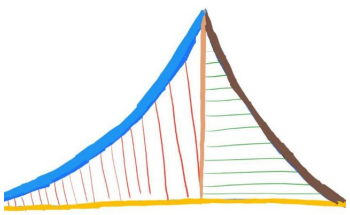
EMBEDDED SYSTEM

G. V. V. Sharma



Contents

Introduction

This book introduces Embedded Systems through using the Vaman framework.

Chapter 1

Vaman-ESP32

1.1. Measuring Unknown Resistance Using ESP32

T:hrough this manual, we learn how to measure an unknown resistance through ESP32 and display it on an LCD.

1.1.1. Components

Component	Value	Quantity
Resistor	220 Ohm	1
	1K	1
ESP32	Devkit V1	1
Jumper Wires		20
Bread board		1
LCD	16 X 2	1
Potentiometer	10K	1

Table 1.1.1: Components

1.1.2. Setting up the Display

1.1.1. Plug the LCD in Fig. 1.1.1.1 to the breadboard.

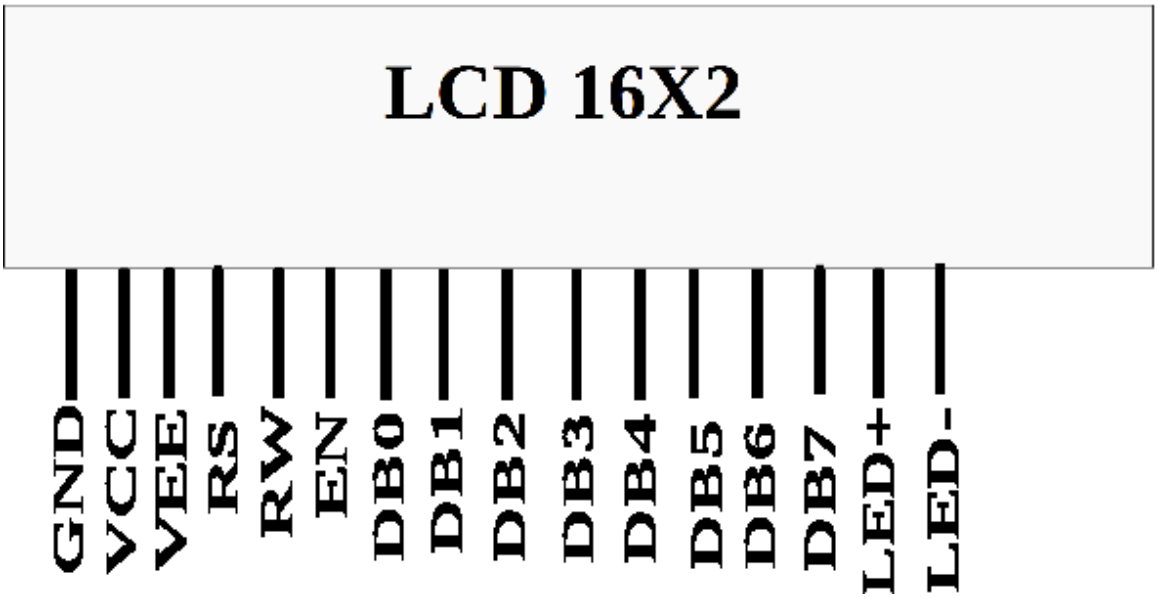


Figure 1.1.1.1: LCD pins

1.1.2. Connect the ESP32 pins to LCD pins as per Table 1.1.2.1. Make sure that all 5V sources are connected to the LCD through a 220 Ω resistance.

1.1.3. Execute the following code after editing the wifi credentials

```
lcd/codes/setup
```

You should see the following message

```
Hi
This is CSP Lab
```

1.1.4. Modify the above code to display your name.

ESP32	**LCD Pins**	**LCD Pin Label**	**LCD Pin Description**
GND	1	GND	
5V	2	Vcc	
GND	3	Vee	Contrast
GPIO 19	4	RS	Register Select
GND	5	R/W	Read/Write
GPIO 23	6	EN	Enable
GPIO 18	11	DB4	Serial Connection
GPIO 17	12	DB5	Serial Connection
GPIO 16	13	DB6	Serial Connection
GPIO 15	14	DB7	Serial Connection
5V	15	LED+	Backlight
GND	16	LED-	Backlight

Table 1.1.2.1: Make sure that all 5V sources are connected to the LCD through a 220 Ω resistance.

1.1.3. Measuring the resistance

1.1.1. Connect the 5V pin of the ESP32 to an extreme pin of the Breadboard shown in Fig. 1.1.1.1. Let this pin be V_{cc}.

1.1.2. Connect the GND pin of the ESP32 to the opposite extreme pin of the Breadboard.

1.1.3. Let R_1 be the known resistor and R_2 be the unknown resistor. Connect R_1 and R_2 in series such that R_1 is connected to V_{cc} and R_2 is connected to GND. Refer to Fig. 1.1.3.1

1.1.4. Connect the junction between the two resistors to the GPIO34 pin on the ESP32.

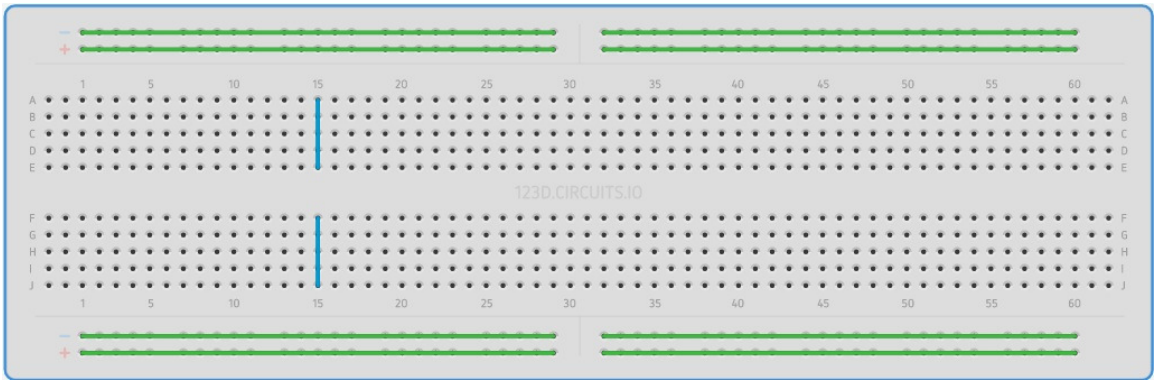


Figure 1.1.1.1: Breadboard

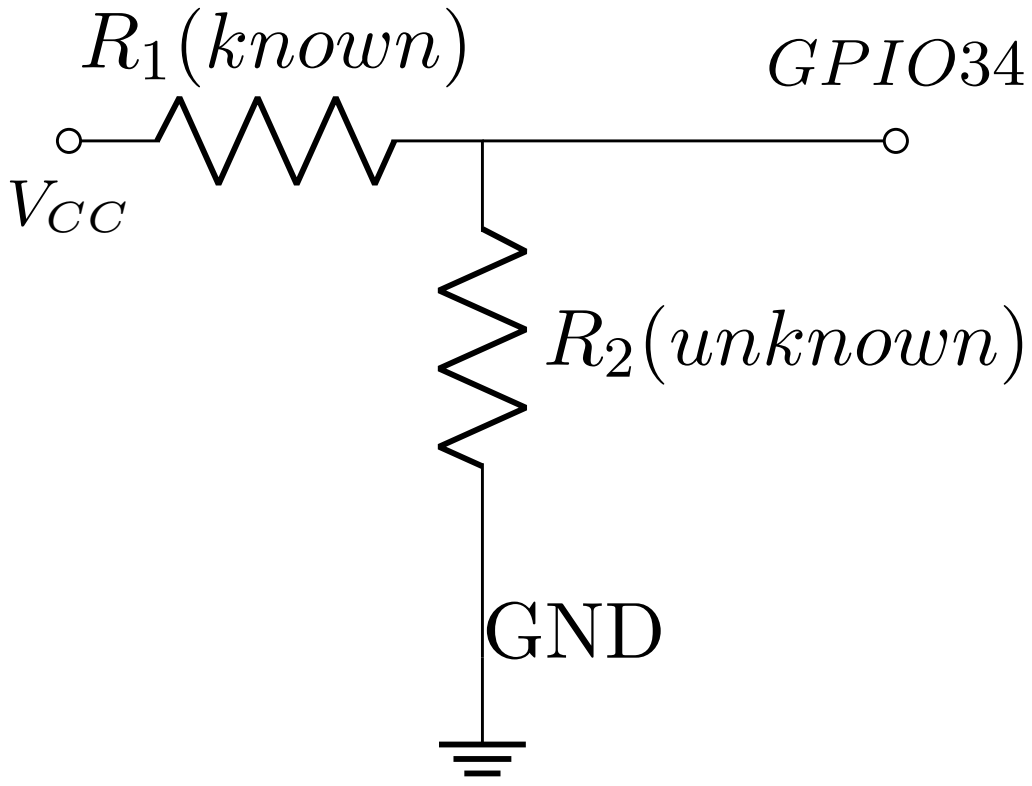


Figure 1.1.3.1: Voltage Divider

1.1.5. Connect the ESP32 to the computer so that it is powered.

1.1.6. Execute the following code after editing the wifi credentials

```
lcd/codes/resistance
```

1.1.4. Explanation

1.1.1. We create a variable called analogPin and assign it to 0. This is because the voltage value we are going to read is connected to analogPin GPIO34.

1.1.2. The 12-bit ADC can differentiate 4096 discrete voltage levels, 5 volt is applied to 2 resistors and the voltage sample is taken in between the resistors. The value which we get from analogPin can be between 0 and 4095. 0 would represent 0 volts falls across the unknown resistor. A value of 4095 would mean that practically all 5 volts falls across the unknown resistor.

1.1.3. V_{out} represents the divided voltage that falls across the unknown resistor.

1.1.4. The Ohm meter in this manual works on the principle of the voltage divider shown in Fig. 1.1.3.1.

$$V_{out} = \frac{R_1}{R_1 + R_2} V_{in} \tag{1.1.4.1}$$

$$\Rightarrow R_2 = R_1 \left(\frac{V_{in}}{V_{out}} - 1 \right) \tag{1.1.4.2}$$

In the above, $V_{in} = 5\text{V}$, $R_1 = 220\Omega$.

1.1.5. Repeat the exercise with another unknown resistance.