

EXPERIMENT 11

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BATCH: EA-3

SUBJECT: ESRTOS

AIM: To Simulate Real Time Clock for LPC2129 in KEIL UVision with and Without UART.

Theory: A real-time clock (RTC) is an IC that keeps an updated track of the current time.

RTCs are a very common element. They are present in everything from the instrument clusters and infotainment systems in automotive applications to house metering. RTCs frequently integrate into other devices—for example, the broadband communications ICs used in car radios.

They usually interface to a microprocessor circuit by an SPI or I²C serial bus, and may contain a number of other functions like backup memory, a watchdog timer for supervising the microprocessor and countdown timers to generate real time event. Some RTCs include second or minute interrupt outputs and are even clever enough to account for leap years

RTCs need continuous power and must have extremely low power consumption. Most RTCs use the digital circuits supply when the device is on and active, but switch over to a continuously connected power source when the circuit is powered down. This power source

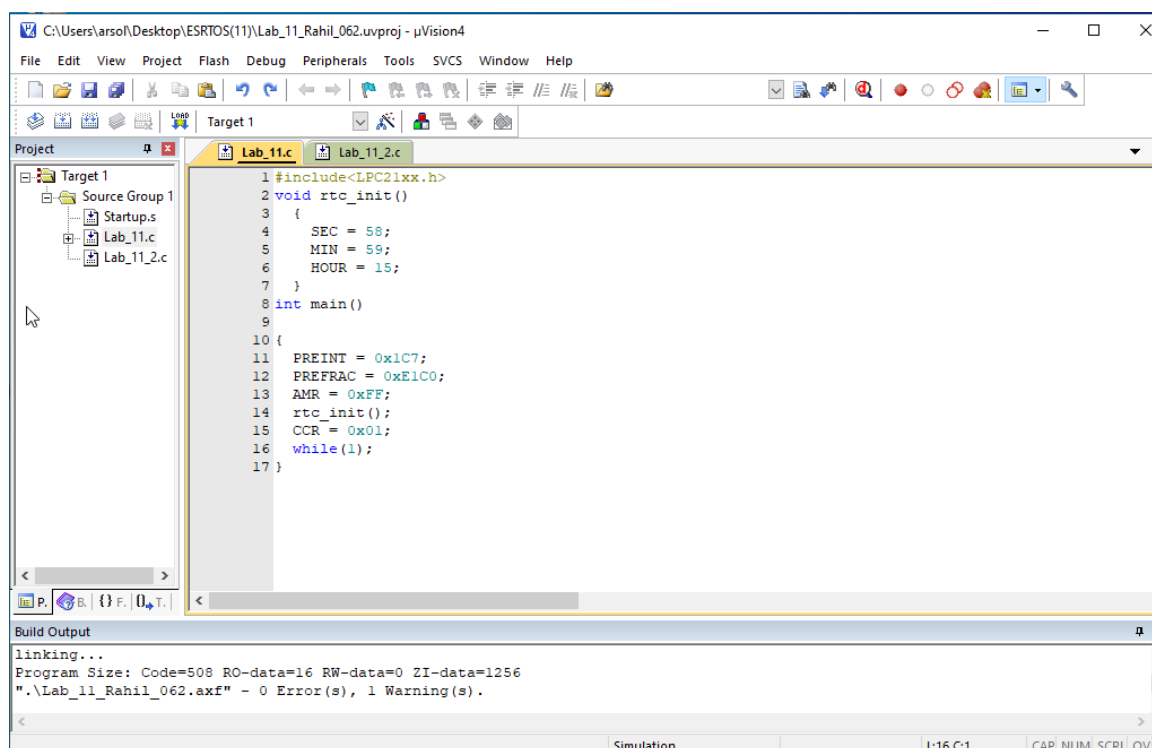
could be a dedicated battery, a charged supercapacitor or a separate power supply from mains.

Many RTCs can detect this change-over and go into an ultra-low power state where they power down all circuitry except those essential for maintaining the clock in order to conserve battery life. RTCs can also include alarm functions – set times that when reached trigger the RTC to drive an output that wakes the processor up.

Code 1: without UART

```
#include<LPC21xx.h>
void rtc_init()
{
    SEC = 58;
    MIN = 59;
    HOUR = 15;
}
int main()
{
    PREINT = 0x107;
    PREFRAC = 0xE100;
    AMR = 0xFF;
    rtc_init();
    CCR = 0x01;
    while(1);
}
```

Screenshot of the Code:



Screenshot of the Output of the Program:

The screenshot shows the uVision4 IDE interface. The main window displays the assembly code for the program, with the following code visible:

```
11: PREINT = 0x1C7;  
0x00000124 E59F0030 LDR R0, [PC, #0x00000124]  
0x00000128 E59F1028 LDR R1, [PC, #0x00000128]  
0x0000012C F1C10A80 STRH R0, [R1, #0x0000012C]
```

The Real Time Clock configuration dialog box is open, showing the following settings:

- Clock Control:** CCR: 0x01, ☒ CLKEN, ☐ CTRCST.
- Clock Tick Count:** CTC: 0x2D40.
- Interrupt Location:** ILR: 0x00, ☐ RTCCIF, ☐ RTCALF.
- Counter Increment Interrupt:** CIIR: 0x00, ☐ IMSEC, ☐ IMDOM, ☐ IMMON, ☐ IMMIN, ☐ IMDOW, ☐ IMYEAR, ☐ IMHOUR, ☐ IMDOY.
- Alarm Mask:** AMR: 0xFF, ☒ AMRSEC, ☒ AMRDOM, ☒ AMRMON, ☒ AMRMIN, ☒ AMRDOW, ☒ AMRYEAR, ☒ AMRHOUR, ☒ AMRDOY.
- Time Counter:** SEC: 58, DOM: 0, MONTH: 0, MIN: 0, DOW: 0, YEAR: 0, HOUR: 16, DOY: 0.
- Consolidated Time:** CTIME0: 0x0010003A, CTIME1: 0x00000000, CTIME2: 0x00000000.
- Alarm:** ALSEC: 0, ALDOM: 0, ALMON: 0, ALMIN: 0, ALDOW: 0, ALYEAR: 0, ALHOUR: 0, ALDOY: 0.
- Prescaler:** PREINT: 0x01C7, PREFRAC: 0x61C0, 1s Tick (s): 0.20043786.

The Command window shows the status: "Real-Time Agent: Not in target". The simulation time is 300.04500008 sec.

The screenshot shows the uVision4 IDE interface. The main window displays the assembly code for the program, with the following code visible:

```
11: PREINT = 0x1C7;  
0x00000124 E59F0030 LDR R0, [PC, #0x00000124]  
0x00000128 E59F1028 LDR R1, [PC, #0x00000128]  
0x0000012C F1C10A80 STRH R0, [R1, #0x0000012C]
```

The Real Time Clock configuration dialog box is open, showing the following settings:

- Clock Control:** CCR: 0x01, ☒ CLKEN, ☐ CTRCST.
- Clock Tick Count:** CTC: 0x0B64.
- Interrupt Location:** ILR: 0x00, ☐ RTCCIF, ☐ RTCALF.
- Counter Increment Interrupt:** CIIR: 0x00, ☐ IMSEC, ☐ IMDOM, ☐ IMMON, ☐ IMMIN, ☐ IMDOW, ☐ IMYEAR, ☐ IMHOUR, ☐ IMDOY.
- Alarm Mask:** AMR: 0xFF, ☒ AMRSEC, ☒ AMRDOM, ☒ AMRMON, ☒ AMRMIN, ☒ AMRDOW, ☒ AMRYEAR, ☒ AMRHOUR, ☒ AMRDOY.
- Time Counter:** SEC: 51, DOM: 0, MONTH: 0, MIN: 0, DOW: 0, YEAR: 0, HOUR: 16, DOY: 0.
- Consolidated Time:** CTIME0: 0x00100033, CTIME1: 0x00000000, CTIME2: 0x00000000.
- Alarm:** ALSEC: 0, ALDOM: 0, ALMON: 0, ALMIN: 0, ALDOW: 0, ALYEAR: 0, ALHOUR: 0, ALDOY: 0.
- Prescaler:** PREINT: 0x01C7, PREFRAC: 0x61C0, 1s Tick (s): 0.20043786.

The Command window shows the status: "Real-Time Agent: Not in target". The simulation time is 264.71583333 sec.

Code 2: with UART

Main:

```
#include<lpc21xx.h>
#include "header.h"
int main(){
    int a;
    Uart_Init();
    rtc_init();
    while(1){
        Uart_Data(HOUR/10+'0');
        Uart_Data(HOUR%10+'0');
        Uart_Data(':');
        Uart_Data(MIN/10+'0');
        Uart_Data(MIN%10+'0');
        Uart_Data(':');
        Uart_Data(SEC/10+'0');
        Uart_Data(SEC%10+'0');
        Uart_Data('\n');
    }
}
```

Header:

```
void Uart_Init(void);
void Uart_Data(unsigned char data);
void Uart_String(unsigned char *dat);
void rtc_init(void);
```

UART:

```
#include<lpc21xx.h>
#include "header.h"
void Uart_Init()
{
    PINSEL0 = PINSEL0 | 0x00000005;
    U0LCR= 0x9B;
    U0DLL= 0x62;
    U0DLM= 0x00;
    U0LCR= 0x1B;
}
void Uart_Data(unsigned char data){
    U0THR = data;
    while((U0LSR & 0X20)!= 0X20);
}
void Uart_String(unsigned char *dat){
    while(*dat!='\0') {
        Uart_Data(*dat);
        dat++;
    }
}
```

RTC:

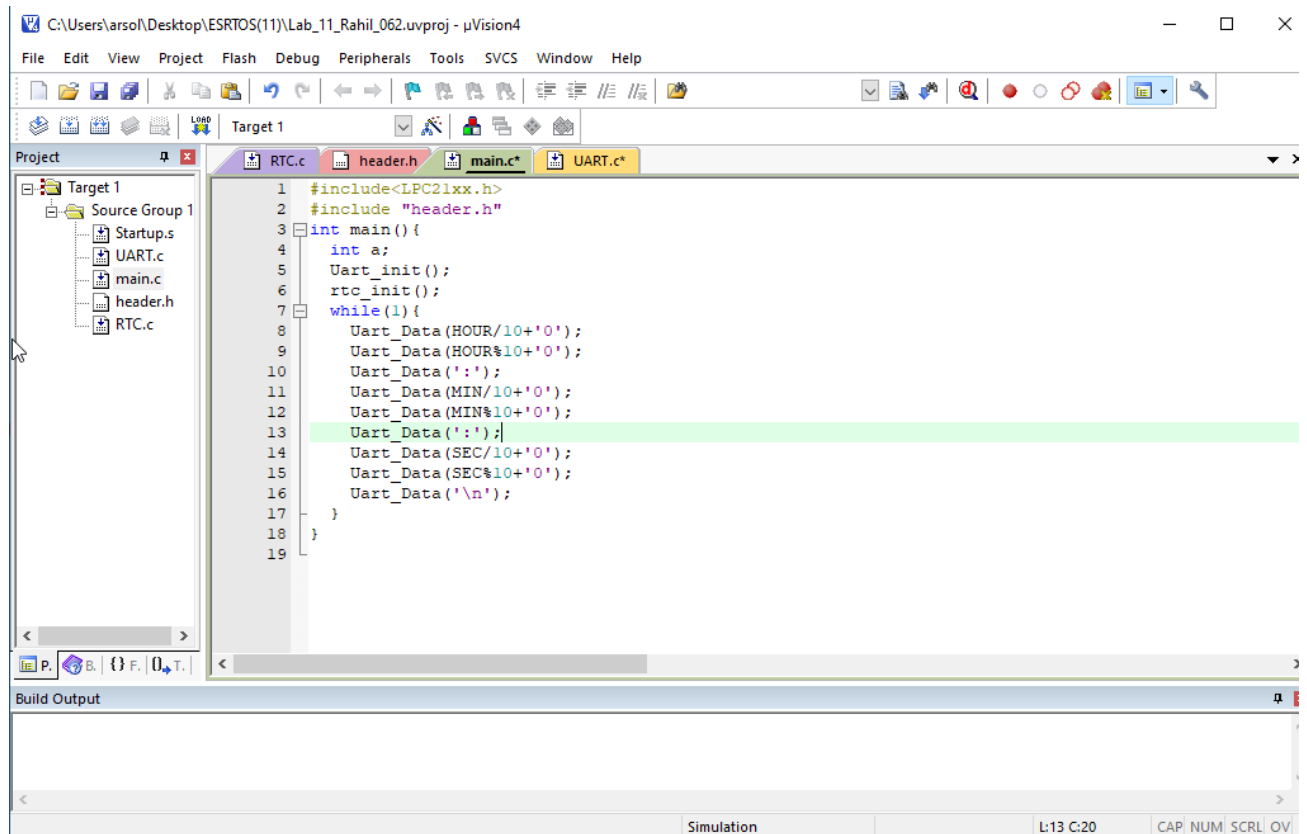
```
#include<LPC21xx.h>
void rtc_init()
```

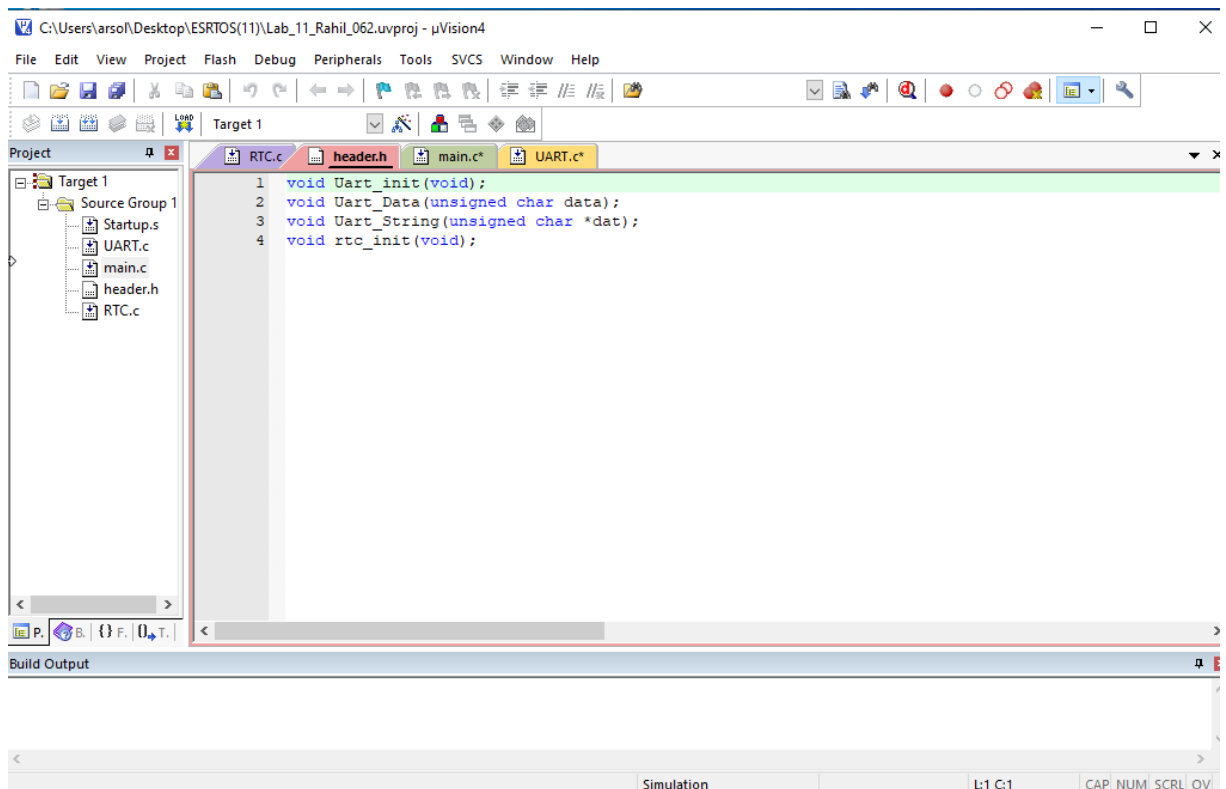
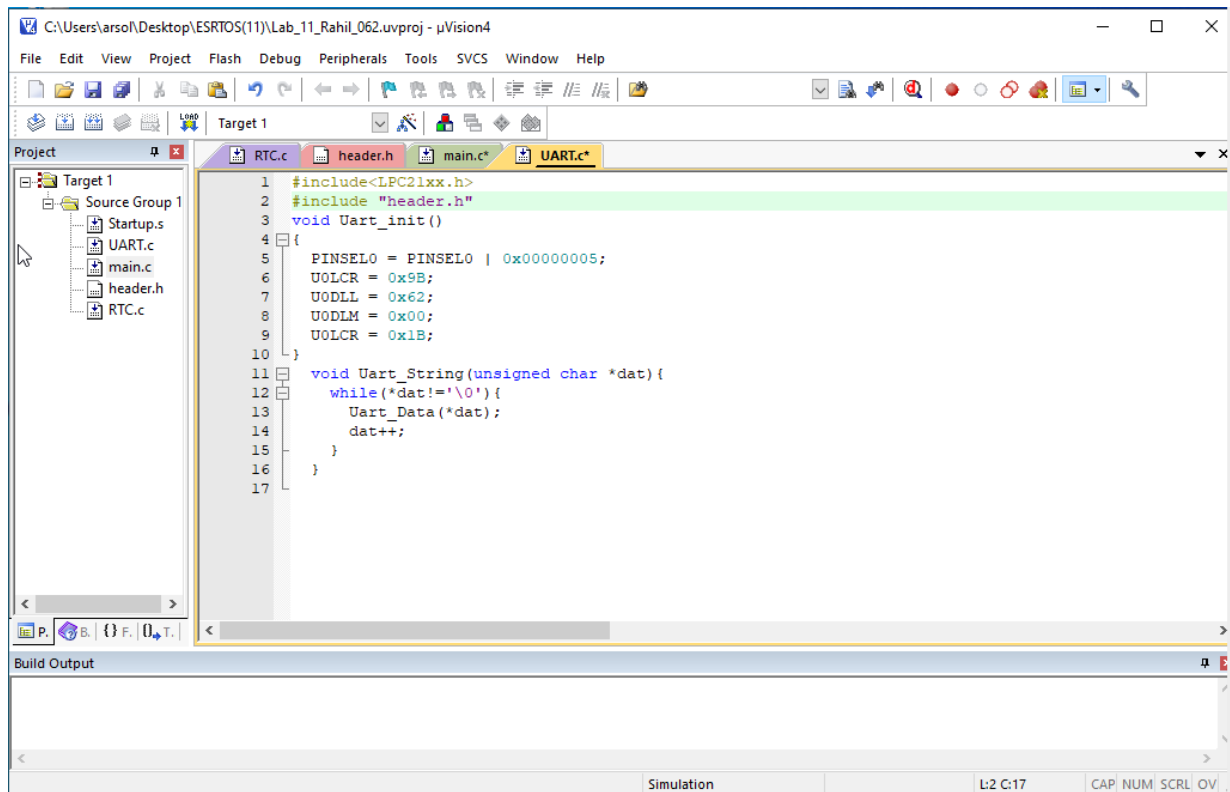
```

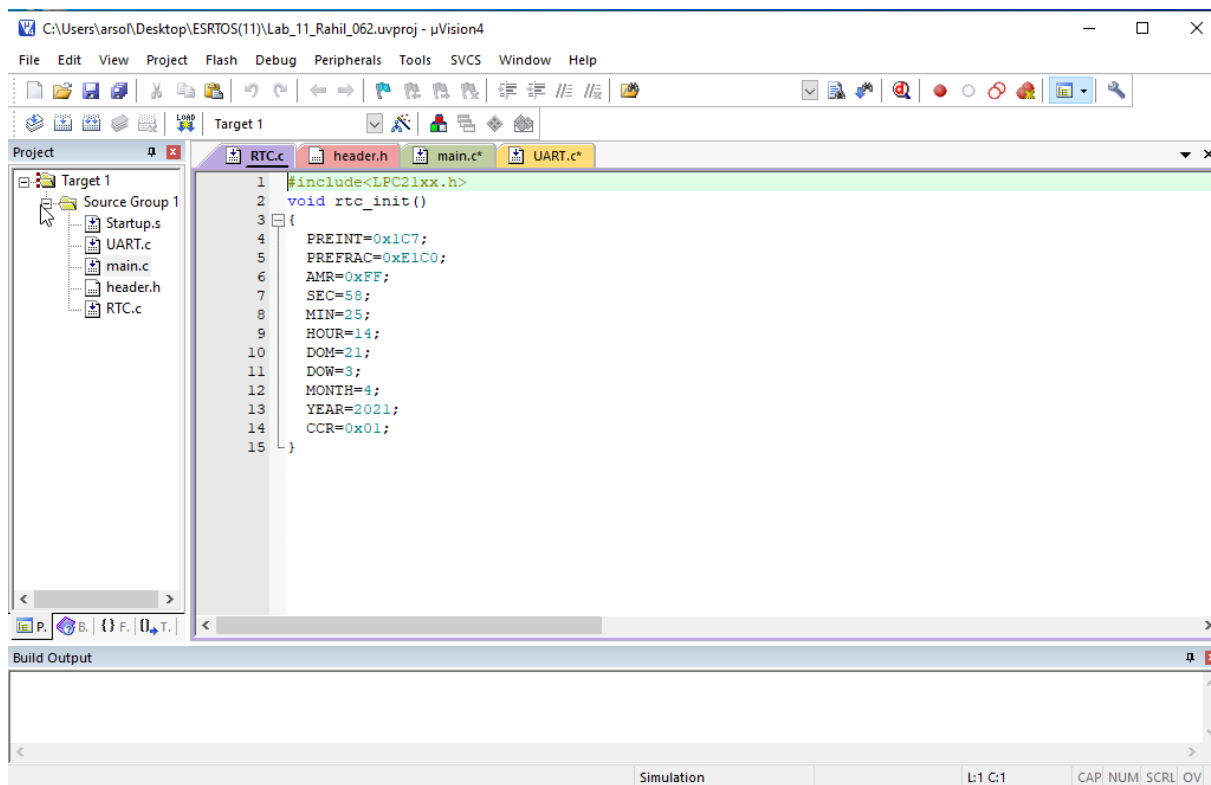
{
PREINT=0x1C7;
PREFRAC=0xE1C0;
AMR=0xFF;
SEC=58;
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SEC=58;
MIN=25;
HOUR=14;
DOM=21;
DOW=3;
MONTH=4;
YEAR=2021;
CCR=0x01;
}

```

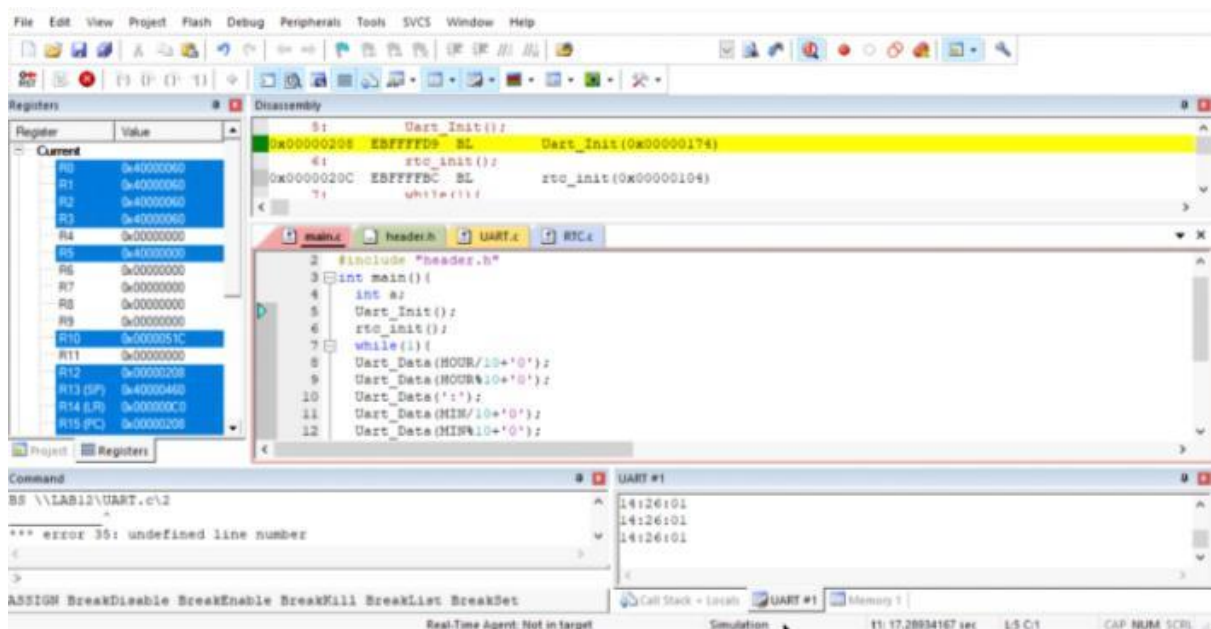
Screenshot of the Code:







Screenshot of the Output of the Program:



CONCLUSION: From this experiment we studied about the operation of RTCs with and without UART.