



DEVELOPING A TEACHING MEDIA OF MICROCONTROLLER 8051 IN DISPLAYING CGRAM CHARACTER ON LCD BY USING THE MCU 8051 IDE AND ASM51 IN SUPPORTING ALFHE

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ABSTRACT

On this occasion, the author developed an instructional media of active learning teaching of microcontroller 8051 in displaying Character of Generator Random Access Memory (CGRAM) on Liquid Crystal Display (LCD). This simulator simulated of how the program in generating special character, also widely called as customized character, like symbol, smiley, and etc. that had not been provided by the LCD manufacturer on Character Generator Read Only Memory (CGROM) and eventually displaying the CGRAM character on LCD as the normal character of CGROM. This program of simulator was developed in Micro Controller Unit (MCU) 8051 Integrated Development Environment (IDE) widely known as MCU 8051 IDE and Assembly-51 (ASM51).

Keywords: micro controller, MCU8051 IDE, ASM51, simulator, active learning, teaching, media, CGRAM, LCD, CGROM, controller, screen.

1. INTRODUCTION

Based on the author's experience in teaching at college, the authors see the need for a changing in teaching methodologies (Instructional Strategy of teaching) in order to increase the success rate of teaching and learning process; transforming conventional learning methodologies (teacher as central or learning resources) to the active teaching methodologies or Active Learning Methodology (students as a learning centre). The application of active learning strategy has demonstrated some significant efficacies compared to the conventional learning [1] [2]. Active learning strategy has been shown to increase the participation and student engagement (reduction in stress level of the students and teachers) in the classroom and increasing students' learning aspiration and eventually produce more innovative students; students are given more freedom to try new things come up in their mind by using innovative and interactive teaching media. They can use the simulator before starting developing or manufacturing real equipment; the implication is the decrease of the production costs. One of the strategies in the application of active learning is the use of instructional media in the process of teaching and learning, especially the using of computer simulation as the media of teaching. At this time there are various microcontroller simulator 8051 learning that can be downloaded for free and can then be used as a media of learning in the application of active learning[3][4]. The author used the simulator MCU 8051 IDE and ASM-51 to develop the simulator. Issue or problem of how to display CGRAM character on the LCD screen has been accidentally read by the author occasionally when browsing the Internet and while reading a few posts on discussion groups of microcontroller and robotics enthusiasts. Writers saw some readers tried to help by providing some answers and examples of the program, but not so many of them have given a satisfactory answer to them. This problem background and

the need for the media of microprocessor teaching in the classroom when teaching, and in supporting the ALFHE implementation worldwide have encouraged and drove author to develop a simulator to generate the CGRAM character and displaying it on the LCD screen. LCD module consists of two main devices, the controller and LCD. The controller is a kind of microcontroller that has its own instruction set and two kinds of memory, Display Data RAM (DDRAM), and CGROM. CGRAM actually is part of and located in CGROM with addresses of 00h-07h; only 8 special characters can be generated and saved there each will take one location. Each character has a size of 5X8.

2. RELATED WORK

Using media of active learning teaching developed both by using computer program in the form of simulator and non-computer related media have been done by some researchers and scholars. Some of them have published their works in this field as follow; in this paper [5] the author reported the designing of decoder to display the result of the digital voltage level on a seven segment display in the form of character "H" and "L". The author proposed the using of his design to be implemented in active learning class especially in electronic digital laboratory. In paper [7] the authors develop an active learning simulator using both MCU8051 IDE and SDCC. In this paper they report that the simulator will display the level voltage of a pin of an 8051 port on a virtual seven segment display and propose to use it as a media of teaching especially in the classes that have adopted active learning strategies. In this paper[8] the authors reported the development of a simulator program that simulate the process of multiple interrupts runs on a 8051 microcontroller by using MCU8051 IDE and ASEM 51.



3. PROPOSED SYSTEM

In this paper the author proposed the development of an active learning media of teaching microcontroller 8051 in the form of simulator in displaying some special character/customized character on LCD. The developed simulator can be used in an active learning class or a laboratory. The simulator program was developed by using free to download programs MCU8051 and ASM-51 from Internet and can be run on various operating systems (OSs). This simulator will answer some people questions in the Internet of how to generate customized character or CGRAM character and display them on the LCD and also enable the learning participants in an active learning class to run the learning process conveniently. This simulator also will display the running program on a Graphical User Interface (GUI) and some virtual hardware as shown on Figure-1, Figure-4 below.

4. SIMULATION

A simulation has been done and the result of it has been captured as shown on the Figure-1, Figure-4. Figure-1 below shows the result of a print screen of the GUI (Graphical User Interface) of the simulator prior compiling the program.

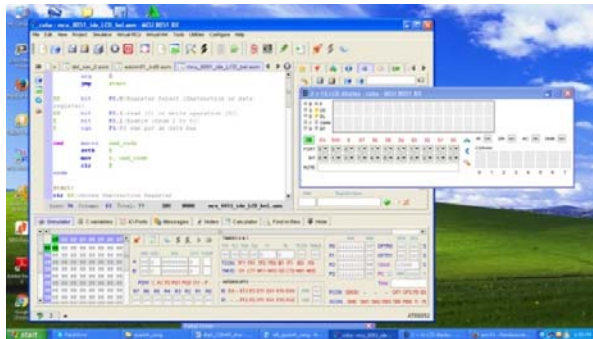


Figure-1. Print screen of GUI Prior compiling the program [3] [4].

Figure-2, below show the GUI after compiling the program by clicking the compiling tab (the rocket picture). You can see the changing of the play tab colour; become bold.

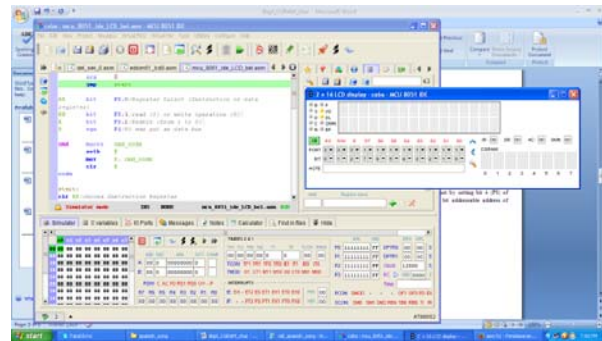


Figure-2. Print screen of GUI after compiling the program [3] [4].

In Figure-3 you can see the GUI picture with the three special function characters of CGRAM displayed on CGRAM addresses (00h-02h). As mentioned before that CGRAM located in CGROM with address location of 00h-07h.

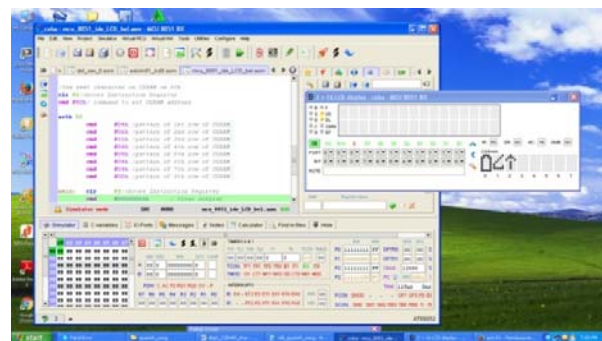


Figure-3. Print screen of GUI shows the program generating three special characters of CGRAM prior displaying them on the LCD [3][4].

In Figure-4, you can see those three special characters of CGRAM displayed on LCD.

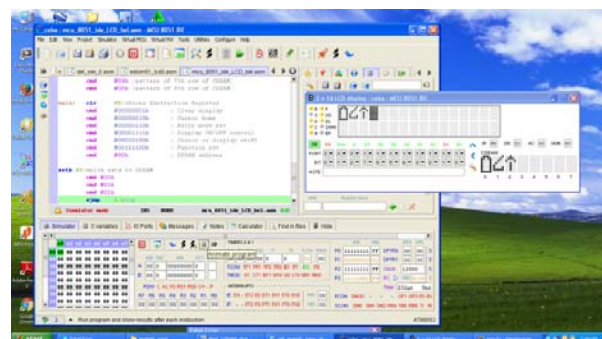


Figure-4. Print screen of GUI shows the program displaying the special character of CGRAM on LCD [3] [4].

4.1 The complete program of simulator

The flow chart and the full program of the simulator are shown below:

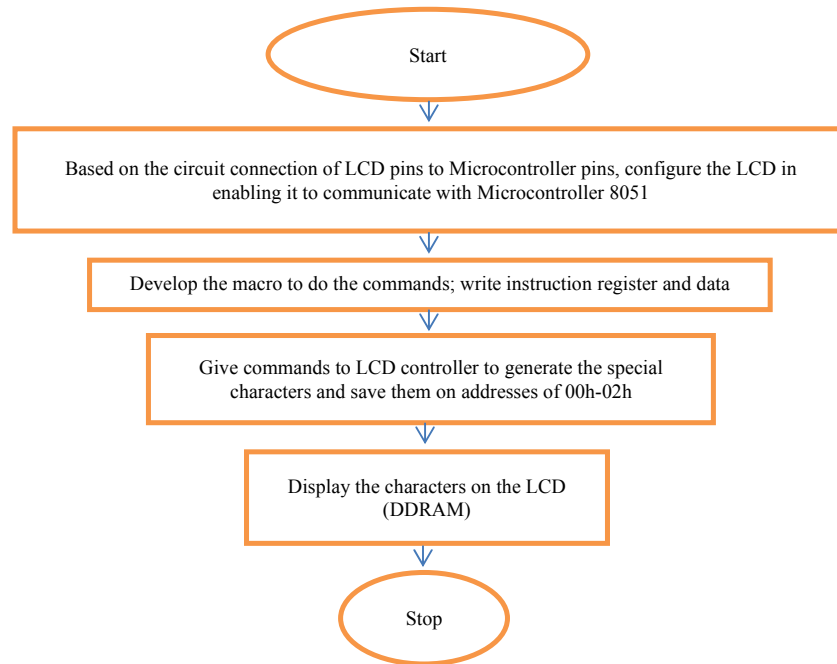


Figure-5. The flowchart program of the simulator.

The complete program of the simulator is shown below[7].

```

org      0
jmp      start

RS       bit    P3.0    ; Register Select (Instruction
                        ; or data register)
RW       bit    P3.1    ; read (1) or write operation (0)
E        bit    P3.2    ; Enable (from 1 to 0)
D        equ    P1      ; P1 was put as data bus

cmd      macro    cmd_code
setb     E
mov      D, cmd_code
clr      E
endm

start:
clr RS           ; choose Instruction Register
clr RW           ; write operation
cmd #40h         ; command to set CGRAM address
setb RS         ; choose data register
cmd  #0eh        ; pattern of 1st row of CGRAM
cmd  #01bh       ; pattern of 2nd row of CGRAM
cmd  #011h       ; pattern of 3rd row of CGRAM
cmd  #011h       ; pattern of 4th row of CGRAM
cmd  #011h       ; pattern of 5th row of CGRAM
cmd  #011h       ; pattern of 6th row of CGRAM
cmd  #011h       ; pattern of 7th row of CGRAM
cmd  #01fh       ; pattern of 8th row of CGRAM

;the next character on CGRAM on 48h
clr RS           ; choose Instruction Register
cmd #48h         ; command to set CGRAM address
setb RS
cmd  #01h        ; pattern of 1st row of CGRAM
cmd  #02h        ; pattern of 2nd row of CGRAM
cmd  #04h        ; pattern of 3rd row of CGRAM
cmd  #08h        ; pattern of 4th row of CGRAM
cmd  #010h       ; pattern of 5th row of CGRAM
cmd  #011h       ; pattern of 6th row of CGRAM
cmd  #01fh       ; pattern of 7th row of CGRAM
cmd  #00h        ; pattern of 8th row of CGRAM

;the next character on CGRAM on 50h
clr RS           ; choose Instruction Register
cmd #50h         ; command to set CGRAM address
setb RS
cmd  #04h        ; pattern of 1st row of CGRAM
cmd  #0eh        ; pattern of 2nd row of CGRAM
cmd  #11h        ; pattern of 3rd row of CGRAM
cmd  #04h        ; pattern of 4th row of CGRAM
cmd  #04h        ; pattern of 5th row of CGRAM
cmd  #04h        ; pattern of 6th row of CGRAM
cmd  #04h        ; pattern of 7th row of CGRAM
cmd  #00h        ; pattern of 8th row of CGRAM

main:  clr RS           ; choose Instruction
                        ; Register
cmd    #00000001b      ; clear display
cmd    #00000010b      ; cursor home
cmd    #00000110b      ; entry mode set
cmd    #00001111b      ; display
                        ; ON/OFF control
cmd    #00010100b      ; cursor
  
```



```

; or display shift
cmd #00111100b ; Function set
cmd #80h ; DDRAM address

setb RS ; write data to DDRAM
cmd #00h
cmd #01h
cmd #02h
sjmp $ ; stop

end

```

5. CONCLUSIONS

From the results of the simulation and its implementation in the class a few thing can be observed,

- MCU 8051 IDE can be used as an alternative media of teaching of Microcontroller in ALFHE class.
- The ASM-51 language can be used to build up the simulation program.
- The program runs according to the plan, and is stable
- The learning participants can immediately modify the program according to the needs or ideas that come up in each student group of study [7] [8].
- CGRAM character is also known as customized character is character that was not prepared by the LCD manufacturer.
- CGRAM addresses are memory spaces located in CGROM with addresses of 00h-07h.
- CGRAM locations in CGROM are empty location; blanked intentionally.
- One needs to give command to LCD controller to generate the characters needed on CGRAM addresses
- The character size is 5 X 8 (5 column X 8 rows)
- Give command to displayed the generated characters on LCD (DDRAM)

6. CLOSING

This article is expected to contribute to science, particularly in the areas of microprocessor, computer, robotics, microcontroller or computer based control system engineering. And the simulator can be used as a media of learning and teaching in an active learning mode in higher education that will facilitate the teaching and learning participant to master the subjects more conveniently especially in topic associated with interfacing, displaying CGROM character and special characters (CGRAM character) of LCD. The author also hopes it will increase the participation and engagement of the students in the learning process, allowing the teacher to apply their teaching strategies more conveniently and successfully in overcoming the lack of funds to meet the needs for equipment or devices in supporting active learning [6]. The simulation program has also been successful in reducing errors in developing or manufacturing the real equipment (reducing costs) [7][8]. The author also hopes that this simulator will

contribute to the development of science, particularly in the fields of microprocessor, microcontroller, computer science, telecommunication, robotics, and computer-based control system and engineering and can also be used in higher education as a media of teaching in active learning class and can further inspire the teachers to create a variety of other medias of teaching by utilizing the MCU 8051 IDE simulator and ASM-51 [7][8]. Eventually hopefully it will enable the teacher to carry out the teaching process better as well [7][8].

REFERENCES

- [1] 2011. Action Research and Active Learning in Indonesia, Excellence in Higher Education. 2(2): 67-69.
- [2] Ely Djulia, Tita Juwitaningsih, Abdul Hamid, Roslin Siallagan. 2011. Active Learning in Language Study and Science: Transforming Teacher Practice in North Sumatra's Elementary Schools, Excellence in Higher Education. 2(2): 90-96.
- [3] Ošmera Martin, Czech Republic (Central Europe, member of EU), MCU 8051 IDE, [Online]. Available: <http://sourceforge.net/projects/mcu8051ide>.
- [4] James Rogers. 2013. Introducing EdSim51DI" 2013 [Online]. Available: <http://www.edsim51.com>
- [5] Dahlan R P Sitompul, Poltak Sihombing. Designing Learning Media Of Control Based On Micro Controller 8051 By Using The Mcu 8051 Ide To Support The Implementation Of Active Learning In Higher Education-ALFHE (Active Learning For Higher Education). International Journal IJECIERD, ISSN(P): 2249-684X; ISSN(E): 2249-7951 Vol. 4, Issue 3, TJPRC Pvt. Ltd. Jun 2014, 9-14 [online] Available: www.tjprc.org
- [6] Charles C. Bonwell, Ph.D. Active Learning: Creating Excitement in the Classroom. Active Learning Workshops PO Box 407 Green Mountain Falls, CO 80819 (719) 684-9261 [online] Available: https://www.ydae.purdue.edu/lct/HBCU/documents/Active_Learning_Creating_Excitement_in_the_Classroom.pdf
- [7] Poltak Sihombing, Dahlan Sitompul. Designing A TTL Voltage Level Logic Probe By Using Common Anode Seven Segment Display And An Inverting Logic Gate On Proteus Isis 7 Professional. International Journal Of Electronics, Communication and Instrumentation Engineering Research And Development (IJECIERD) ISSN(P): 2249-684x;



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14 [online] Available: www.tjprc.org

- [8] P. Sihombing and D. R. Sitompul. 2015. Designing A Media Of Active Learning (AL) Strategy Of Micro Controller 8051 Multiple Interrupts Handling Teaching By Using The MCU 8051 IDE-Integrated Development Environment And Asem-51 In Supporting The Implementation Of Active Learning In Higher Educat. International Journal of Applied Engineering Research (IJAER).10(3): 5751-5763, 184.