Arduino Matrix Clock

by AnthoTRONICS

Description:

Build your clock using an Arduino, a matrix display, and a Real Time Clock (RTC) module. This is a fun and simple project which I feel is great for beginners. The clock uses the RTC module to accurately track time as well as the day, month, and year. In addition, the module has a built-in temperature sensor. You can learn more about the DS3231 module here as well as the I2C communication bus used for it here. Lastly we will use a Dot Matrix Display to of course, display the time, day of the week, month .etc. You can more about the display here and the MAX7219 IC driver in the datasheet below.

You can also download the pdf version for this project here. It's virtually the same as this instructable.

[UPDATE: 2/22/19] Don't use the pdf guide, I've updated this instructable but those changes are not yet reflected on the pdf.

Step 1: Gather Components

The components you'll need for this project:

- Max7219 Dot Matrix Display [Buy here] [Datasheet]
- RTC DS3231 [Buy here] [Datasheet]
- 3V CR3032 battery (for DS3231)

In addition, you'll need an Arduino of any kind (preferably a Nano to minimize the size of the project), a breadboard, jumper wires as well as the Arduino IDE installed on your PC.

Step 2: Libraries

Download the following libraries and install the .zip file to the Arduino IDE by going to ***Sketch > Include Library > Add .Zip library***

NOTE: THE VERSIONS MATTER!!!

***** Verify that you have the correct versions before downloading. I'd recommend downloading each library within the Arduino IDE to be on the safe side.

MD_Parola 3.0.1: https://github.com/MajicDesigns/MD_Parola

MD_MAX72XX 3.0.2: https://github.com/MajicDesigns/MD_MAX72XX

DS3231 1.0.2: https://github.com/NorthernWidget/DS3231

Alternatively,

In the Arduino IDE go to **Sketch > Include Library > Manage Libraries** and in the search bar type: “MAX72XX” and you should see the following (See image):

Install only MD_MAX72XX and MD_Parola. MD_MAXPanel is ***NOT*** needed.

Step 3: Testing Your Components

After Installing the libraries, test your components individually to ensure that they are working as they should. Please follow these steps before wiring everything together.

To test DS3231 RTC Module, Connect the DS3231 to the Arduino (see Wiring below). Then in the Arduino IDE, go to **Files > Examples > DS3231 > DS3231_Test** and upload the sketch. Open the Serial Monitor and check to see that you're getting the correct date, time, day .etc.

To test the matrix display, first connect it to the Arduino (see Wiring below). Next, in the Arduino IDE, go to **Files > Examples > MD_Parola > Parola_HelloWorld** and upload the sketch. You should see **HELLO** printed on the display and it may or may not be printed backwards. If the text is backwards then you must change the following line:

```
#define HARDWARE_TYPE MD_MAX72XX::PAROLA_HW
```

To

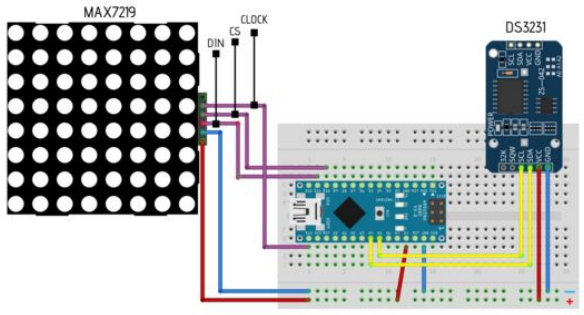
```
#define HARDWARE_TYPE MD_MAX72XX::FC16_HW
```

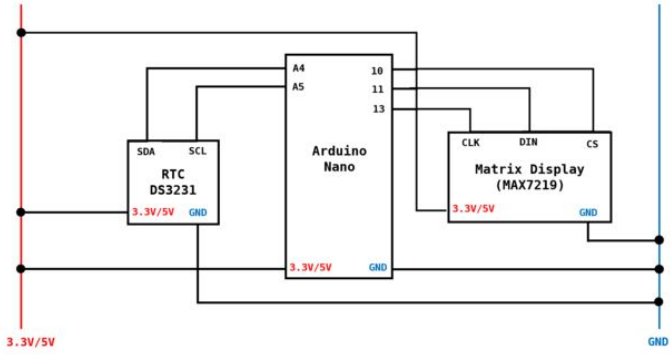
Upload the sketch again and the problem should be resolved.

Now that we've tested our components, we are ready to wire everything together!

Step 4: Wiring

Refer to the diagram or schematic or table





For DS321	For MAX7219
$GND \rightarrow GND$	$VCC \rightarrow 3.3V/5V$
$VCC \rightarrow 3.3V/5V$	$GND \rightarrow GND$
$SDA \rightarrow SDA\ or\ A4$	$DIN \rightarrow 11$
$SCL \rightarrow SCL\ or\ A5$	$CS \rightarrow 10$
	$CLOCK \rightarrow 13$

Step 5: CODE

Get the code here

Note: I used a code originally by Electronic Projects but modified it to support current (at the time of completion) libraries.

Clock Features:

The clock is automatically set to tell time in 24hr format but it can be easily changed to 12hr. The clock will also display the temperature (both in Celsius and Fahrenheit). I've also included a feature called 'Sleep Mode' which is set to "OFF" (See Sleep Mode below for details).

12hr Format: To set the clock to tell time in 12hr format, you'll have to comment line 88

```
hour =Clock.gethour(h12,PM); //24hr Format
```

And uncomment lines 93 through 100

```
if (Clock.getHour(h12,PM)>=13 || Clock.getHour(h12,PM)==0)
{
   h = Clock.getHour(12,PM) - 12;
}
   else
{
   h = Clock.getHour(h12,PM);
}
```

Sleep Mode:

This is a feature that helps reduce the brightness of the clock particularly during the hours in which we are asleep. I don't think you want to wake up in the middle of the night and by blinded by this clock. It is very bright even when it's at the lowest setting. To enable sleep mode, uncomment lines 177 to 184

```
if(h == 12 || h<8) //Time intervals (in this case, from 12AM to 8AM)
{
   P.setIntensity(0); //Set display brightness to lowest setting
}
   else
{
   P.setIntensity(6); //Set display brightness to 6 (15 is the brightest)
}
```

Note: I've come across an issue when using sleep mode while the clock is set to 12hr mode. You'll notice that it will run twice a day since 8am and 8pm are interpreted both as 8. So if you set Sleep Mode to be active from 9pm to 7am, then it will also be active from 9am to 7pm. HOWEVER, this issue does not occur if the clock is set to 24hr mode.

Step 6: Conclusion

Congrats!!! You have a working clock. This is how mine turned out [Clock Gallery]. I hope that you not only learned a little bit more about components and coding, but that you enjoyed the journey getting there. Please share with me your thoughts on this guide over at anthotroncis@gmail.com. This is in fact my first project guide and hoped it served you well. I hope to create many more guides. In addition, if you have any questions, suggestions, and/or improvements on the project, feel free to message me.

Hi am Francis from Ghana am also interested with your project and i want to do it but am also facing the problem of font error please help me solve this problem some body ask the same question but i didnt get the esplanation well

Hello
Unfortunately I can't compile the code, I get this error

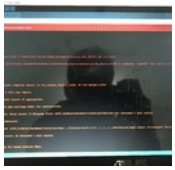
Arduino:1.8.9 (Windows Store 1.8.21.0)
(Windows 10), Scheda:"Arduino/Genuino Uno"
lto1.exe: internal compiler error: in
lto_output_varpool_node, at lto-cgraph.c:624
Please submit a full bug report,
with preprocessed source if appropriate.
See <http://gcc.gnu.org/bugs.html>;
for instructions.
lto-wrapper.exe: fatal error: C:\Program
Files\WindowsApps\ArduinoLLC.ArduinoIDE_1.8.21.0_x86__mdqgnx93n4wtt\hardware\tools\avr/bin/avr-
gcc
returned 1 exit status
compilation terminated.
c:/program
files/windowsapps/arduinollc.arduinoide_1.8.21.0_x86__mdqgnx93n4wtt/hardware/tools/avr/bin/../lib/gcc/avr/5.4.
error: lto-wrapper failed
collect2.exe: error: ld returned 1 exit
status
exit status 1

Have you any idea why ?
Thanks !!

thank you for your help and reply, author. I've done all the step you said. but the problem is still here. I've changed my arduino uno to nano same as you too, but it didn't fix the problem.

When you get that error, if you scroll up on that black area, it should say why the error is occurring. What is that message saying?

This is the error.



Hi It's me again. I have reinstalled the Parola library I was using version 3.0.2.that seems to have sovled the 'numeric7Seg' problem only to indicate an error in the next line - include<DS3231.h> Cannot find file. As I said earlier this is my first project, please forgive me for keep bothering you. Many Thanks.

No troubles, what is the exact error message that you are getting?

The error message reads - DS3231.h: No such file or Directory.

I assume that you do have the library for the DS3231 installed so do you perhaps by any chance have include<DS3231.h> instead #include<DS3231.h> in your code?

Hi I am still having problems. The library for the DS3231
was missing so I have now installed it. I now get the error message ‘error
compiling for board Arduino Nano’ . The library’s I have installed are:

MD_Payola (3.0.1)

MD_MAX32XX (3.0.2)

RTClib (1.2.0)

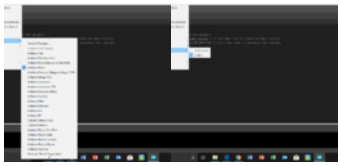
DS3231 (1.0.2)

I am also missing the library for wire.h I can’t find where to download it, can you
help?

The code I have was copied from your published project
and pasted into the Arduino IDE

Once again I would like to thank you for your assistance.

The wire.h library should already be pre-installed when you download the Arduino IDE. If you able to verify the code by clicking on the check to the upper left without any errors, then you're all set. If not, maybe you need to download the latest version of the IDE. Other than that, it seems that you've fixed everything in your code and what we're dealing with now is a mechanical issue. You are most likely getting this error because you are either uploading to the wrong board or do not have the correct port selected. Take a look at mine for example. When I connect my Nano I have to select that board under tools (If you're using an UNO, then you select Arduino/Genuino UNO). I also have to select what port I am using, for me that is port 5. Once you do that, everything should be good to go.



Hi I am still having problems and have decided to leave this project until I learn a bit more. I have Reinstalled the IDE. I now see that it was upgraded to version 1.8.9 two days ago. I am getting the same error message. I have checked and the wire.h library is there. I have checked the board and I have the Nano selected and is connected to port 4.

I am now at a loss.The Library's I have installed are:

MD_Payola (3.0.1)

MD_MAX32XX (3.0.2)

RTClib (1.2.0)

DS3231 (1.0.2)

Many thanks for your help. If I can I would like to contact you at a later date.

Sorry to hear that, it can be frustrating to run into errors again in again. Sometimes the best solution is to take a break and come back to it with a fresh mind. As you said, this is your first project, you have work out the kinks but you will eventually get it and it will be so satisfying. Try researching that error "error compiling for board Arduino Nano." Let me know how it goes, you can reach me over at anthotroncis@gmail.com. Good Luck!

Thanks for you prompt reply, That helped me solve that problem. There is now an error message I am having a problem with. The error is in the line below Case 2: // Clock and reads P.setFont (0, numeric7Seg); Error message reads - 'numeric7Seg' was not decleared in this scope. An help would be appricated. Many thanks.

Hmm...It seems that it's an issue with the Font_Data.h file. That's strange because based on the steps above, there should be no issues because 'numeric7Seg' is defined in that file. There should be no changes done to that file. It might also be that the libraries have updated and are bringing up some issues. The versions I'm used are as follows.

MD_Parola 3.0.1
MD_MAX72XX 3.0.2
RTClib 1.0.2

Check to see if you have the same versions. If not delete the library and reinstall with the versions mentioned above. See if this helps.

Nice design. Do you have any more pictures of the assembly.

Hey, I've just add a few more images on the project including the completed breadboard circuit and a video. Click on the Clock Gallery on the conclusion to view them.