Digital Compass Utilizing the GY-271

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Abstract

In this short article we describe our simple digital compass, which utilizes the inexpensive GY-271 magnetometer. We made use of the *helscream (Omer Ikram ul Haq)* compass library on a SAMD211 processor and after a source code fix to the library, we successfully calibrated and utilized the compass[1]. We provide a list of components and a circuit schematic.

1 Introduction, Origins and Usage

1.1 Introduction and Background

This project is an offshoot from our larger effort to find a reliable, hobby-level digital compass for use with the Teensy 3.* boards and the GY-271. These boards use non-AVR processors and we had continuing issues finding a GY-271 Arduino library that worked reliably with the Teensy 3 family of boards. After making a fix to the *helscream* library, we found our Teensy-driven configuration to be useful[1]. We then decided to spin this GY-271 code off to form the basis for a simple compass intended for non-AVR hardware. The result is herein described.

1.2 Compass Usage

We created a proof-of-concept compass, built on a small solderless breadboard, with a separate dual AA cell battery pack[2].

Our proof-of-concept compass is shown in Figure 1. At the top was the GY-271 magnetometer, in the middle was the SSD1306 OLED display and at the bottom was the Adafruit Trinket M0. The battery pack was attached to the back of the red breadboard. The battery pack happened to have an embedded on-off switch[1].

Figure 2 shows the compass in calibration mode. Within 60 seconds, the compass must be rotated three times[2]. After 60 seconds, the compass will

[1] The battery pack was of unknown origin.

[2] We have always rotated right three times, within 60 seconds.

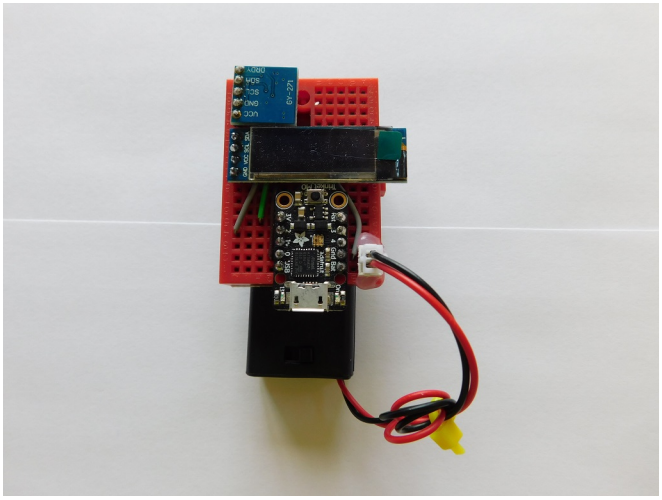

Figure 1: Compass Powered Off

begin normal operations. If the rotations are not performed, the compass will not be accurate.

Figure 3 displays the compass in normal operation, showing the current directional reading. Our testing showed that the compass was accurate enough for hobby use[3].

2 Hardware

The exact choice of hardware used was largely determined by the extra hardware we had on hand! The main requirement was that the processor used not an AVR processor as we wanted to test the changes made to the original **compass.cpp** module. Our modified module was named **compass2.cpp**.

2.1 Processor

An Adafruit Trinket M0 board was used[3]. It contained a 3.3 volt SAMD21 processor and functioned nicely using a dual AA battery pack.

2.2 OLED Display

The OLED used was a common *MakeFocus* SSD1306. We have purchased these from Amazon[4].

[3]The compass seemed to be accurate within a few degrees of magnetic north.

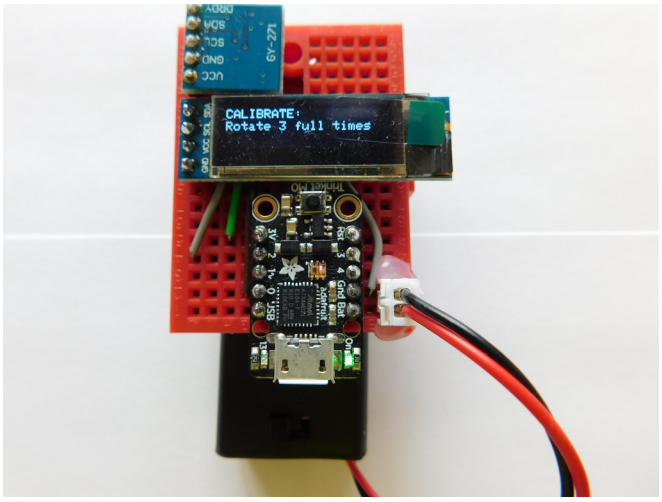

Figure 2: Compass Calibration

2.3 Magnetometer

The magnetometer used was a common GY-271. We have purchased these from both Amazon and Bangood[5].

2.4 Circuit Layout

Figure 4 shows a simplified circuit schematic. The **Bat** pin was connected to the positive wire of the battery pack and the **GND** pin was connected to the negative wire. Also note that the GY-271 **DRDY** pin was unused. The remaining pins were connected together according to their names.

3 Software

3.1 Software Items and Location

This software is available for download at URL https://github.com/rwsenser/Compass271. Listed below are some of the files in the GIT repository:

1. **compass2.cpp**: Modified **compass.cpp** module
2. **compass2.h**: Modified **compass.h** module
3. **Compass271.pdf**: This document
4. **rws271Compass.ino**: The "compass" Arduino application
5. **rwsD271.h**: Wrapper for **compass2.h** and **compass2.cpp**

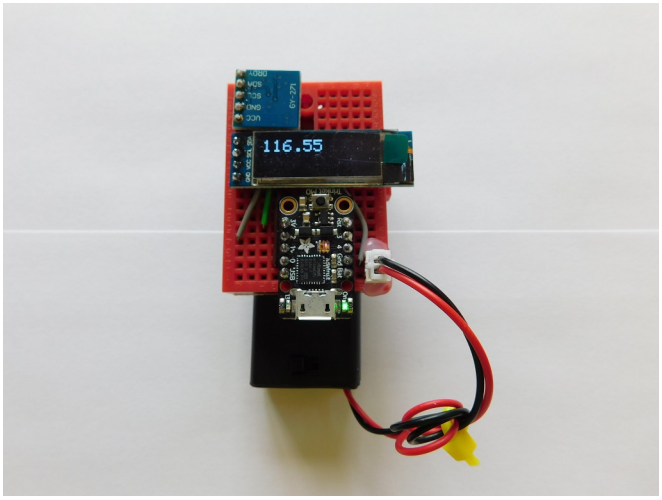

Figure 3: Compass Shows a Heading

3.2 Purpose of rwsD271 Wrapper

The **rwsD271** wrapper made the compass code easier to access and put this C++ code in its own namespace.

3.3 Changes Make to compass.cpp

The most important change to the **compass.cpp** code was to replace the **int** data type with **short** for the **compass_x**, **compass_y** and **compass_z** variables. This change was made at approximately line 42. The changed module, and its header file, were renamed by adding a "2". For example, **compass.cpp** became **compass2.cpp**. Minor additions were also made to provided a facility to blink LEDs during the calibration step.

3.4 Arduino IDE Version Issues

Late in the writing of this article, we noticed that this code works well with IDE version 1.8.7. With version 1.8.9, we observed that the OLED output is sometimes corrupted with additional "dots". We assume there is a bug present in the OLED handling. As this is not related to our needed GY-271 support, we did not pursue this unfortunate issue.

4 Future Improvements

- Add support for Trinket M0 *stardot* LED.

  The Trinket M0 provides a multi-colored, star-shaped LED that could be used to show additional information.

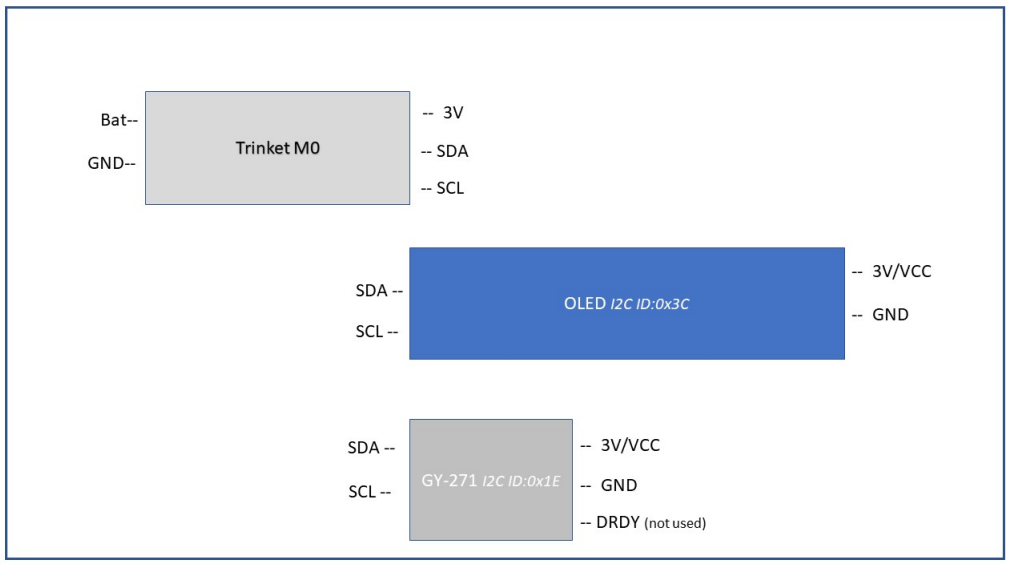

Figure 4: Simplified Compass Schematic

- Merge the rws271Compass and rws271test ino modules.

  The GIT archive also supplies **rws271test.ino**, which is a helpful test program for use with more than the Trinket M0. This could be merged with **rws271Compass.ino**.

5 Conclusions

We had found it difficult to assemble a reliable digital compass using a non-AVR processor with the commonly-available, public Arduino compass libraries for the GY-271. After a small modification to the *helscream (Omer Ikram ul Haq)* library, we were able to create workable digital compasses using the Adafruit Trinket M0.

References

[1] helscream (Omer Ikram ul Haq). Gy-271 library. Technical report, •, 2014. URL: https://github.com/helscream/HMC5883L_Header_Arduino_Auto_calibration/blob/master/Core/Compass_header_example_ver_0_2/Compass_header_example_ver_0_2.ino.

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[3] Adafruit Industries LLC. Adafruit Trinket M0, 2022. URL: https://www.adafruit.com/product/3500.

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