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Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF ELECTRONICS & COMMUNICATION

FALL SEMESTER 2023 – 2024

ECE – 4003

EMBEDDED SYSTEM DESIGN

Professor: Sundar. S

LAB ASSESSMENT – 3

SIMPLE CALCULATOR USING KEYPAD AND LCD

VINYAS A SHETTY

20BEC0780

L27+28

QUESTION:

Design and Implement a Basic Arithmetic Calculator with Keypad Interface and LCD Display for +, -, *, / Operations.

CODE:

```
//VINYAS A SHETTY 20BEC0780
ORG   0000H
START:
ACALL LCDINIT
ACALL GETKEY
MOV A,R7
SUBB A,#30H
MOV R6,A      //NUMBER 1 IN DECIMAL IS STORED IN R6
CLR A
ACALL GETKEY
MOV A,R7
MOV R5,A       //OPERATOR ASCII AT R5
CLR A
ACALL GETKEY
MOV A,R7
SUBB A,#30H
MOV R1,A        //NUMBER 2 IN DECIMAL IS STORED IN R1
CLR A

MOV A,#'='
ACALL DATAWRT
ACALL DELAY

CJNE R5,#'+', SKIP_ADD
SJMP ADDITION
SKIP_ADD:
CJNE R5,#'-', SKIP_SUB
SJMP SUBTRACT
SKIP_SUB:
CJNE R5,#'*', SKIP_MUL
SJMP MULTIPLY
SKIP_MUL:
CJNE R5,#'/', SKIP_DIV
SJMP DIVIDE
SKIP_DIV:
MOV A,#'E'
ACALL DATAWRT
ACALL DELAY
ADDITION:
CLR A
ADD A,R6
```

```
ADD A,R1
ADD A,#30H
ACALL DATAWRT
ACALL DELAY
SJMP THERE

SUBTRACT:
CLR A
MOV A,R6
SUBB A,R1
ADD A,#30H
ACALL DATAWRT
ACALL DELAY
SJMP THERE

MULTIPLY:
MOV A,R6
MOV B,R1
MUL AB
ADD A,#30H
ACALL DATAWRT
ACALL DELAY
SJMP THERE

DIVIDE:
MOV A,R6
MOV B,R1
DIV AB
ADD A,#30H
ACALL DATAWRT
ACALL DELAY
THERE: SJMP THERE


LCDINIT:    MOV   A,#38H      ;INIT. LCD 2 LINES, 5X7 MATRIX
ACALL COMNWRT     ;call command subroutine
ACALL DELAY             ;give LCD some time
MOV   A,#0EH            ;display on, cursor on
ACALL COMNWRT
ACALL DELAY
MOV   A,#01             ;clear LCD
ACALL COMNWRT
ACALL DELAY
MOV   A,#06H            ;shift cursor right
ACALL COMNWRT
ACALL DELAY
MOV   A,#80H            ;cursor at line 1, pos. 4
ACALL COMNWRT
ACALL DELAY
RET
```

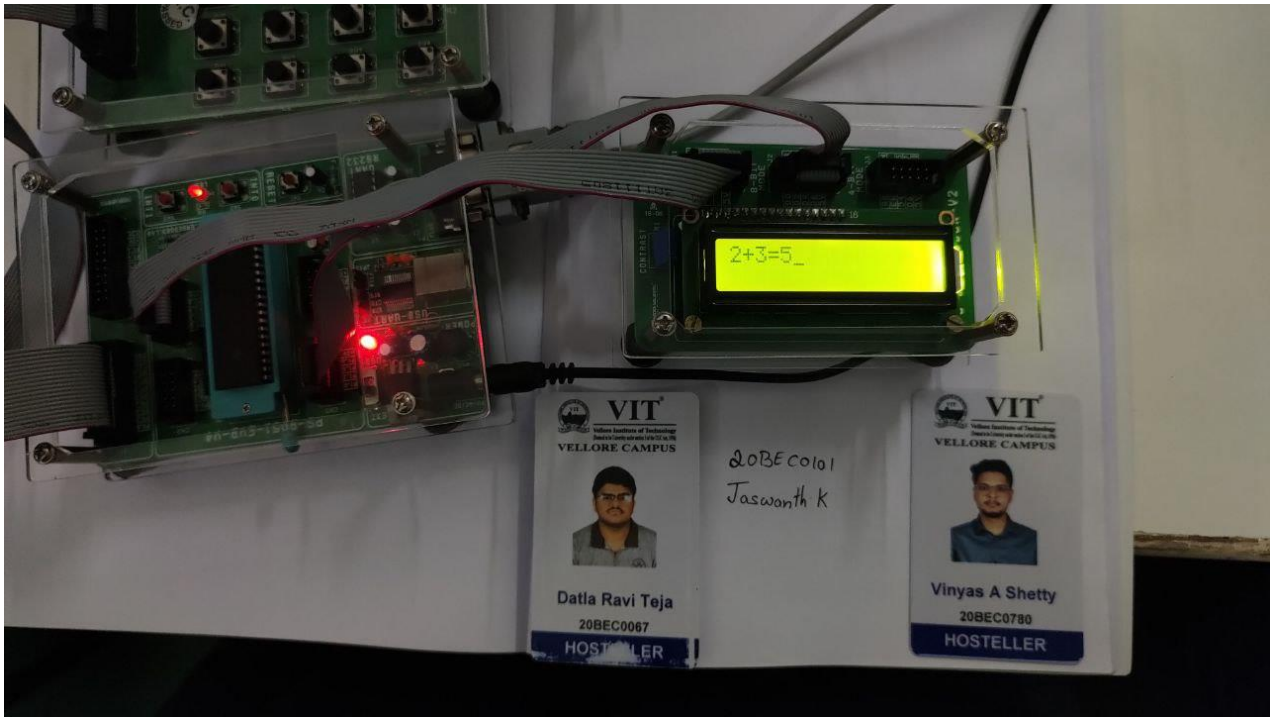
```
COMNWRT:MOV   P1,A    ;command subroutine
CLR   P2.0
CLR   P2.1
SETB  P2.2
ACALL DELAY
CLR   P2.2
RET
DATAWRT:MOV   P1,A            ;display subroutine
SETB  P2.0
CLR   P2.1
SETB  P2.2
ACALL DELAY
CLR   P2.2
RET
DELAY:MOV   R3,#50
HERE2:MOV   R4,#255
HERE:DJNZ  R4,HERE     ;stay until R4 becomes 0
DJNZ  R3,HERE2
RET
;Keyboard subroutine. This program sends the ASCII

GETKEY:     MOV P0,#0FH
K1:MOV P0,#0FH
MOV A,P0
ANL A,#0FH
MOV P0,A
MOV A,P0
ANL A,#0FH
CJNE A,#0FH,K1
K2:ACALL DELAY
MOV A,P0
ANL A,#0FH
CJNE A,#0FH,OVER
SJMP K2
OVER:ACALL DELAY
MOV A,P0
ANL A,#0FH
CJNE A,#0FH,OVER1
SJMP K2
OVER1:CLR  P0.4   ;ROW1 SELECTED
SETB P0.5
SETB P0.6
SETB P0.7
MOV A,P0
ANL A,#0FH
CJNE A,#0FH,ROW0
CLR P0.5          ;ROW2 SELECTED
SETB P0.7
SETB P0.6
SETB P0.4
```

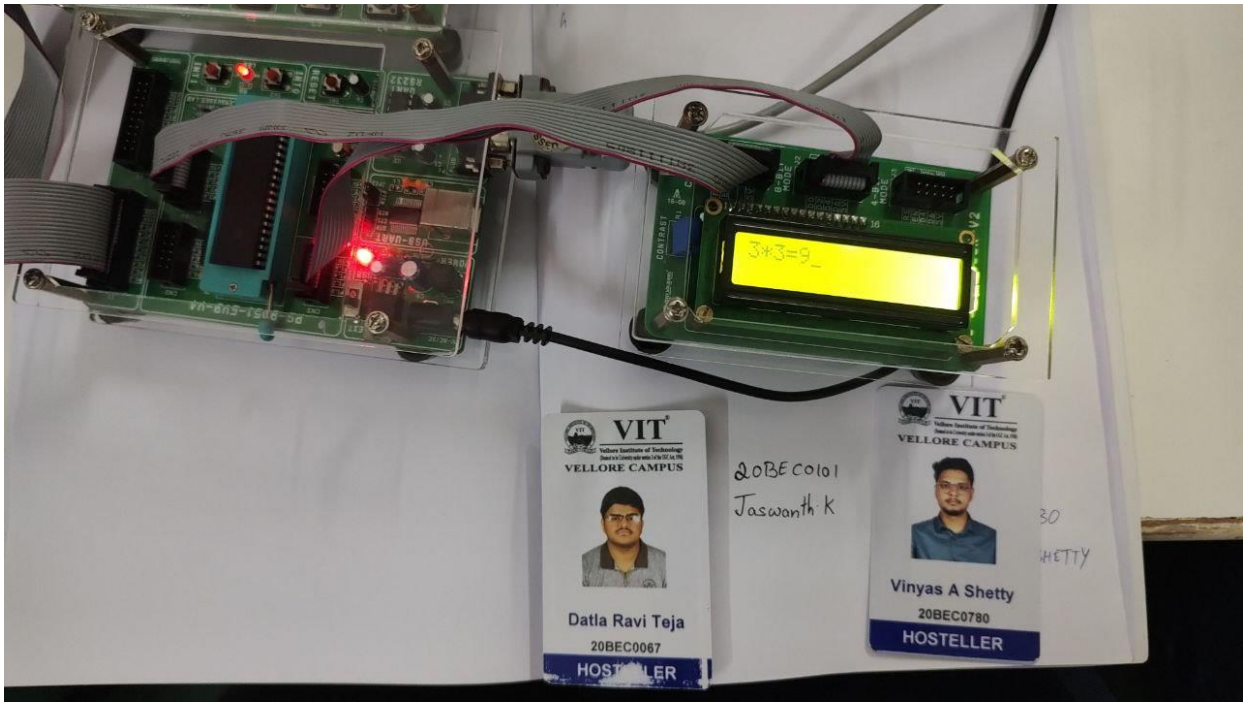
```
MOV A,P0
ANL A,#0FH
CJNE A,#0FH,ROW1
CLR P0.6          ;ROW3 SELECTED
SETB P0.7
SETB P0.5
SETB P0.4
MOV A,P0
ANL A,#0FH
CJNE A,#0FH,ROW2
CLR P0.7          ;ROW4 SELECTED
SETB P0.4
SETB P0.6
SETB P0.5
MOV A,P0
ANL A,#0FH
CJNE A,#0FH,ROW3
SJMP K2
MOV R0,#04H
ROW0:MOV DPTR,#KCODE0
SJMP FIND
ROW1:MOV DPTR,#KCODE1
SJMP FIND
ROW2:MOV DPTR,#KCODE2
SJMP FIND
ROW3:MOV DPTR,#KCODE3
FIND:RRC A
JNC MATCH
INC DPTR
DJNZ R0,FIND
MATCH:
;MOV   A,#84H     ;display pressed key
;ACALL COMNWRT    ;
;ACALL DELAY
CLR  A                ;set A=0 (match is found)
MOVC A,@A+DPTR        ;get ASCII from table
MOV R7,A
ACALL DATAWRT
ACALL DELAY
MOV   A,#06H          ;shift cursor right
ACALL COMNWRT
ACALL DELAY
RET
ORG  300H
KCODE0: DB   '1','2','3','4' ;ROW 0
KCODE1: DB   '5','6','7','8' ;ROW 1
KCODE2: DB   '9','0','+','-' ;ROW 2
KCODE3: DB   '*','/','C','=' ;ROW 3
END
```

SIMULATION RESULTS:

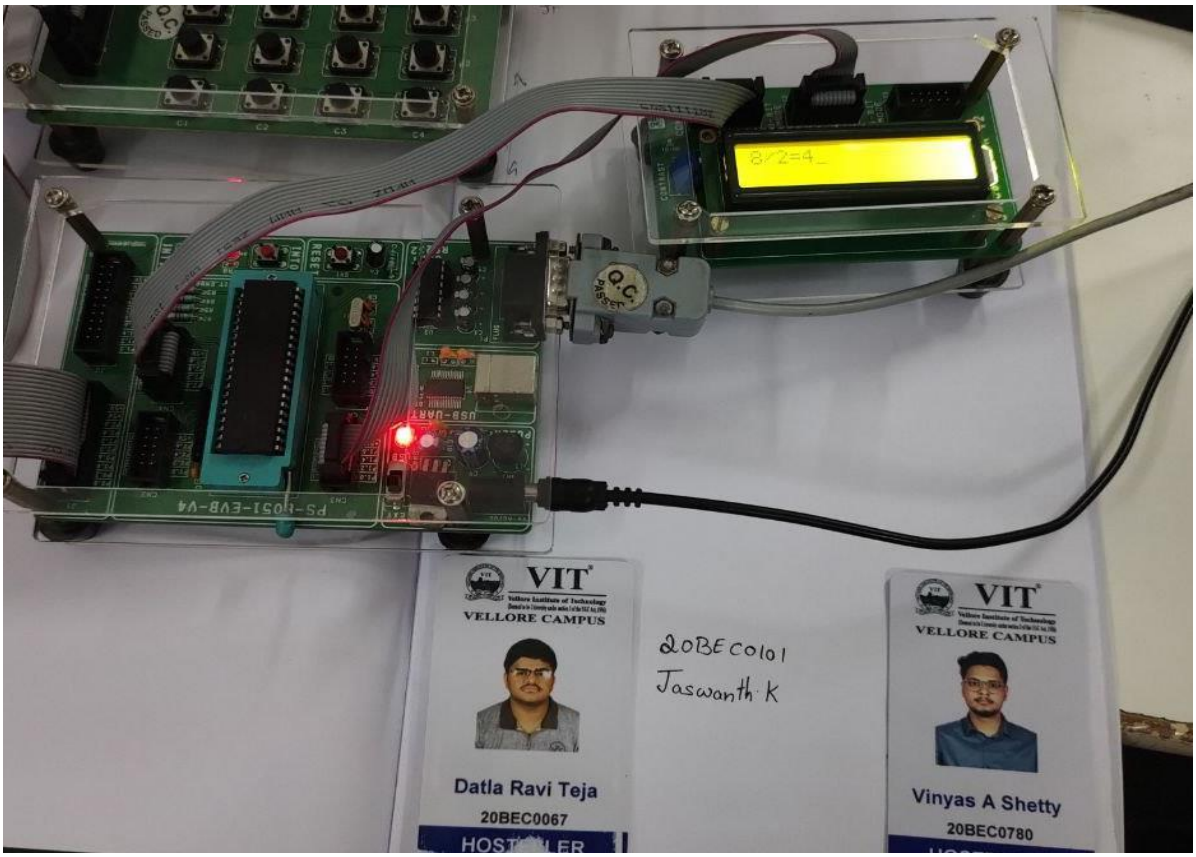
SUBTRACTION OPERATION



ADDITION OPERATION



MULTIPLICATION OPERATION



DIVISION OPERATION

OBSERVATIONS:

In the project we successfully implemented a basic arithmetic calculator using a 8051 microcontroller and Keil µvision, offering user-friendly interface for basic operations (+, -, *, /) with input through a keypad and displaying the results on an LCD screen.