be used effectively in places like colleges, where the order and special discounts can be displayed at all branches simultaneously. It can be installed at public transportation hubs like airports, bus terminals, and train stations. It can also be used on the side of the road for emergencies and traffic control. The latency of using papers to display notices is avoided, and an authorized person can update the information.

Conflict of interest

The author declares no conflicting interest.

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