Practical Utility Software

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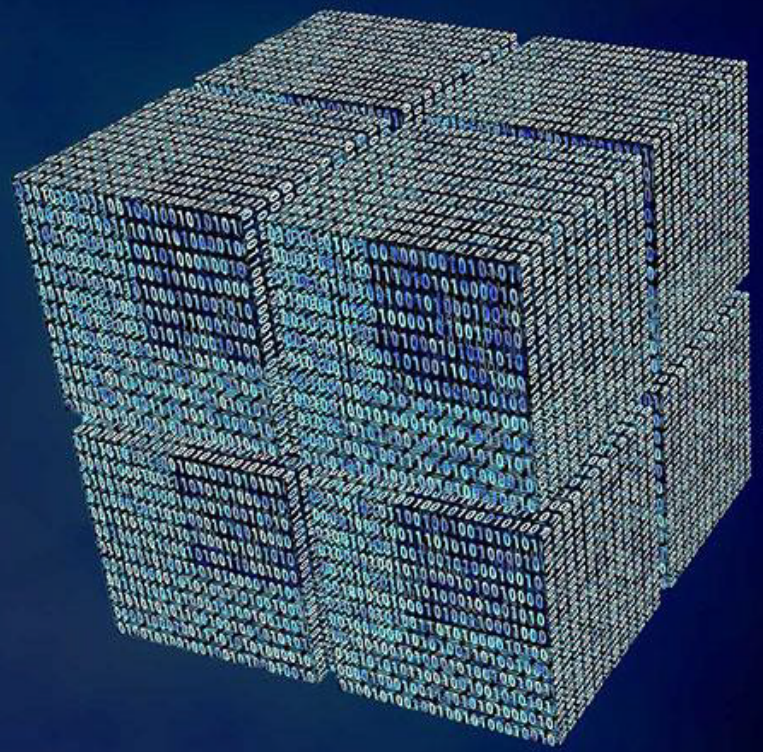
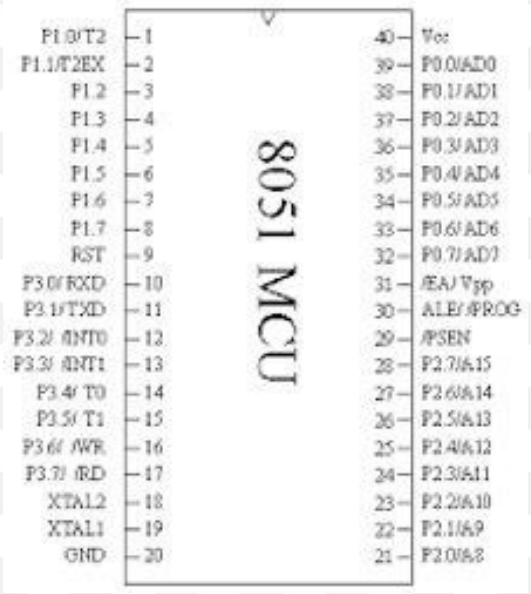
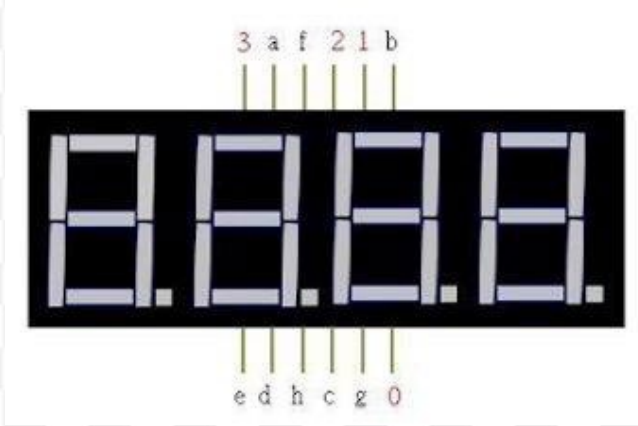
Contents

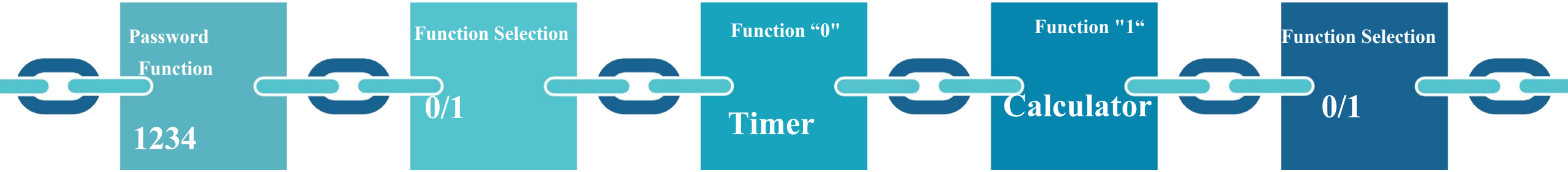


Hardware Structure





Feature Introduction



Password Function

Input via 8051 Keypad

Function Selection

Function Selection via Keypad

Timer

Countdown Initiation via Keypad Input

Calculator

Calculator Functions:
- **"F" key**: Addition (+)
- **"E" key**: Subtraction (-)
- **"D" key**: Multiplication (*)
- **"C" key**: Division (/)

Return to Function Selection

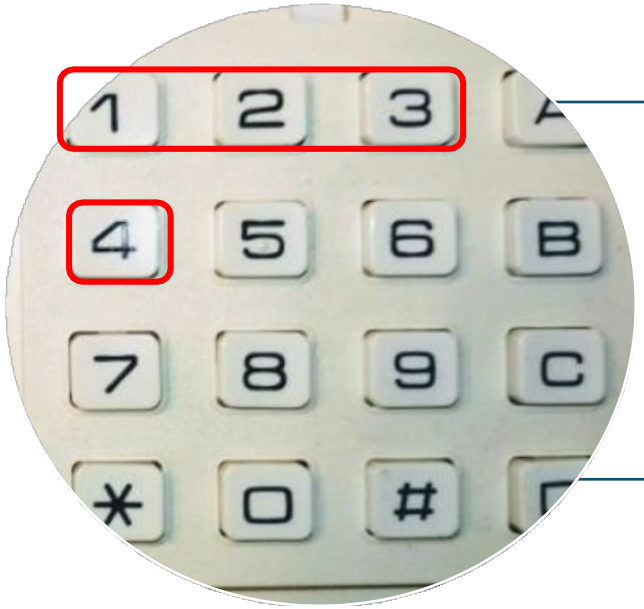
Return to Function Selection for Re-evaluation

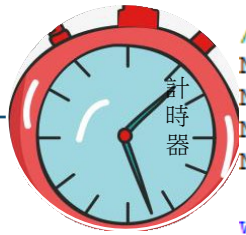
Password & Function Selection

```
void main(void) {
    while (1) {
        keyboard();                         //show th
        display2Num();

        if (c == 1) {                       //if pass
            pass();
              for (hold = 0; hold < 100; hold++)
                display2Num();
          jump:
```

```
void pass(void) {                   //if the codes ar
    if (N1 == 4 && N2 == 3 && N3 == 2 && N4 == 1) {
        N1 = S;
        N2 = S;
        N3 = v;
        N4 = f;
    }


}
```

Function Descriptions

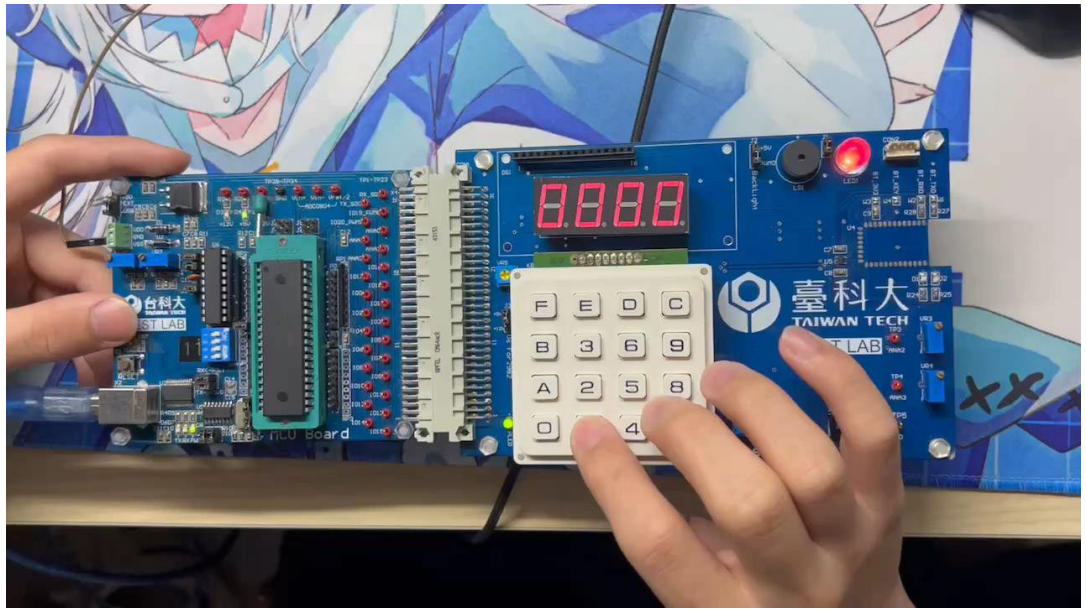




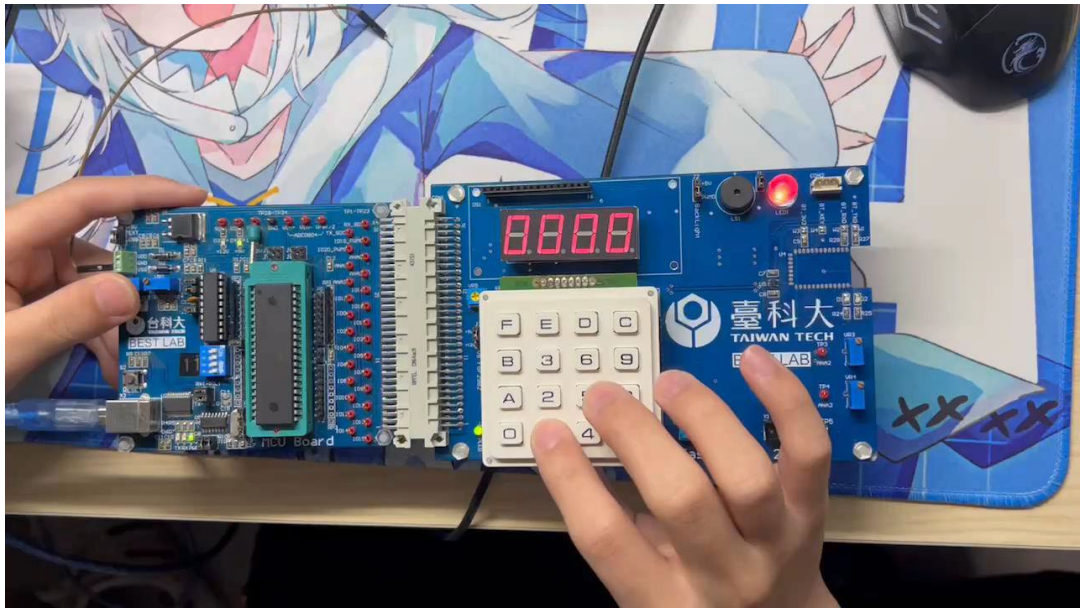

```
jump:

// Reset all digits to 0x00
N1 = 0x00;
N2 = 0x00;
N3 = 0x00;
N4 = 0x00;

while (1) {
    int key = read4x4();
    // Check for a new keypress
    if (key != -1) {
        // Check if keypress is not regis
        if (!keypress) {

          while(1){
            N4 = decodekey[key];
            buffer1 = N4;
            display2Num();
            switch (buffer1) {
```

Function Demonstration

Password Correct



Password Incorrect



Timer

Function "0" - Timer Overview

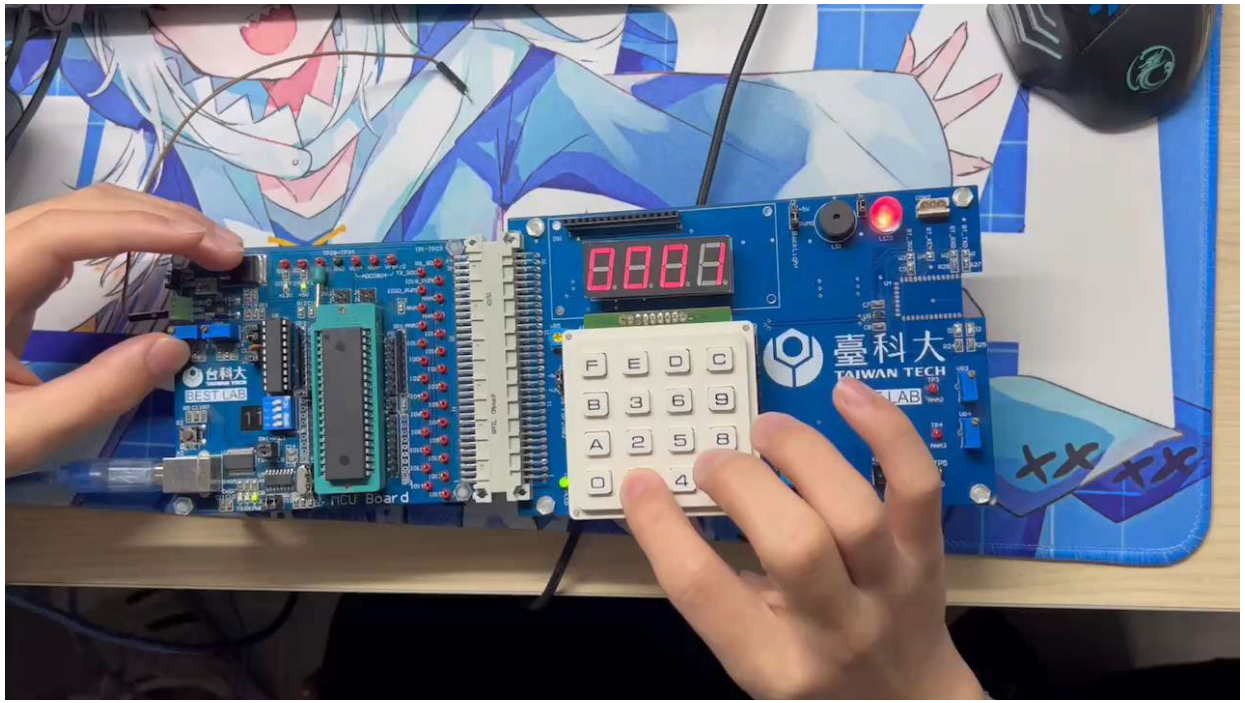
Operation Flow: Pressing the N4 key selects **Function 0 (Timer)**, triggering the **keyboard()** subroutine for time input (e.g., "0300" for 3 minutes), then activates the **count_down_timer()** subroutine to execute the countdown in MM:SS format with real-time display updates until completion.

```
case 0:
    c = 0;
    //count = 0;
    while(1){
      keyboard();
      display2Num();
      if(c == 1)
        count_down_timer()
      if(timecheck == 1){
        N4 = 0x00;
        goto jump;
      }
      break;
    }
    break;
```

```
void count_down_timer(void){          //counter
    while(1){

    if(N1 > 0) {
      while(N1 > 0){
      N1--;
      Delay_ms(1);
      display2Num();
      }
    } else if(N2 > 0) {
      N2--;
      N1 = 9;
      display2Num();
    } else if(N3 > 0) {
      N3--;
      N2 = 9;
      N1 = 9;
      display2Num();
    } else if(N4 > 0) {
      N4--;
      N3 = 9;
      N2 = 9;
      N1 = 9;
      //display2Num();
    }

    Delay_ms(1);
    if(N1 == 0 && N2 == 0 && N3 == 0 && N4 == 0)
      timecheck += 1;
      break;
    }
  }
}
```

Function Demonstration

Countdown Function



Calculator

Function “1" - Calculator Overview

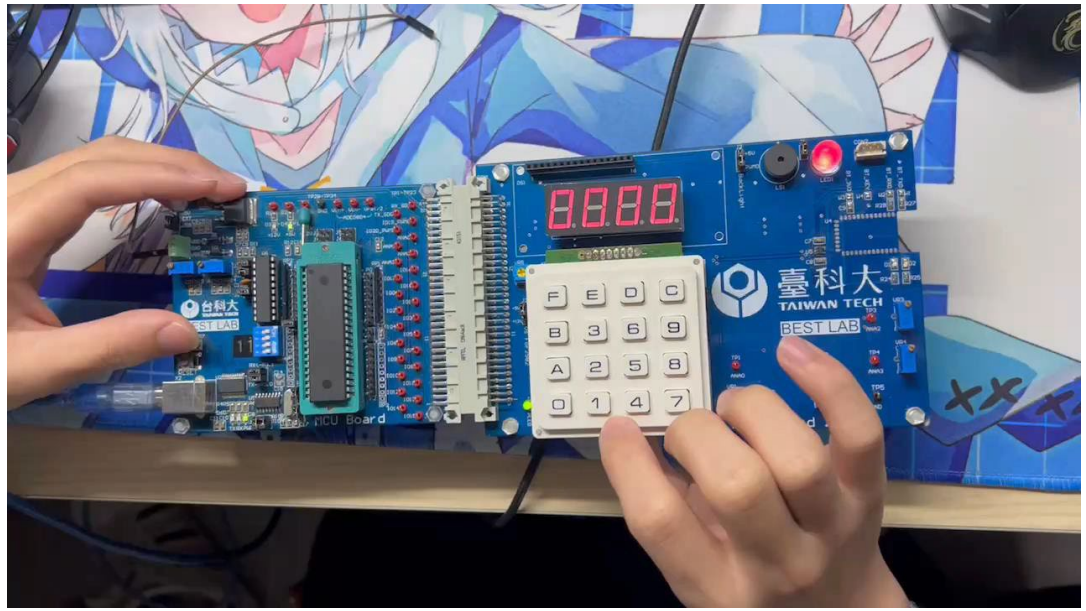
Operation Flow: Pressing the N4 key selects **Function 1 (Calculator)**, invoking the **multiplier()** subroutine for dual number input (e.g., "5" and "3"), then pressing N4 again enables operation selection via "F" (addition), "E" (subtraction), "D" (multiplication), or "C" (division), with the computed result passed to the **counter()** subroutine for final output display.

```
case 1:
    N1 = 0x00;
    N2 = 0x00;
    N3 = 0x00;
    N4 = 0x00;
    while(1){
      multiplier();
      if(calculate_check == 1
        N4 = 0x00;
        display2Num();
        goto jump;
      }
      break;
    }
    break;
case 2:
```

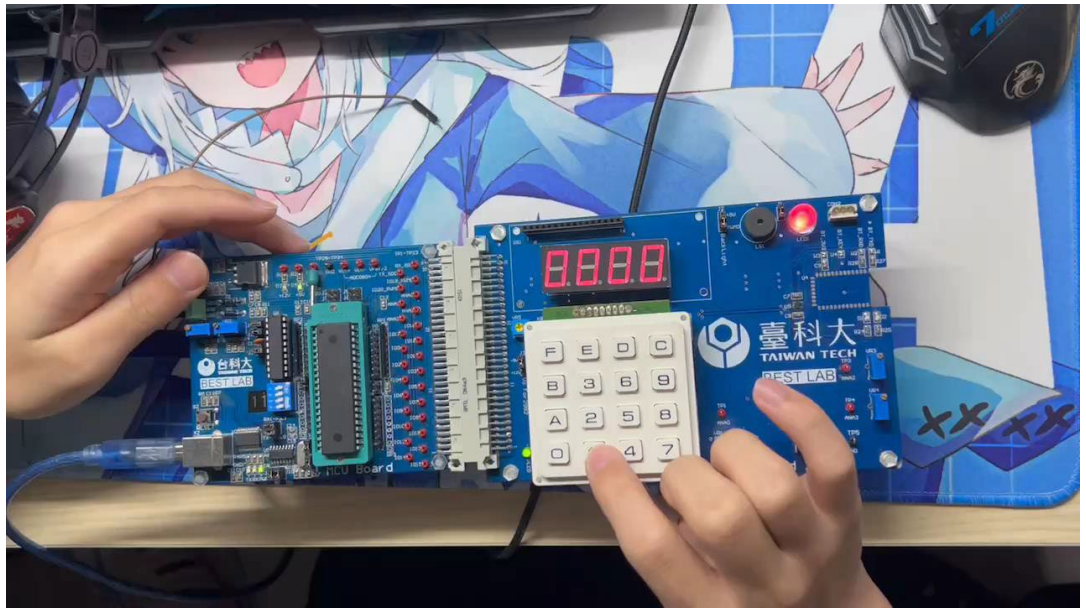
```
    break;
}
N1=N2=N3=N4=0;                          //Prompt
display2Num();
while(1){                               //this
c = 0;
keyboard();
b = N1+N2*10+N3*100+N4*1000;
display2Num();
operand2  = b;
if(b/1000 != 0)
  break;
}
N1=N2=N3=N4=0;                          //Prompt
display2Num();
while (1) {                             //to de
  int key = read4x4();
  if (key != -1) {
    // Check if keypress is not registered
    if (!keypress) {
      //count = c = 0;
      N4 = decodekey[key];
      casechose = N4;
      //display2Num();
      switch (casechose) {
        case 15://+
            result = operand1 + operand2;
            counter();
             break;
        case 14://-
```

Function Demonstration

Addition Function

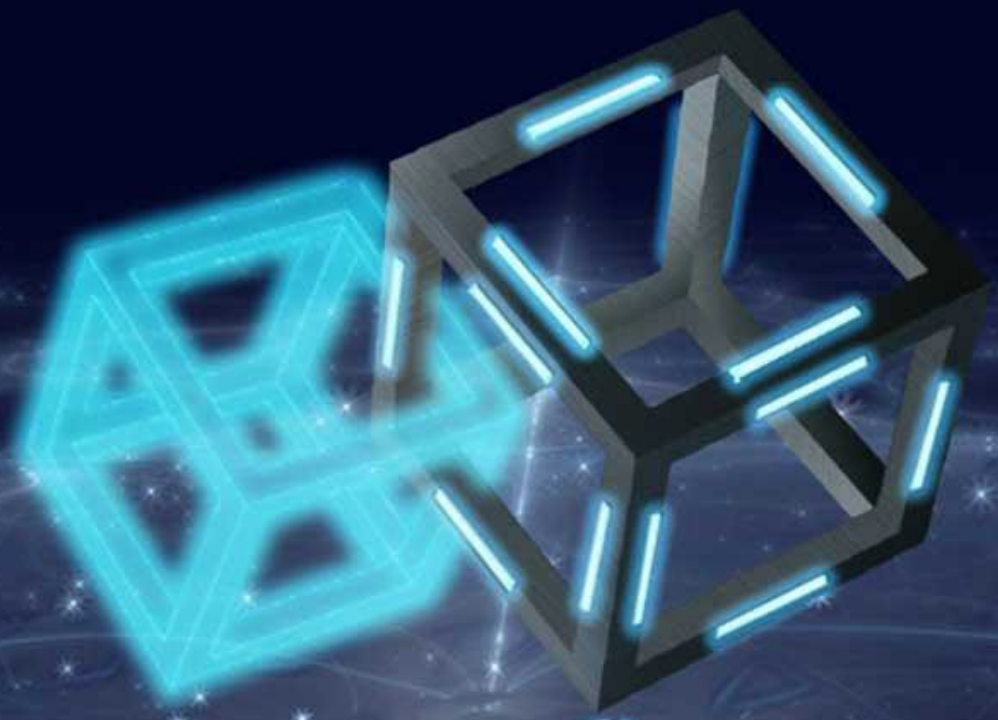


Division Function



Work Assignment

	Project
Jingze He	The project begins with **topic conceptualization** to define system specifications (password/timer/calculator) and hardware selection (8051 MCU, 4x4 keypad, 7-segment display). Next, **7-segment display programming** implements digit encoding (0-9) and multiplexed output, while **keypad programming** develops row-column scanning with debounce logic. The **integration phase** combines subsystems with rigorous I/O testing. For core functionalities, **countdown programming** adds MM:SS timing with alarm triggers, and **calculator programming** handles arithmetic operations (+, -, *, /) including divide-by-zero checks. Finally, **report compilation** documents all design stages with schematics, flowcharts, and validation data.
Chiajui Lee	The project begins with **topic conceptualization** to define objectives and scope, followed by **LCD research** to understand its interface protocols and control methods. Next, **LCD countdown programming** implements a timer function with real-time display updates, while **LCD calculator programming** develops arithmetic operations (+, -, *, /) with result output. The **integration phase** combines all modules, ensuring seamless interaction between hardware and software. Finally, **report writing** documents the entire development process, including design choices, code snippets, test results, and conclusions.



THANK YOU