An-Najah National University
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جامعة النجاح الوطنية
كلية الهندسة وتكنولوجيا المعلومات

Computer Engineering Department
Microcontroller Lab (10636496)

Report Grading Sheet

Instructor Name: Hikmat Darawsheh	**Experiment: 4**
Academic Year: 2024/2025	**Performed on:**
Semester:	**Submitted on:**
Student Names:	
1- Sadeen Hawash	2- Walaa Ashqar
3-	4-
5-	6-

Evaluation Criterion	CLO	Grade	Points
Abstract and Aims Aims and idea of the experiment are clearly stated in simple words		10	
Introduction, Apparatus and Procedures Introduction is complete and well-written, all grammar/spelling correct, Appropriate background information related to the principles of the experiment is provided. The list of apparatus and procedures are also provided		15	
Experimental Results, Calculations and Discussion Results analyzed correctly. Experimental findings adequately and specifically summarized, in graphical, tabular, and/or written form. Comparison of theoretical predictions to experimental results, including discussion of accuracy and error analysis as needed.		50	
Conclusions Conclusions summarize the major findings from the experimental results with adequate specificity. Highlighting the most important results		15	
Appearance Title page is complete, page numbers applied, content is well organized, correct spelling, fonts are consistent, good visual appeal. You have also to use reference for the information you provide		10	
Total		100	

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Abstract

The purpose of this experiment is to familiarize the students with the Bluetooth interface (PmodBT2) and how to communicate it with the microcontroller.

Introduction

Using the UART module from the last experiment, we will expand on our understanding of asynchronous communication in this experiment. To establish communication between the PC and the mobile phone, we will integrate both the USART0 and USART1 modules of the PIC kit. This will make it possible for us to communicate between the two devices by using the PIC kit as a mediator for data transmission.

Materials

- Material: ChipKITTM Pro MX7 processor board with USB cable.
- Microchip MPLAB R X IDE.
- MPLAB R XC32++ Compiler.
- MPLAB Harmony Framework.
- Serial Bluetooth terminal in mobile.
- Tera Term application.

Methods

The two buffers in the uart0 PC and uart1 (Bluetooth) mobile must first be checked. We should read any data that one of them has and transfer it to another module. We utilize a flag to determine how the module stores data and where it should be conveyed. The microcontroller read data from UART0 if the flag value is 1. If the flag value is 2, it indicates that the microcontroller has read data from UART1, hence we should send it to UART1.And it supposed to be sent to UART0.

Experimental Results

First, we initiate the states in the app.h file as shown:

```
typedef enum
{
    APP_STATE_INIT=0,
    APP_STATE_SERVICE_TASKS,
    TX0_STATE,
    TX2_STATE,
    RX0_STATE,
    RX2_STATE,

} APP_STATES;
```

Then we initiate the variables in app.h and give its initial value in app.c in the init state as shown:

```
typedef struct
{
   APP_STATES state;
   char byte1;
   char byte2;
   char*buffer; //part 2
   char*buffer2; //part2

} APP_DATA;

case APP_STATE_INIT: {
        if (appInitialized) appData.state = APP_STATE_SERVICE_TASKS;
        break;
}
int i, k, j, x; //part 2
```

Then we write the code for the Receive state and we check also if the text was LED1 and if it was true then turn led1 (RG12) on:

```
 case APP_STATE_SERVICE_TASKS: {
        if(!DRV_USART0_ReceiverBufferIsEmpty())
           appData.state=RX0_STATE;
        if(!DRV_USART1_ReceiverBufferIsEmpty())
           appData.state=RX2_STATE;
        break;
 }
 case RX0_STATE: {
        appData.byte1=DRV_USART0_ReadByte();
        appData.state=TX0_STATE;
        break;
  }
```

```
case TX0_STATE: {
        DRV_USART1_WriteByte(appData.byte1);
        appData.state=APP_STATE_SERVICE_TASKS;
        break;
}
 case RX2_STATE: {
        appData.byte2=DRV_USART1_ReadByte();
        appData.state=TX2_STATE;
        break;
 }
  case TX2_STATE: {
        DRV_USART0_WriteByte(appData.byte2);
        appData.state=APP_STATE_SERVICE_TASKS;
        break;
   }
```

Make changes on the previous states so if the button is pressed then turn on a led and then send a message to both the mobile and Tera Term:

```
  case RX0_STATE: {
        appData.byte1=DRV_USART0_ReadByte();
        if(appData.byte1=='\n' || appData.byte1=='\r' ){
           appData.buffer[i]='\0';
           i=0;
           appData.state= TX0_STATE;
        }
        else {
           appData.buffer[i++]=appData.byte1;
           appData.state=APP_STATE_SERVICE_TASKS;
        }
        break;
     }
```

```
case TX0_STATE: {
      for(j=0;appData.buffer[j]!='\0';j++)
         DRV_USART1_WriteByte(appData.buffer[j]);
      if(strcmp(appData.buffer,"led1")==0){
         LATG=0x1000;
         DRV_USART0_WriteByte('\n');
      }
      else if(strcmp(appData.buffer,"led2")==0){
         LATG=0x2000;
         DRV_USART0_WriteByte('\n');
      }
      else if(strcmp(appData.buffer,"led3")==0){
         LATG=0x4000;
         DRV_USART0_WriteByte('\n');
      }
      else if(strcmp(appData.buffer,"led4")==0){
         LATG=0x8000;
         DRV_USART0_WriteByte('\n');
      }
      else if(strcmp(appData.buffer,"led0")==0){
         LATG=0x0000;
         DRV_USART0_WriteByte('\n');
      }
      appData.state=APP_STATE_SERVICE_TASKS;
      break;
}
case RX2_STATE: {
      appData.byte2=DRV_USART1_ReadByte();
      if(appData.byte2=='\n' || appData.byte2=='\r' ){
         appData.buffer2[k]='\0';
         k=0;
         appData.state= TX2_STATE;
      }else {
         appData.buffer2[k++]=appData.byte2;
         appData.state=APP_STATE_SERVICE_TASKS;
      }
      break;
  }
```

```
case TX2_STATE: {
        for(x=0;appData.buffer2[x]!='\0';x++)
           DRV_USART0_WriteByte(appData.buffer2[x]);
        if(strcmp(appData.buffer2,"led1")==0){
           LATG=0x1000;
           DRV_USART1_WriteByte('\n');
        }
        else if(strcmp(appData.buffer2,"led2")==0){
           LATG=0x2000;
           DRV_USART1_WriteByte('\n');
        }
        else if(strcmp(appData.buffer2,"led3")==0){
           LATG=0x4000;
           DRV_USART1_WriteByte('\n');
        }
        else if(strcmp(appData.buffer2,"led4")==0){
           LATG=0x8000;
           DRV_USART1_WriteByte('\n');
        }
        else if(strcmp(appData.buffer2,"led0")==0){
           LATG=0x0000;
           DRV_USART1_WriteByte('\n');
        }
        appData.state=APP_STATE_SERVICE_TASKS;
        break;
}
```

Discussion

We tested sending a string from the PC to the mobile phone and then from the phone to the PC after configuring the code and connecting the phone to the Bluetooth module, and it worked and also sending a text (LED1) from either device will turn led1 on (RG12) and also when we press a button (RG6) it will turn LED1 on and send a message to both devices telling them that
led1 is on.

Conclusion

Through this experiment, we were able to construct a two-way chat system by concurrently using the USART0 and USART1 modules. We can establish a communication link to exchange messages between the mobile phone and the PC.