

LAB TITLE AND CODE: EMBEDDED COMPUTING LAB (19CE283)

EXPERIMENT NUMBER: 1

DATE: 12/04/2022 (TUESDAY)

GPIO INTERFACING USING MSP432 (LED BLINKING & SEVEN SEGMENT)

* AIM:

To interface external peripherals, LED and seven segment, using MSP432 microcontroller.

* SOFTWARE REQUIRED:

Keil µVision 5 IDE (32 bit)

Publisher - ARM Ltd.

Version - 5.30.0.0

* ALGORITHM (LED BLINKING):

- ① Configure functionality of P2.1 as GPIO (General Purpose I/O) Port
- ② Configure Direction of P2.1 as Output Port
- ③ Switch on LED on P2.1 (Configure Data as Logic High)
- ④ Delay
- ⑤ Switch off LED on P2.1 (Configure Data as Logic Low)
- ⑥ Delay

* CODE (LED BLINKING):

/*

P2-1.c Toggling green LED in c using header file register definitions.
This program toggles green LED for 0.5 second ON and 0.5 second OFF.
The green LED is connected to P2.1.
The LEDs are high active (a '1' turns ON the LED).

Tested with Keil 5.30 and MSP432 Device Family Pack V2.2.0 on
XMS432P401R Rev C.

*/

```
#include "msp.h"
```

```
void delayms (int n); // Delay Function
```

```
// Main Function:
```

```
int main (void)
```

```
{
```

```
P2 → SEL1 &= ~2; // Configure P2.1 as Simple I/O
```

```
P2 → SEL0 &= ~2;
```

```
P2 → DIR |= 2; // P2.1 set as output pin
```

```
// Infinite Loop (An embedded program does not stop):
```

```
while (1)
```

```
{
```

```
P2 → OUT |= 2; // Turn ON P2.1 Green LED
```

```
delayms (500); // Delay for 500 ms
```

```
P2 → OUT &= ~2; // Turn OFF P2.1 Green LED
```

```
delayms (500); // Delay for 500 ms
```

```
}
```

```
}
```

```
// Delay milliseconds when system clock is at 3MHz for Rev C mcu:
```

```
void delayms (int n)
```

```
{
```

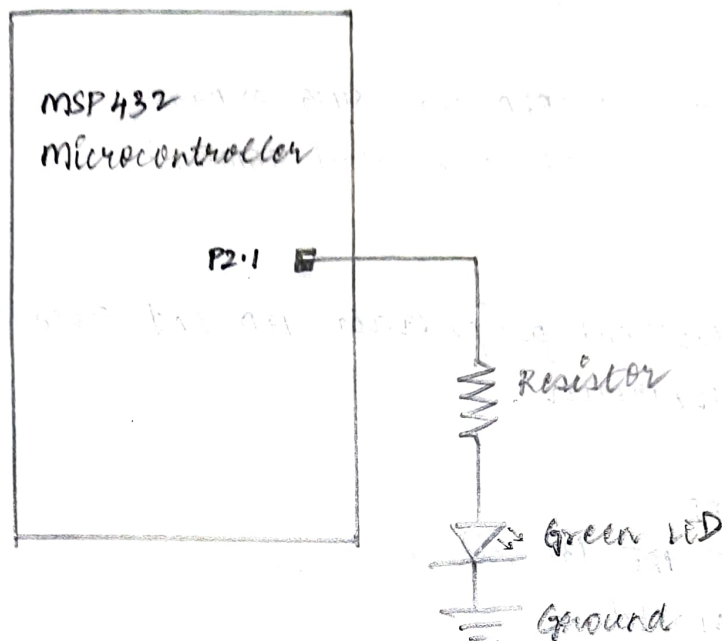
```
int i, j;
```

```
for (j=0; j<n; j++)
```

```
for (i=750; i>0; i--); // Delay of 1ms
```

```
}
```

* CIRCUIT DIAGRAM (LED BLINKING) :



The green LED will turn ON for half a second and turn OFF for half a second repeatedly forever.

* ALGORITHM (SEVEN SEGMENT) :

- ① Define the hexadecimal values in an unsigned character array.
- ② Configure functionality of P4, P5.0 and P5.1 as simple I/O.
- ③ Configure direction of P4, P5.0 and P5.1 as output pins.
- ④ Display and select tens digit for each of the hexadecimal value repeatedly.
- ⑤ Delay

* CODE (SEVEN SEGMENT) :

```
#include "msp.h"
```

```
void delays (int n);
```

```
// main Function:
```

```
int main (void)
```

```
{
```

```
const unsigned char digitPattern[] = {0x3F, 0x06, 0x5B, 0x4F,  
0x66, 0x6D, 0x7D, 0x07, 0x7F, 0x6F, 0x77, 0x7C, 0x39, 0x5E, 0x79,  
0x71}; // Hexadecimal Values
```

```
P4 → SEL1 & = ~0xFF; // configure P4 as simple I/O
```

```
P4 → SEL0 & = ~0xFF;
```

```
P4 → DIR 1 = 0xFF; // P4 set as output pins
```

```
P5 → SEL1 & = ~2; // configure P5.0, P5.1 as simple I/O
```

```
P5 → SEL0 & = ~2;
```

```
P5 → DIR 1 = 2; // P5.0, P5.1 set as output pins
```

```
// Infinite Loop (An embedded program does not stop):
```

```
while (1)
```

```
{
```

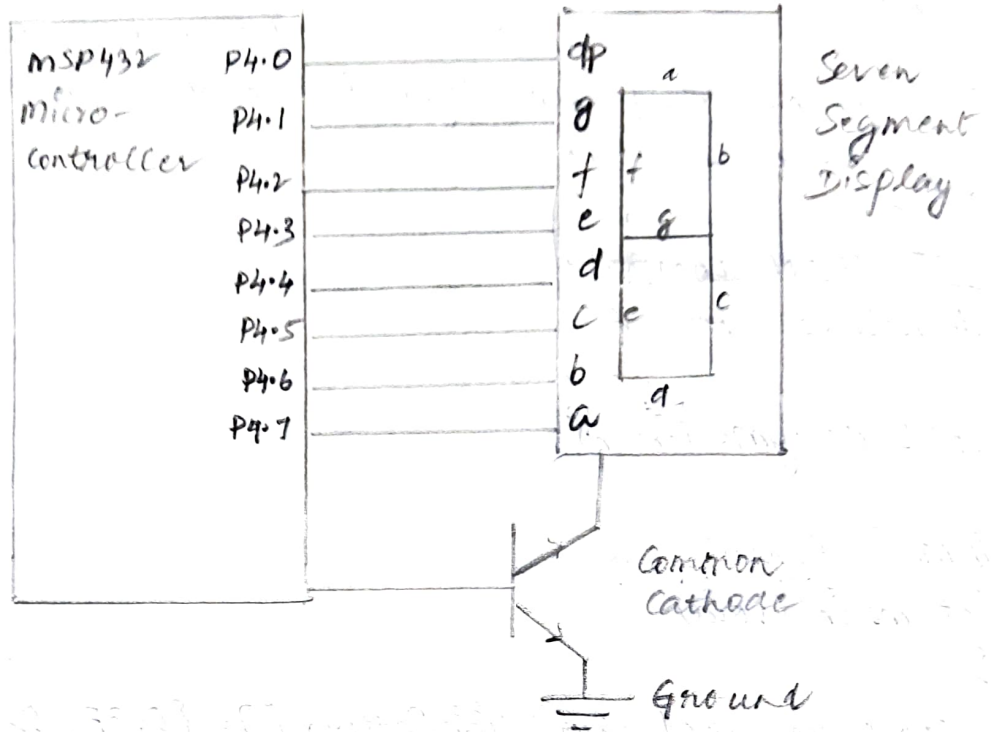
```
int i;
```

* SEVEN SEGMENT INTERFACING (DISPLAY)

	dp	g	f	e	d	c	b	a	Hex
	P4.0	P4.1	P4.2	P4.3	P4.4	P4.5	P4.6	P4.7	
0	0	0	1	1	1	1	1	1	0x3F
1	0	0	0	0	0	1	1	0	0x06
2	0	1	0	1	1	0	1	1	0x5B
3	0	1	0	0	1	1	1	1	0x4F
4	0	1	1	0	0	1	1	0	0x6C
5	0	1	1	0	1	1	0	1	0x6D
6	0	1	1	1	1	1	0	1	0x7D
7	0	0	0	0	0	1	1	1	0x01
8	0	1	1	1	1	1	1	1	0x7F
9	0	1	1	0	1	1	1	1	0x6F
10(A)	0	1	1	1	0	1	1	1	0x73
11(b)	0	1	1	1	1	1	0	0	0x7C
12(c)	0	0	1	1	1	0	0	1	0x39
13(d)	0	1	0	1	1	1	1	0	0x5E
14(E)	0	1	1	1	1	0	0	1	0x79
15(F)	0	1	1	1	0	0	0	1	0x71

Common Cathode Type

* CIRCUIT DIAGRAM :



All the positive terminals (cathode) of all the 8 LEDs are connected together all the negative terminals are left alone (ground).

```

for (i=0; i<16; i++)
{
    P4 → OUT = digitPattern[i]; // Display Tens Digit
    P5 → OUT |= 2; // select Tens Digit
    delayMs(5000);
}
}
}

```

// Delay milliseconds when systems clock is at 3MHz for Rev C MCU's
void delayMs (int n)

```

{
    int i, j;
    for (j=0; j<n; j++)
        for (i=150; i>0; i--); // Delay of 1ms
}

```

* INFERENCE:

Interface external peripherals, LED and Seven Segment, using MSP432 microcontroller and all simulation results were verified successfully.