Bilkent University
EEE-313 Electronic Circuit Design
Project - Electronic Compass Showing North and South

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Section - 2
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I Introduction

Design and build an analog compass using a Hall-effect sensor, UGN3503.

II Methodology

The specifications of the circuit are as follows:

1) Current Consumption From +15v Supply $<$ 30 mA.
2) It Should Operate for at Least Three Minutes After Auto-zero.
3) Leds Should Turn on Within ± 45° of North or South.
4) Leds Should Not Flicker While Turning on or Off (Should Have Some Hysteresis).
5) PCB Size Not Greater Than 75mm × 60mm (One-layer Board With a Minimum Number of Jumpers).

III Design

The design of the circuit are as follows:

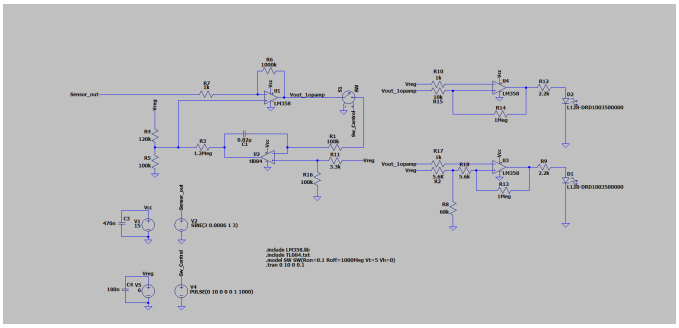

Fig. 1: Circuit Design on LTspice

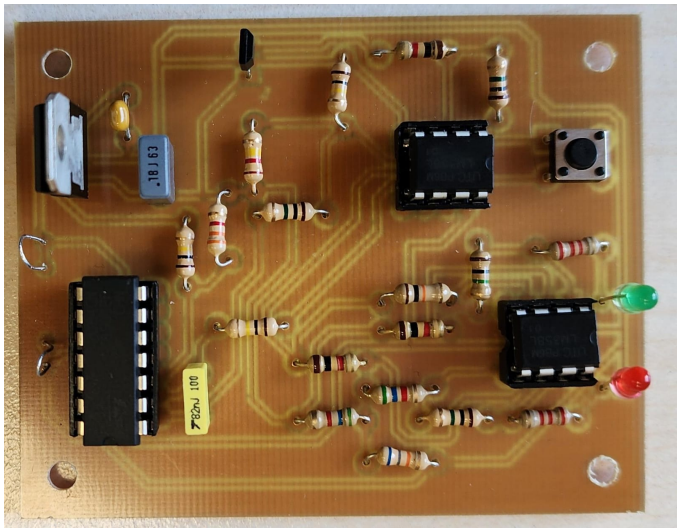

Fig. 2: Implemented Circuit on Copper Board

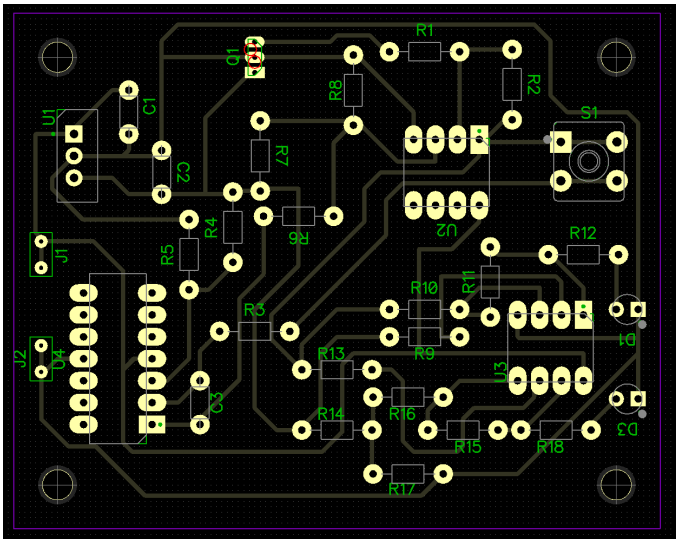

Fig. 3: Diptrace Design With Top Layer View

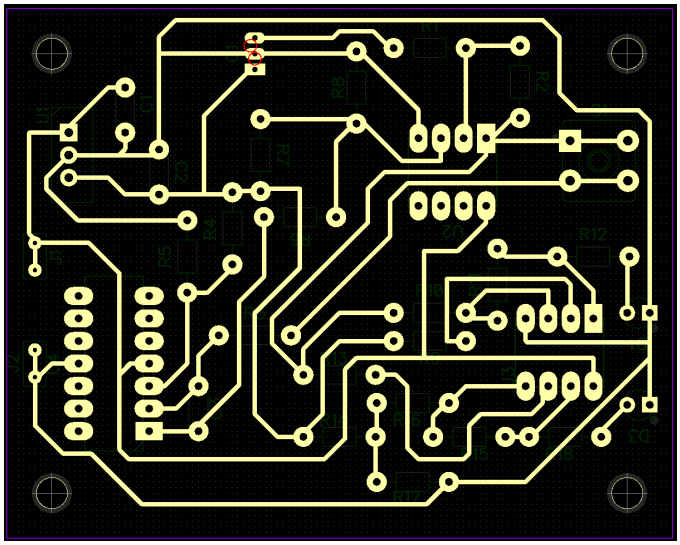

Fig. 4: Diptrace Design With Bottom Layer View

The design occupies an area of 75mm × 60mm and contains no jumpers. This ensures the 5th specification.

IV Specifications

A. *Current consumption from +15V supply $<$ 30 mA*

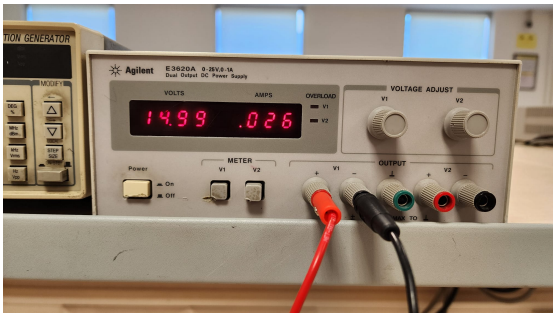

Fig. 5: Current Consumption of the Circuit

As can be seen, the circuit draws less than 30mA current.

B. *Operate for at Least Three Minutes After Auto-zero*

It was observed that the circuit lasted 3 minutes while during the lab and checking, and it can also be seen in the youtube video. Therefore this specification is verified.

C. *Leds Should Turn On Within ± 45° of North or South*

The pictures are arranged as a left is west.

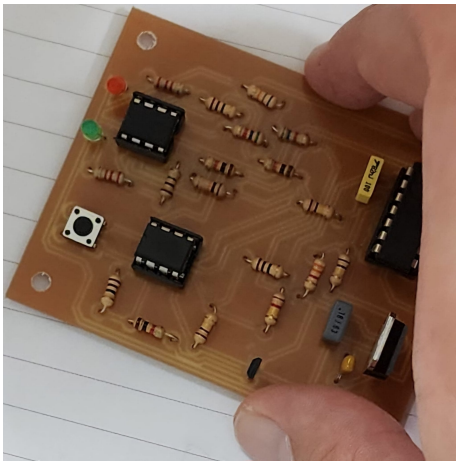

Fig. 6: +40° from West

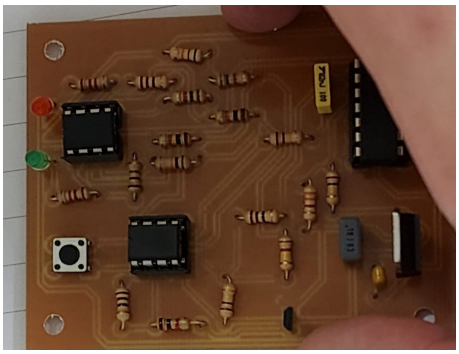

Fig. 7: 0° from West

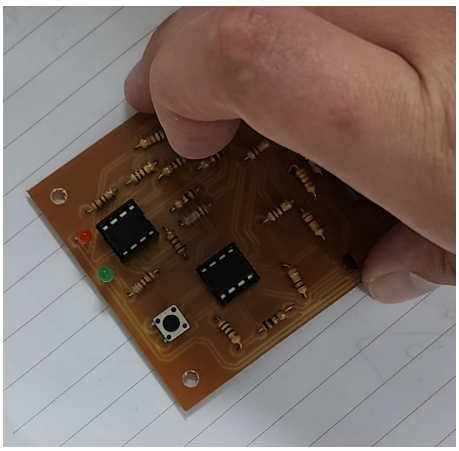

Fig. 8: -40° from West

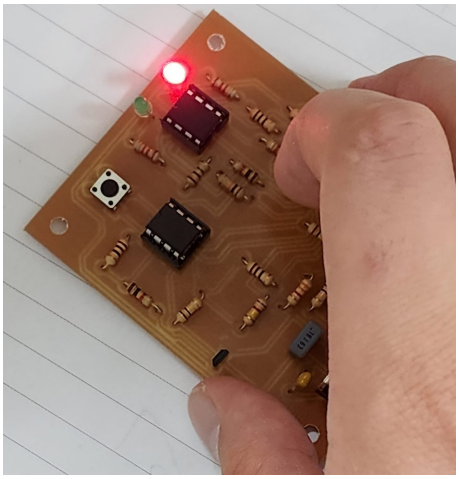

Fig. 9: +50° from West

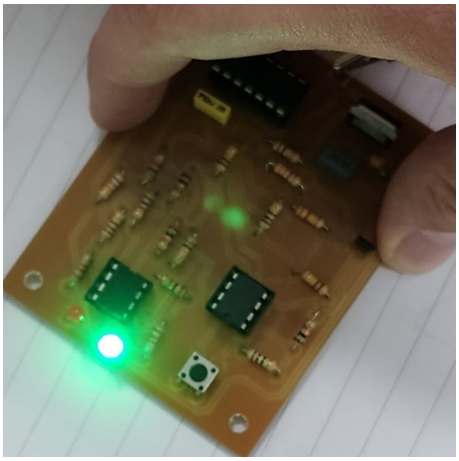

Fig. 10: -50° from West

The angles of leds work correctly according to the pictures.

D. Leds Should Not Flicker While Turning On or Off

The absence of flicker is shown in the video and in the previous specification. Hysteresis resistor was used to prevent flicker.

E. PCB Size Not Greater Than 75mm × 60mm

The board dimensions are 75mm × 60mm as it should be and it has successfully passed from the design phase to the printing phase.

V Conclusion

The aim of the project is to make analog compass using hall-effect sensor, UGN3503. TL084 opamp was used for the auto-zero circuit, and 1 LM358 opamps were used for the amplifier and 2 LM358 comparators, total 4 opamp, 3 chip. In order for the circuit to work close to 3 minute, the auto-zero circuit capacitor was selected as 0.82u and the resistance as 100k. The reference voltage of auto-zero circuit is 5.8V and 3 resistor values have been calculated to reduce the effect of the Tl084 opamp output.In order to ensure that the LEDs operate at ±45 degrees, a comparator circuit was established with the amplifier opamping output at certain voltage values and a hysteresis resistor was added to prevent the LEDs from flickering. The circuit and project meets all specifications.