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Random Variable LED Dice Roll Implementation

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ABSTRACT

In this paper, we use a single-chip AT89C52 to control the signals, and the arrangement of LEDs is used to analogize the dice. When the manual switch SW1 is pressed and held down, the LED light will change from 1 to 6 dots. When the SW1 switch is released, the LED will stop changing and stop at any one of the numbers 1~6. It can also shake the board like a dice, and the LEDs will change from 1 to 6 dots when you shake the board; After shaking and vibrating this board, the LED will stop changing and stop at any one of 1~6 dots to complete the function of this LED electronic dice.

Keywords: Single chip, LED, Dice roll

1.INTRODUCTION

Although “Electronic Dice” is a very easy to complete circuit, but such a simple circuit is “small but complete”, because it contains many small circuits that are often used in daily life.

The objectives of the study are as follows: 1. to be more flexible in the application of 8051 single chip, 2. to learn how to control LEDs by using 8051, 3. to make electronic dice by using the above learning.

Using the 8051 to control the flashing LEDs that we learned in the original school internship course, we changed and innovated to make a more interesting circuit board. The function of this LED electronic dice can replace the ordinary dice, so that we can have a little different fun in our busy life, and achieve the purpose of reducing the pressure of life.

2. HARDWARE EQUIPMENT

The LED lights present the rows of dice, the LED lights will have the number one to six different conditions of the light display. We press button SW1 to activate or shake the vibration switch to activate. If we press the button and do not let go of the LED light will run faster and faster, let go of the hand will stop the action, stop at one of the six changes in the change of the phenomenon. The LED light will run faster and faster if the button is pressed and not released. There is also a reset button that allows the circuit to be restored to its original state, ready to run again.

Figure 1 shows the hardware block diagram of this implementation, and the features are described below: 1. Use a common anode (CA) 7-segment display to show the number of dice points. 2. Dice LEDs run to show random numbers, resulting in numbers from 1 to 6. 3. Use button SW1 to activate or shake the vibration switch to activate. 4. The buzzer will beep when the dice LED is running.

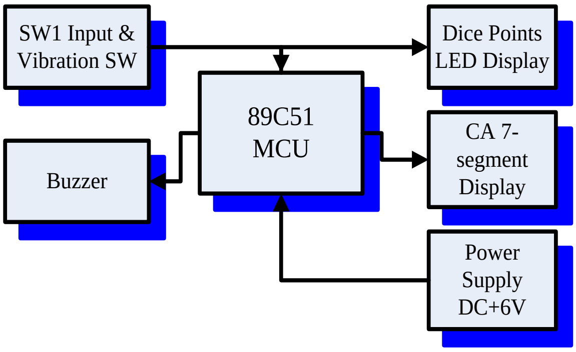

Figure 1: Block diagram of hardware composition

Figure 2 shows the circuit diagram of this electronic dice. The hardware operation is described as follows: Its core is the AT89C52 single-chip microprocessor produced by Atmel, which can be used in the software of this electronic dice. The microprocessor chip has internal flash memory for program storage, eliminating the need for external memory. The quartz crystal X1 and capacitors C1 and C2 form a clock oscillator, and the microprocessor directly drives seven light-emitting diodes (LEDs) and a common anode (CA) seven-segment display through its I/O pins. No additional buffer is required due to the use of a low-current light-emitting diode [1-9].

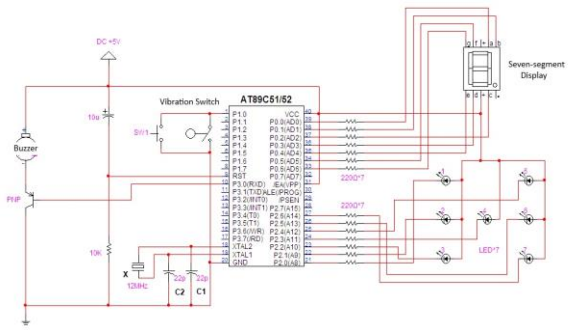

Figure 2: Electronic Dice circuit diagram

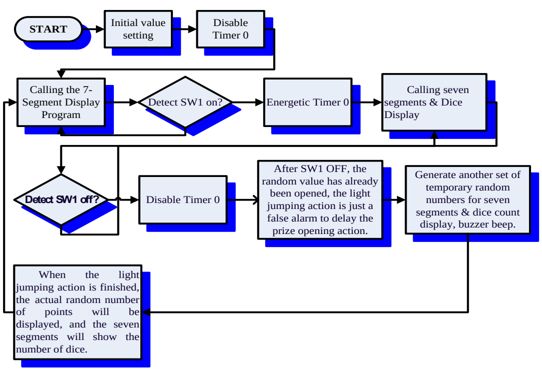

Figure 3: Main program flow chart

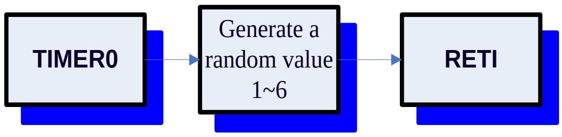

Figure 4: Subroutine program flow chart

3. SOFTWARE DESCRIPTION

The main program flowchart design is shown in Figure 3. The main program design functions are depicted as follows: 1. Initial value setting. 2.Disable Timer 0. 3.Calling the seven-segment display program (Display the random value). 4.Detect SW1 on? 5.Energetic Timer 0. 6.Calling seven segments & Dice Display (showing the random values being generated). 7.Detect SW1 off? 8.Disable Timer 0. 9.After SW1 off, the random value has already been opened, the light jumping action is just a false alarm to delay the prize opening action. 10.Generate another set of temporary random numbers for seven segments and dice count display, buzzer beep. 11.When the light jumping action is finished, the actual random number of points will be displayed, and the seven segments will show the number of dice. The subroutine flowchart is designed as shown in Figure 4 for the TIMER0 timer interrupt program, whose purpose is to generate 1~6 random values.

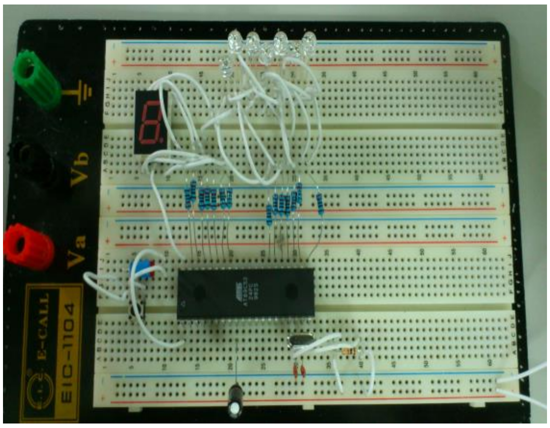

Figure 5: Electronic dice circuit test diagram


Figure 6: The dice show “1”.

4. HARDWARE IMPLEMENTATION

The circuit test diagram is shown in Figure 5. We assembled the required components on the breadboard, tested the correct operation and then soldered the components to the hole board. There are six different states of electronic dice. With the 7490 decimal counter function, the seven-segment display from “000” to “101” (MSB is C, LSB is A) is also displayed. The completed hardware execution is shown in Figure 6 to Figure 11. When the hardware executes the action, use the oscilloscope to measure the voltage waveform of each component as shown in Figure 12 to Figure 20.

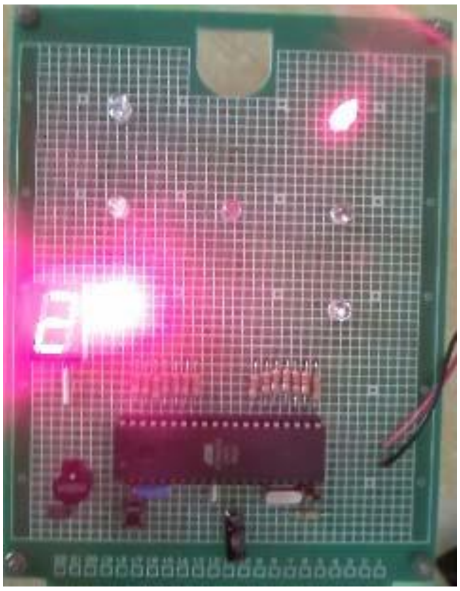
Figure 7: The dice show “2”.

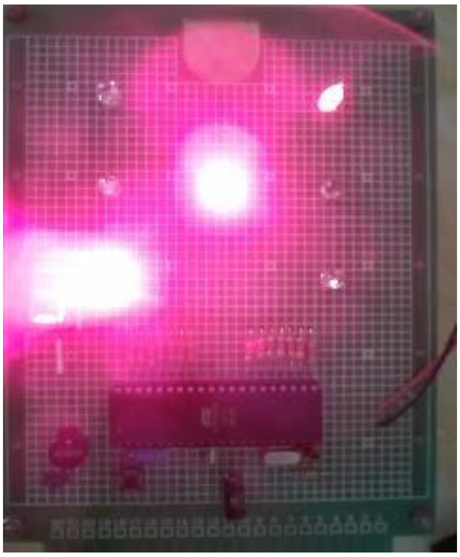
Figure 8: The dice show “3”.

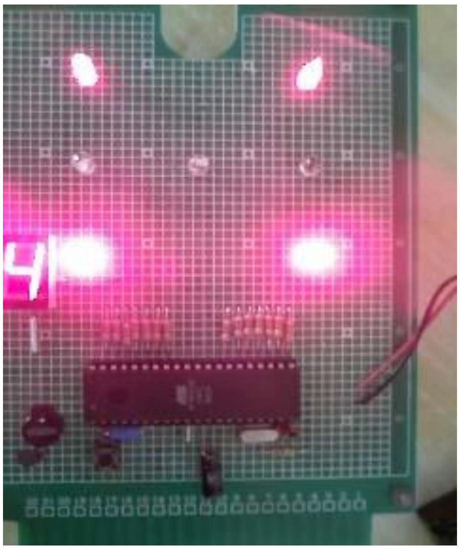
Figure 9: The dice show “4”.

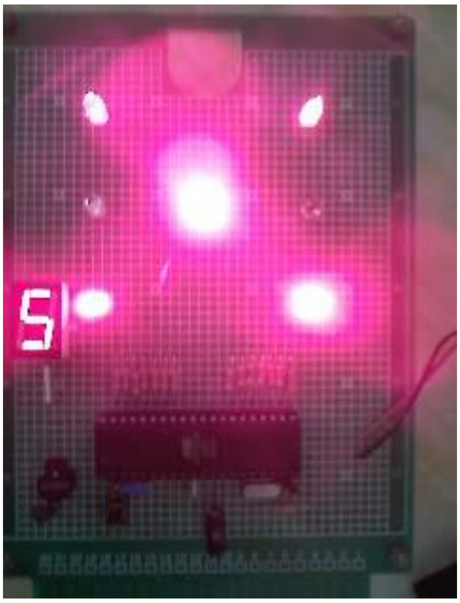
Figure 10: The dice show “5”.

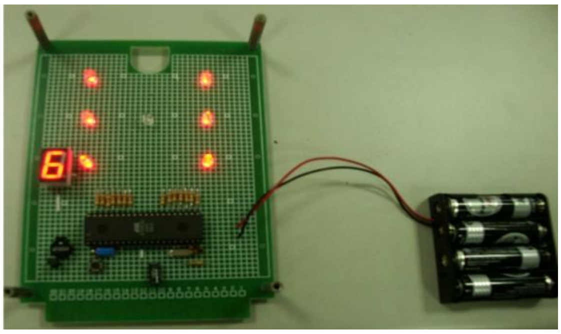

Figure 11: The dice show "6" with total hardware diagrams.

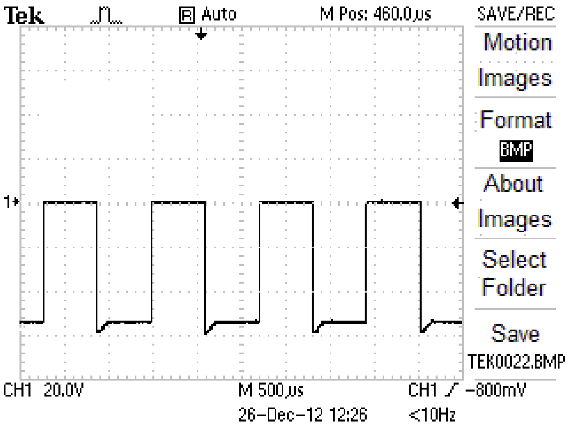

Figure 12: 6V Power supply voltage waveforms

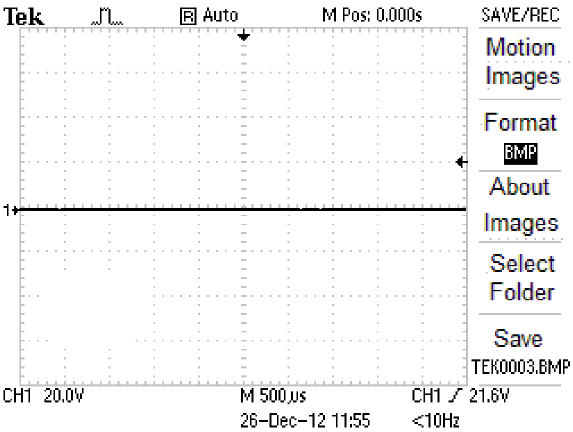

Figure 13: Voltage waveform when LED is off

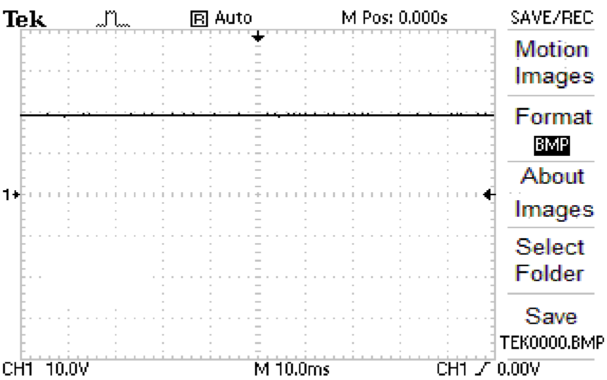

Figure 14: Voltage waveform when LED is on

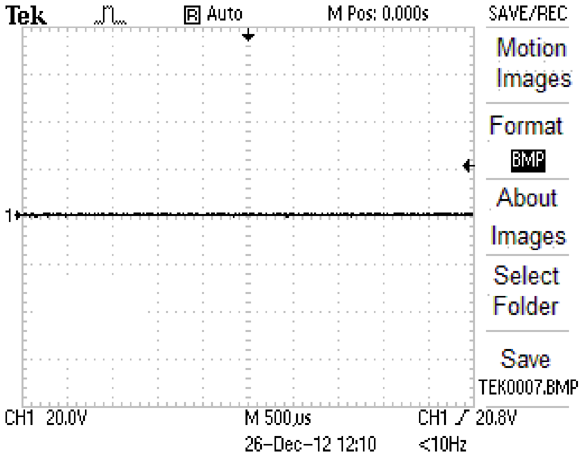

Figure15: Voltage waveform of 7-segment display when not energized

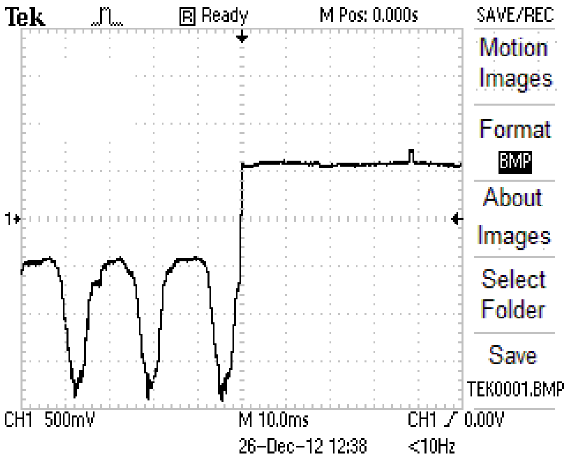

Figure16: Seven-segment display voltage waveform at power-on.

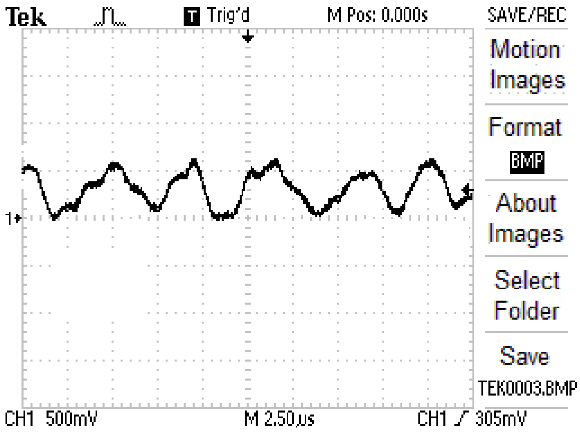

Figure17: Voltage waveform during diode conduction

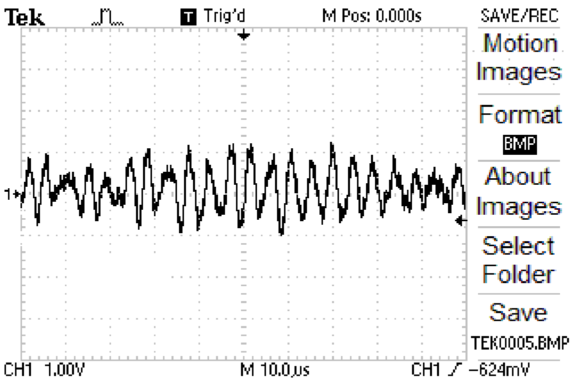

Figure18: Ceramic capacitor and quartz oscillator voltage waveforms during hardware operation

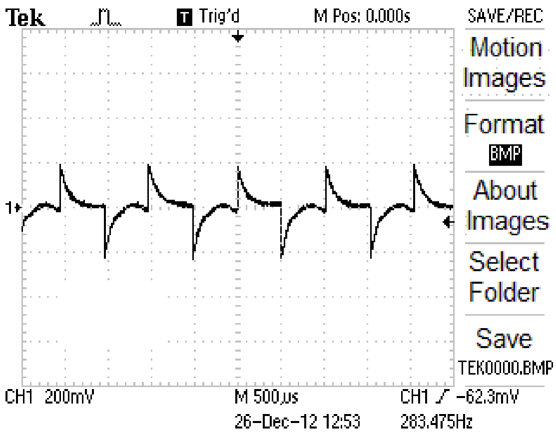

Figure19: Buzzer voltage waveform during hardware operation

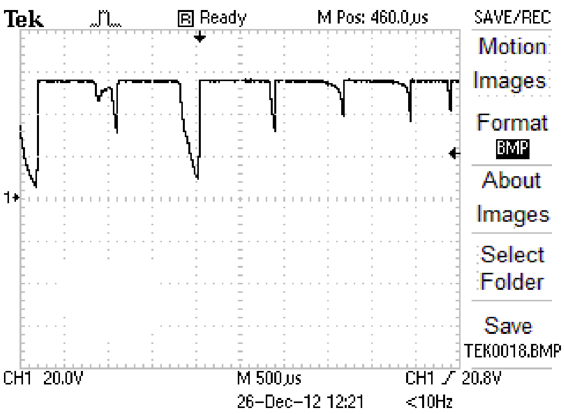

Figure20: Voltage waveforms during vibration SW switching when the system is on.

5.CONCLUSION

In this paper, an MCS-51 family single-chip microprocessor is used as the core of the circuit to satisfy the function of random number LED electronic dice. The results are used to verify that the designed circuit operates and meets the required functions.

Declaration by Authors

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Conflict of Interest: No conflicts of interest declared.

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