भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology
Hyderabad

# ARM for Beginners

Teaching Learning Center
IIT Hyderabad

Alok Ranjan Kesari and G V V Sharma*

Contents



***Abstract*—The objective of this manual is to introduce beginners to arm embedded programming through an electronics game.**

## 1 Components

| Component | Value | Quantity |
|---|---|---|
| Breadboard | | 1 |
| Resistor | 220 Ω | 1 |
| Arduino | Uno | 1 |
| Seven Segment Display | Common Anode | 1 |
| Jumper Wires | | 20 |

TABLE 1.0

## 2 Manual Display Control

### 2.1 Powering the Display

The breadboard can be divided into 5 segments. In each of the green segements, the pins are internally connected so as to have the same voltage. Similarly, in the central segments, the pins in each column are internally connected in the same fashion as the blue columns.

**Problem 2.1.** Plug the display to the breadboard in Fig. 2.1

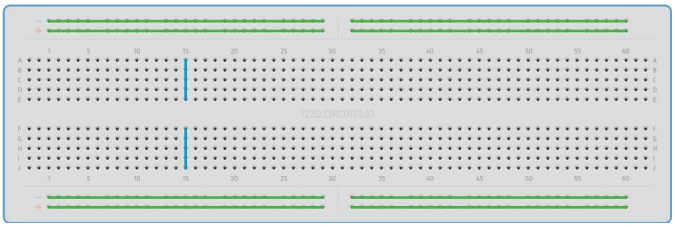

Fig. 2.1

The seven segment display in Fig. 2.2 has eight pins, $a, b, c, d, e, f, g$ and *dot* that take an active LOW input, i.e. the LED will glow only if the input is connected to ground. Each of these pins is connected to an LED segment. The *dot* pin is reserved for the · LED.

**Problem 2.2.** Connect one end of the 1K resistor to the COM pin of the display and the other end to an extreme pin of the breadboard.

The STM32F103C8T6 micro-controller has two ground pins, few analog input pins and few digital pins that can be used for both input as well as output. It has one Vcc (3.3V) pin that can generate $3.3V$. In the following exercises, only the GND, $3.3V$ and digital pins will be used.

**Problem 2.3.** Connect the 3.3V pin of the STM32 to an extreme pin that is in the same segment as the 1K resistor pin.

**Problem 2.4.** Connect the GND pin of the STM32 to the opposite extreme pin of the breadboard

**Problem 2.5.** Connect the STM32 to the Raspberry Pi using the manual titled ”Flashing STM32 using Raspberry Pi”.

*The author is with the Department of Electrical Engineering, Indian Institute of Technology, Hyderabad 502285 India e-mail: gadepall@iith.ac.in. 

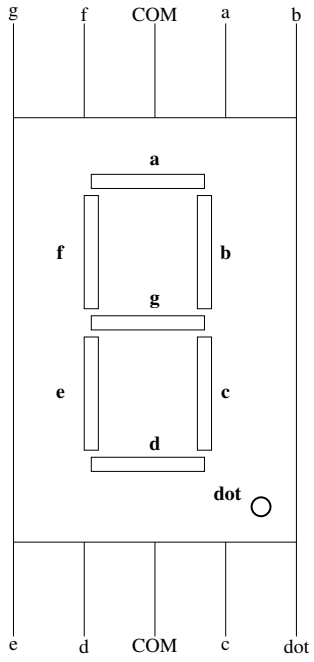


Fig. 2.2

**Problem 2.6.** Connect the *dot* pin of the display to a pin in the same segment as the GND pin. What do you observe?

### *2.2 Controlling the Display*

Fig. 2.9 explains how to get decimal digits using the seven segment display.

**Problem 2.7.** Generate the number 1 on the display by connecting only the pins *b* and *c* to GND.

**Problem 2.8.** Repeat the above exercise to generate the number 2 on the display.

**Problem 2.9.** Table 2.9 summarizes the process of generating the decimal digits. 0 means connecting to ground and 1 means connecting to 3.3V. Complete Table 2.9 for all numbers between 0-9.

| a | b | c | d | e | f | g | decimal |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 2 |

TABLE 2.9

**Problem 2.10.** Now generate all numbers between 0-9 on the display using the above table.

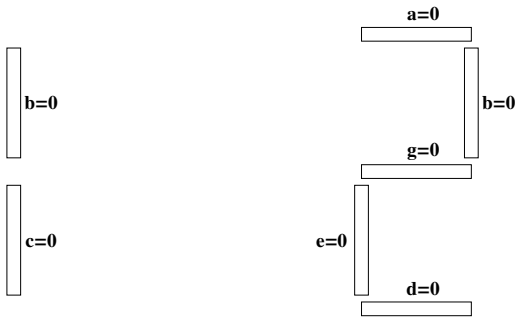


Fig. 2.9

## 3 Display Control with STM32

**Problem 3.1.** Connect the $a-g$ pins of the display to the pins PB3-PB9 of the STM32.

**Problem 3.2.** Clone the following github repository using the following command.

```
git clone https://github.com/
    alokkesari/STM32F103C8T6
cd STM32F103C8T6
nano main.c
```

**Problem 3.3.** Edit and the 'main.c' appropriately for generating the number 0 on the seven segment by placing the below mentioned code snippets appropriately. What do you observe?

```
GPIO_InitStructure.GPIO_Pin =
    GPIO_Pin_3 | GPIO_Pin_4 |
    GPIO_Pin_5 | GPIO_Pin_6 |
    GPIO_Pin_7 | GPIO_Pin_8 |
    GPIO_Pin_9;
```

```
GPIO_ResetBits(GPIOB, GPIO_Pin_3 |
     GPIO_Pin_4 | GPIO_Pin_5 |
    GPIO_Pin_6 | GPIO_Pin_7 |
    GPIO_Pin_8);
GPIO_SetBits(GPIOB, GPIO_Pin_9);
```

**Problem 3.4.** Now generate the numbers 0-9 by modifying the above program.