31.Time_Clock

Introduction

In this lesson, you will learn how to use the DS1302 real-time clock module to get the current date and time.

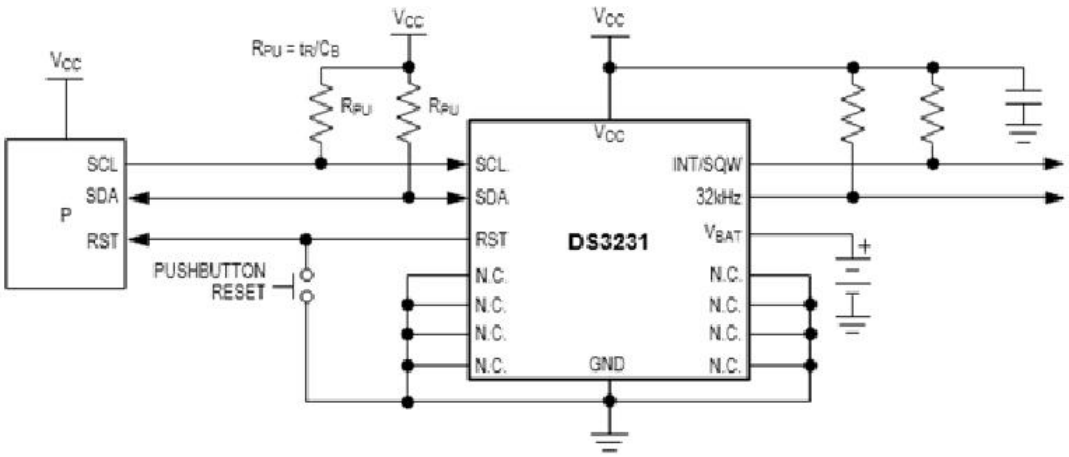
Hardware Required

- ✓ 1 * Raspberry Pi
- ✓ 1 * T-Extension Board
- ✓ 1 * 40-pin Cable
- ✓ 1 * DS3231 RTC Module
- ✓ Several Jumper Wires
- ✓ 1 * Breadboard

Principle

DS3231

The DS3231 is a simple time-keeping chip. It has an integrated battery, so the clock can continue keeping time even when unplugged.



The DS3231 is a low-cost, highly accurate Real Time Clock which can maintain hours, minutes and seconds, as well as, day, month and year information. Also, it has automatic compensation for leap-years and for months with fewer than 31 days.

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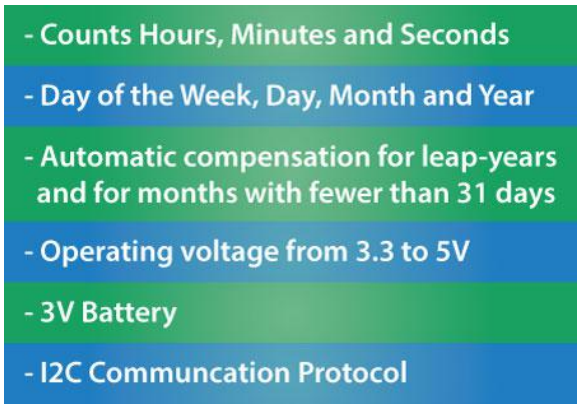

The module can work on either 3.3 or 5 V which makes it suitable for many development platforms or microcontrollers. The battery input is 3V and a typical CR2032 3V battery can power the module and maintain the information for more than a year.

The module uses the I2C Communication Protocol which makes the connection to the Arduino Board very easy.

Schematic Diagram

Raspberry Pi	T-Board Name	DS1302 RTC
GPI00	GPI17	SCL
GPI01	GPI18	SDA
GPI02	GPI27	RST
5V	5V0	VCC
GND	GND	GND

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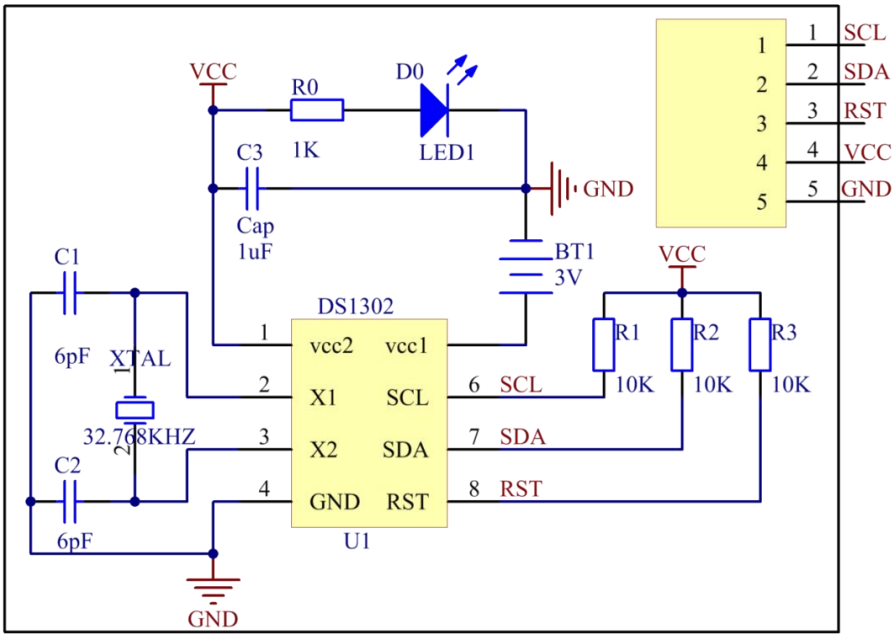
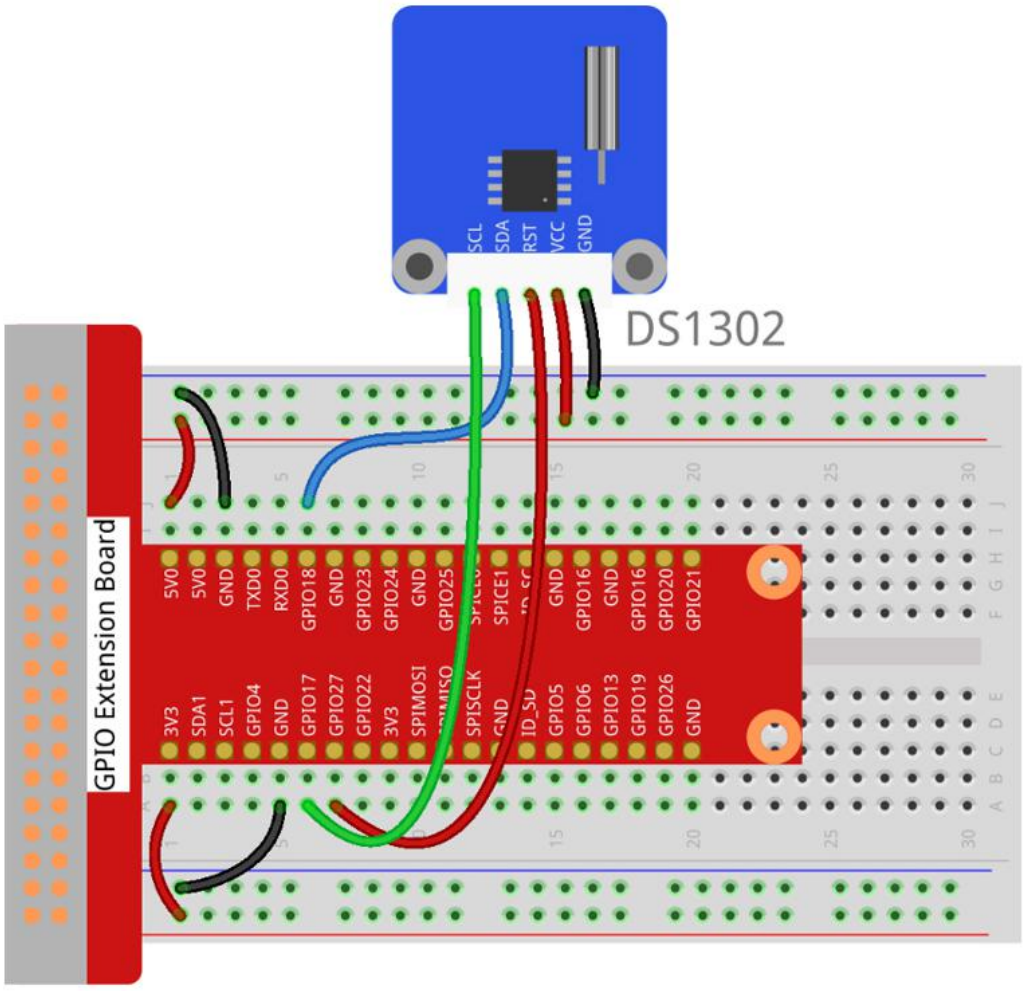


Experimental Procedures

Step 1: Build the circuit.



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For C Language Users

Step 2: Change directory.

```
cd /home/pi/REXQualis_Raspberry_Pi_Complete_Starter_Kit/C/31.Time_Clock
```

Step 3: Compile the code.

```
gcc 31.Time_Clock.c -o Time_Clock.out -lwiringPi -lwiringPiDev
```

Step 4: Set up time by:

```
sudo ./Time_Clock.out –sdsc
```

Set the year, month, and day to: YYMMDD

Set the hours, minutes, and seconds to: HHMMSS

Day of the week (Sunday is 0)

Step 5: Run the executable file above.

```
sudo ./Time_Clock.out
```

Code

```
include <stdio.h>
#include <stdlib.h>
#include <stdint.h>
#include <string.h>
#include <time.h>

#include <wiringPi.h>
#include <ds1302.h>

// Register defines

#define  RTC_SECS    0
#define  RTC_MINS    1
#define  RTC_HOURS      2
```

```
#define  RTC_DATE   3
#define  RTC_MONTH     4
#define  RTC_DAY         5
#define  RTC_YEAR   6
#define  RTC_WP          7
#define  RTC_TC          8
#define  RTC_BM         31

static unsigned int masks [] = { 0x7F, 0x7F, 0x3F, 0x3F, 0x1F, 0x07, 0xFF } ;

// bcdToD: dToBCD:
static int bcdToD (unsigned int byte, unsigned int mask)
{
   unsigned int b1, b2 ;
   byte &= mask ;
   b1 = byte & 0x0F ;
   b2 = ((byte >> 4) & 0x0F) * 10 ;
   return b1 + b2 ;
}

static unsigned int dToBcd (unsigned int byte)
{
   return ((byte / 10) << 4) + (byte % 10) ;
}

// ramTest:
static int ramTestValues [] =
   { 0x00, 0xFF, 0xAA, 0x55, 0x01, 0x02, 0x04, 0x08, 0x10, 0x20, 0x40, 0x80, 0x00,
0xF0, 0x0F, -1 } ;
```

```
static int ramTest (void)
{
   int addr ;
   int got ;
   int i = 0 ;
   int errors = 0 ;
   int testVal ;

   printf ("DS1302 RAM TEST\n") ;

   testVal = ramTestValues [i] ;

   while (testVal != -1)
   {
      for (addr = 0 ; addr < 31 ; ++addr)
         ds1302ramWrite (addr, testVal) ;

      for (addr = 0 ; addr < 31 ; ++addr)
         if ((got = ds1302ramRead (addr)) != testVal)
         {
     printf ("DS1302 RAM Failure: Address: %2d, Expected: 0x%02X, Got:
0x%02X\n",
            addr, testVal, got) ;
     ++errors ;
         }
      testVal = ramTestValues [++i] ;
   }
```

```
  for (addr = 0 ; addr < 31 ; ++addr)
    ds1302ramWrite (addr, addr) ;

  for (addr = 0 ; addr < 31 ; ++addr)
    if ((got = ds1302ramRead (addr)) != addr)
    {
      printf ("DS1302 RAM Failure: Address: %2d, Expected: 0x%02X, Got: 0x%02X\n",
          addr, addr, got) ;
      ++errors ;
    }

  if (errors == 0)
    printf ("-- DS1302 RAM TEST: OK\n") ;
  else
    printf ("-- DS1302 RAM TEST FAILURE. %d errors.\n", errors) ;

  return 0 ;
}

// setLinuxClock:
static int setLinuxClock (void)
{
  char dateTime [20] ;
  char command [64] ;
  int  clock [8] ;

  printf ("Setting the Linux Clock from the DS1302... ") ; fflush (stdout) ;
```

```
    ds1302clockRead (clock) ;

// [MMDDhhmm[[CC]YY][.ss]]

    sprintf (dateTime, "%02d%02d%02d%02d%02d%02d.%02d",
      bcdToD (clock [RTC_MONTH], masks [RTC_MONTH]),
      bcdToD (clock [RTC_DATE],   masks [RTC_DATE]),
      bcdToD (clock [RTC_HOURS], masks [RTC_HOURS]),
      bcdToD (clock [RTC_MINS],   masks [RTC_MINS]),
      20,
      bcdToD (clock [RTC_YEAR],   masks [RTC_YEAR]),
      bcdToD (clock [RTC_SECS],   masks [RTC_SECS])) ;

    sprintf (command, "/bin/date %s", dateTime) ;
    system (command) ;

    return 0 ;
}

// setDSclock:
static int setDSclock (void)
{
    struct tm t ;
    time_t now ;
    int clock [8] ;
    int time = 0 ;
    int date = 0 ;
    int weekday = 0 ;
```

```
    printf ("Setting the clock in the DS1302 from type in... ") ;

    printf ("\n\nEnter Date(YYMMDD): ") ;
    scanf ("%d", &date) ;
    printf ("Enter time(HHMMSS, 24-hour clock): ") ;
    scanf ("%d", &time) ;
    printf ("Enter Weekday(0 as sunday): ") ;
    scanf ("%d", &weekday) ;
//    printf("\ndate: %d,    time: %d\n\n", date, time) ;

    clock [ 0] = dToBcd (time % 100) ;  // seconds
    clock [ 1] = dToBcd (time / 100 % 100) ;      // mins
    clock [ 2] = dToBcd (time / 100 / 100) ;  // hours
    clock [ 3] = dToBcd (date % 100) ;  // date
    clock [ 4] = dToBcd (date / 100 % 100) ;// months 0-11 --> 1-12
    clock [ 5] = dToBcd (weekday) ;      // weekdays (sun 0)
    clock [ 6] = dToBcd (date / 100 / 100) ;            // years
    clock [ 7] = 0 ;            // W-Protect off

    ds1302clockWrite (clock) ;

    printf ("OK\n") ;

    return 0 ;
}

int main (int argc, char *argv [])
{
    int i ;
```

```
int clock [8] ;
int year ;
int month ;
int date ;
int hour ;
int minute ;
int second ;
int weekday ;

wiringPiSetup () ;
ds1302setup      (0, 1, 2) ;

if (argc == 2)
{
   /**/ if (strcmp (argv [1], "-slc") == 0)
      return setLinuxClock () ;
   else if (strcmp (argv [1], "-sdsc") == 0)
      return setDSclock () ;
   else if (strcmp (argv [1], "-rtest") == 0)
      return ramTest () ;
   else
   {
      printf ("Usage: ds1302 [-slc | -sdsc | -rtest]\n") ;
      return EXIT_FAILURE ;
   }
}

for (i = 0 ;; ++i)
{
```

```
 printf ("%5d:    ", i) ;

 ds1302clockRead (clock) ;

hour   = bcdToD (clock [2], masks [2]) ;
minute = bcdToD (clock [1], masks [1]) ;
second = bcdToD (clock [0], masks [0]) ;

 date    = bcdToD (clock [3], masks [3]) ;
month = bcdToD (clock [4], masks [4]) ;
year    = bcdToD (clock [6], masks [6]) + 2000 ;
weekday = bcdToD (clock [5], masks [5]) ;

printf ("    %04d-%02d-%02d", year, month, date) ;
printf ("    %02d:%02d:%02d", hour, minute, second) ;

 switch (weekday){
    case 0: printf ("    SUN") ; break;
   case 1: printf ("    MON") ; break;
   case 2: printf ("    TUE") ; break;
   case 3: printf ("    WED") ; break;
   case 4: printf ("    THU") ; break;
   case 5: printf ("    FRI") ; break;
   case 6: printf ("    SAT") ; break;
}

 printf ("\n") ;

 delay (200) ;
```

```
    }

    return 0 ;
}
```

For Python Language Users

Step 2: Change directory.

```
cd /home/pi/REXQualis_Raspberry_Pi_Complete_Starter_Kit/Python/31.Time_Clock
```

Step 3: Run.

```
sudo python3 31.Time_Clock.py
```

Code

The code here is for Python3, if you need for Python2, please open the code with the suffix py2 in the attachment.

```
#!/usr/bin/env python3
from datetime import datetime
from ds1302 import DS1302
from sys import version_info
import time

if version_info.major == 2:
    input = raw_input

rtc = DS1302()

def setup():
    print ('')
    print ('')
    print (rtc.get_datetime())
    print ('')
```

```
        print ('')
        a = input( "Do you want to setup date and time?(y/n) ")
        if a == 'y' or a == 'Y':
            date = input("Input date:(YYYY MM DD) ")
            time = input("Input time:(HH MM SS) ")
            date = list(map(lambda x: int(x), date.split()))
            time = list(map(lambda x: int(x), time.split()))
            print ('')
            print ('')
            rtc.set_datetime(datetime(date[0], date[1], date[2], time[0], time[1],
time[2]))
            dt = rtc.get_datetime()
            print ("You set the date and time to:", dt)


def loop():
        while True:
            a = rtc.get_datetime()
            print (a)
            time.sleep(0.5)


def destory():
        pass                        # Release resource


if __name__ == '__main__':          # Program start from here
        setup()
        try:
            loop()
        except KeyboardInterrupt:     # When 'Ctrl+C' is pressed, the child program
destroy() will be    executed.
```

```
destory()
```

Phenomenon Picture