

Sensors and Microsystem Electronics

Microcontroller project: Themerin

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1 Manual

The Microcontroller has following features:

- Moving the Joystick left and right controls the frequency of the buzzer
- Pressing button "C" activates the buzzer to produce a sound
- The displays shows the current frequency of the buzzer

A more detailed explanation of the features are given below:

The joystick can have values ranging from 0 to 255 in theory, but in practise they range from around 25 to around 240. This value is determined by the ADC converter taking the joystick output as its input. This value is then used to determine the frequency that is playing on the buzzer by taking the system clock f_{clk} and clock scaling factor K_{clock} into account using following formula:

$$f_{buzzer} = \frac{\frac{f_{clk}}{2K_{clock}}}{255 - r_{joystick}} \quad (1)$$

With $r_{joystick}$ The value of the joystick.

The button "C" controls whether the buzzer makes sound or not. If "C" is not pressed, the buzzer pin does not change its value and thus the buzzer does not produce any sound. When the "C" button is pressed, the buzzer pin value changes at a frequency determined by timer0 and the joystick.

The display shows the frequency at which the buzzer is making sound and the unit of frequency "Hz". This is done by converting the joystick value to the correct frequency value using formula (1). If the buzzer is not making any sound, "0000Hz" is shown.

2 Block Diagram

The block diagram of the microcontroller is shown in figure 1. Below is a list that explains each block:

- Joystick: Joystick present on the microcontroller
- ADC: Analog to digital converter
- ADC complete interrupt: Interrupt caused by the completion of the ADC
- Buzzer frequency: register that controls the buzzer frequency
- Buzzer: Buzzer present on the microcontroller
- Timer0 interrupt: Interrupt that occurs based on the value of the buzzer frequency
- Button "C": button present on the microcontroller keyboard
- Register to frequency calculator: Uses formula (1) to determine the buzzer frequency
- frequency to digit converter: Converts the buzzer frequency to its separate digits
- Number display: Decides what pixels are on when displaying a digit
- "HZ": Shows "Hz" on the display
- Display: Display present on the microcontroller

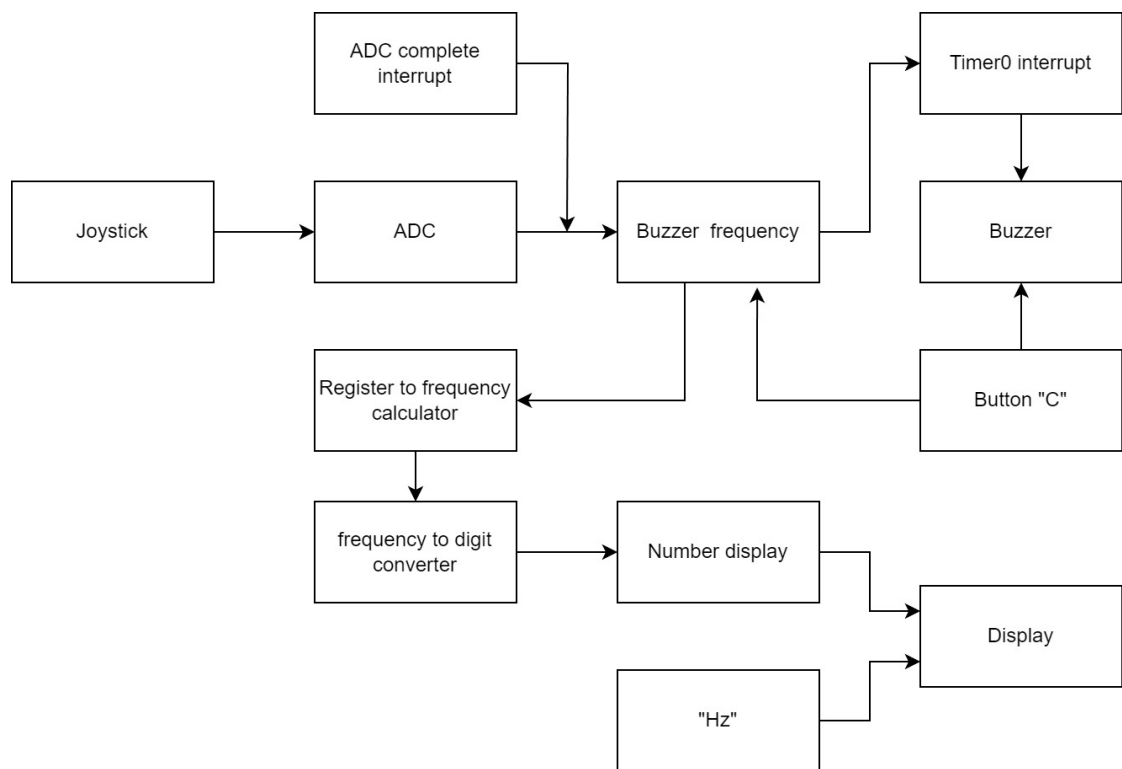


Figure 1: Block diagram of the microcontroller