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The Design and Qibla Direction by Using the Hmc 5883 L Sensor as a Compass Rhi in the UMSU Science Laboratory (OIF)

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Abstract: *The level of accuracy of a measuring instrument is expected to be good because it is expected to provide information that can be used as a reference and benchmark in research and application in public life. The use of a compass measuring device in determining the direction of the wind and the location of the magned earth may vary from year to year such as the compass analog and digital. Both offer good reading results with the same way of working utilizing magnetic poles north and south as a reference point. HMC 5883L sensor is one measuring tool that is able to detect the direction of the compass with the same way of working from analog and digital compasses. By using Arduino Uno as a microcontroller as a central control that is able to change the information received from the HMC 5883L sensor into an easy-to-understand form of data. Qibla is more accurate by comparing the reading results of both. The results of the HMC 5883L compass sensor reading will be visualized in the form of the pointer, the pointer light and will be changed in numerical form. All data changed in the form of work is the result of an order from Arduino Uno received from the HMC 58883L sensor. A total of eight LED lights are used as a pointer to the compass and are connected with data obtained from the sensor.*
Keywords: *HMC 883L sensor; Qibla direction; 8 wind direction; Slope of Qibla direction*

I. Introduction

Within five years the BMKG (Climatology and Geophysics Meteorological Agency) observes changes in the variation map and maps the changes to get the latest and most accurate map variations of the earth, R. A. Putra and A. T. Sutanto. Earth has two magnetic poles which are located in the north and south. Earth's magnetic field or also called geomagnetic field is a magnetic field that reaches from the inside of the bowels of the earth to certain limits until the magnetic field meets the solar wind, G. A. G. & P. H.Roberts. The magnitude of the earth's magnets varies greatly from 25 to 65 tesla or about 0.25 to 0.65 gauss, G. A. G. & P. H.Roberts. In 1635, *Gellibrand* in London reported that the earth's unstable magnetic field undergoes changes in declination every year and continues to experience the movement of the Earth's core fluids N. Knezek and B. Buffett. Changes in the earth's magnetic map affect the direction of the intended compass when using the compass or the google map application when searching for locations both manually and by using the internet network, S. Maus et al. Accuracy in tracing locations and directions is needed especially in finding a direction such as looking for the direction of Qibla for some Muslim communities, especially in Indonesia.

Aids that are often used manually in searching for the Qibla direction such as the Analog compass are still inaccurate because they can only show directions with a needle without giving information on the presence and degrees of the place to look for, A. A. AL-Ihsan. Muhammadiyah University of North Sumatra has a Falak Science Observatory that has equipment that can be used to see the coming of the hilal beginning of the month of Ramadan using a telescope and has a Qibla direction pointer device called Kompas RHI.

The RHI compass works the same way as an analog compass works manually and has a weakness very sensitive to metal objects and electronic equipment, R. S. Michał Nowicki. The need for more precise compass equipment to be used as a comparison and strengthen the results of a more precise Qibla direction and this can use digital sensors that can be operated using the Arduino Uno Micro controller. The sensor in question is a type of HMC 5883L three axis. HMC 5883L three axis is a very simple magnetoresistive sensor, very sensitive to the rotation and direction of the sensor, which uses the earth's magnetic field as a reference, B. Li, W. Lai, C. Yang, and S. Zheng. After reading a lot that the HMC 5883L sensor can be used as a substitute for an arduino-based compass, it is hoped that the HMC 5883L compass sensor can be a companion tool to determine the direction of the compass and the direction of the RHI analog compass used so far by the OIF Institute for OMS.

II. Review of Literatures

2.1 Problems in the Field of Production

The problem in the field of compass sensor production is when assembling components that require high accuracy and persistence. Adjustment of test data with Arduino uno by making the program in the form of a program language that can be read by Arduino Uno to apply the data obtained from the HMC 5883L sensor. The solution of the problem with the install process can be done after the equipment and materials mentioned above after it is complete and available. After the installation process the sensor that has been installed will not run without a program that has been made on the HMC 5883L sensor.

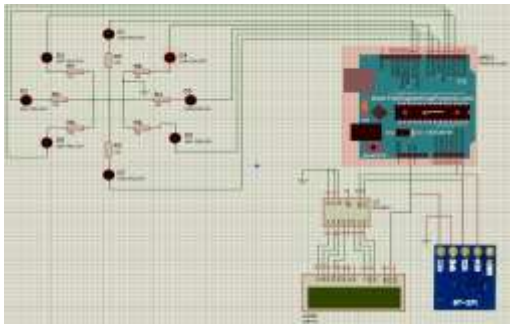

Figure 1. *A series of experiments*

The series above was created using the ISIS program on Proteus 8 software by following the program instructions that were made in the previous Arduino uno program. The function of drawing the experimental circuit is to make it easier to understand the circuit by looking at the paths on the PCB board. The program that has been run has been dedicated to the HMC 5883L sensor and can only be read and installed on Arduino if the program is correct and does not experience error errors. After the program has been successfully inputted into Arduino, the next process is to approach and adjust the sensor readings by comparing the results of other sensor readings or with other analog and digital compasses. The arduino circuit image with a compass sensor can be seen in Figure 1: The experimental circuit.

2.2 Problems in the Field of Management

Based on the above series of experiments, the first step is to start, after starting the input input initialization initialization, which is meant here whether the device is actually installed correctly in accordance with the circuit schematic and after all the coding is entered

it will read the HMC 5883L sensor on the screen LCD and the lights will be active simultaneously.

a. In the first experiment the sensor will read 3380-220 then the direction of the compass is in the north and lamp 1 is active. Followed by 2 lights off.
b. Furthermore, the second experiment of the sensor will read 220-680 then the direction of the compass is in the Northeast and the 2nd lamp is on. Followed by lights 1 and 3 turned off.
c. Trial to the three sensors will read 680-1130 then the direction of the wind is in the East and lamp 3 is active. Followed by lights 1,2 and 4 turned off.
d. Trial to the three sensors will read 1130-1580 then the direction of the wind is in the East and lamp 3 is active. Followed by lights 1,2 and 4 turned off.
e. The fifth sensor test will read 1580-2030 then the angina eye's direction is at the South and the 5th lamp is active. Followed by lights 1,2,3,4 and 6 are turned off.
f. The six sensors will read 2030-2480 then the cardinal direction is in the Southwest and the 6th light is on. Followed by lights 1,2,3,4,5 and 7 will turn off.
g. Trial of the seven sensors will read 2480-2900 then the direction of the wind is in the West and the lamp 7 is active. Followed by lights 1,2,3,4,5,6 and 8 will turn off.
h. And the eighth experiment of the sensor will read 2900-3380 then the direction of the angina eye is in the Northwest and the 8th light is on. Followed by all the lights will turn off.
i. After everything is going well, the program is declared Completed.

2.3 Problems in the field of marketing

Problems in the field of marketing with increasing technological advances can help in the field of marketing of finished products from compass sensor devices that have been produced. The introduction of the tool will be done through socialization to the surrounding community by showing the results of the reading to the community after getting calibration from a compass in a trusted institution. The approach to the community begins with conducting socialization by conducting training and general lectures on the qibla direction that has been used by the community around the Medan city to young students and students who do not use the internet in their operations.

2.4 Feasibility of Higher Education

The North Sumatra Muhammadiyah University Campus is one of Muhammadiyah's charitable endeavors which is currently carrying out tridarma of tertiary institutions through research, service and research activities involving the community. As a well-known private university in North Sumatra, UMSU always cooperates with third parties outside the campus from the government, steak holders and industry that aim to advance knowledge in education, especially in the North Sumatra area in order to improve human resources and increase the competency of graduates of Muhammadiyah University of Saumatera Utara.

The relationship between the tridarma activity and the partnership program is very much related, in addition to increasing the ability to interact with the surrounding community, the output can also be a useful tool in finding the direction of Qibla and the direction of the compass. The application of this tool will later be used at an apprenticeship training institute to Japan which is socialized to apprentice participants so that it can be used to find the right direction for qibla when outside the area that is difficult to find houses of worship.

III. Result and Discussion

After testing, the results obtained will be discussed in order to obtain conclusions and answer from the research objectives mentioned in the first chapter before. According to information obtained from OIF UMSU that the direction of the angle of inclination from Qibla to the present day is 2930 heading northwest. In the relevant literature and research it has been mentioned that the workings of digital compass sensors and analog compasses are very dependent on the presence of earth's magnetism. If the earth's magnet shifts, the compass reading results will also change. In Figure 2 the following results of the reading of the Qibla direction by using the HMC 5883L sensor at a slope angle from north to northwest 2930 are shown on the LCD screen and the LED lights are on.

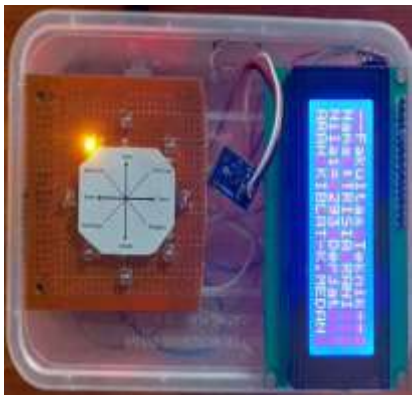

Figure 2. *Compass reading results for the Qibla direction of 2930 degrees*

In the same arc line the degree of slope of the Qibla direction is drawn at the Taqwa mosque in the University of Muhammadiyah University of North Sumatra which has been measured in the Qibla direction by the OIF UMSU team to equalize the starting point of measurement so as to obtain a difference in the slope of the HMC 5883L sensor in finding the Qibla tilt angle.

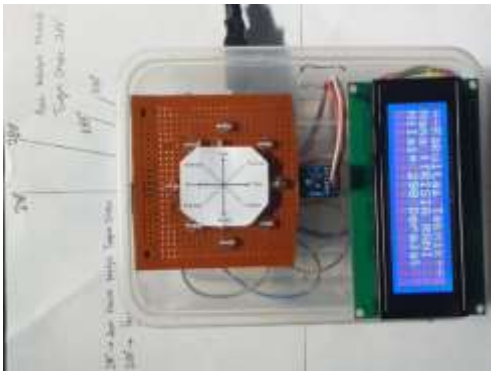

Figure 3. *Looking for the direction direction of Qibla at the Taqwa Mosque in the University of Muhammadiyah North Sumatra with HMC 5883 sensor*

When compared with the results of the RHI compass readings printed on the Taqwa mosque on the campus environment of the University of Muhammadiyah North Sumatra, it can be concluded that the results of the HMC 5883L compass reading approached the Qibla direction indicated by the RHI compass reading results. Comparison of the degree of slope of the reading direction of the RHI sensor and HMC 5883L can be seen in Figure. 4 below

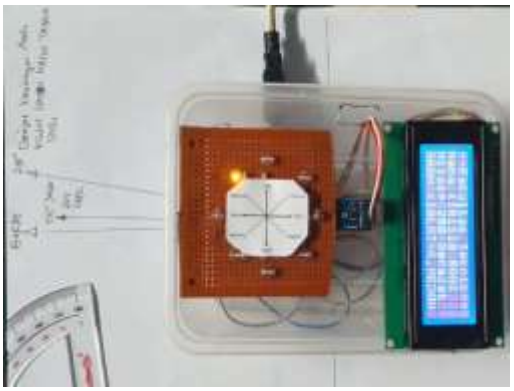

Figure 4. *Results of RHI compass reading and HMC 5883L sensor*

From Figure 4 above, it can be seen the different degrees of slope of the HMC 5883L compass sensor reading with the qibla direction of the UMSU taqwa mosque. The degree of slope of the reading of the difference of 7o from the Qibla direction in the UMSU taqwa mosque. Indonesia is at 2900 to 295o the direction of the Qibla direction to the northwest, while the difference in the Qibla direction reading results of the HMC 5883L compass sensor is only 2o from the safe distance, the HMC 5883L sensor can still be used as an RHI compass companion in reading the Qibla direction.

IV. Conclusion

After getting the results of the discussion in the previous chapter 4 it can be concluded the effectiveness of the HMC 5883L sensor to answer the research objectives mentioned earlier.

1. The reading ability of HMC 5883L sensor is quite good because the difference in the reading angle of the Qibla direction which is still in the safe category is 7o while the safe distance range of the Qibla direction in Indonesia is 5o.
2. The reading of the HMC 5883L sensor is very easy to understand as the language displayed by the LCD screen can be replaced by the everyday language we use.
3. Comparison of the results of the measurement of the degree of Qibla direction is not too far away and it is proper to be used as a companion of the RHI compass sensor that is on the OIF UMSU.

Suggestion

After getting a lot of knowledge from the tests carried out, the authors suggest several things that researchers need to do next in order to improve the weaknesses that still exist in this test.

1. HMC 5883L sensor cannot work alone to read the degree of slope of the Qibla of each existence. Because each region does not have the same degree of orientation, the HMC 5883L sensor should be operated by including GPS as a point of coordinate, so that the sensor can work by directly reading the angle of the direction of the Qibla.
2. Because the HMC 5883L sensor is very sensitive to metal objects, electronic equipment and especially magnets, each test is expected to be far from the equipment and objects, so that the measurement results can be read accurately.

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