COMPONENTS AND ICs

1. Magnetic reed switch sensors
2. IN4148 (Fast Switching Diodes)
3. IC SN7442 (BCD to Decimal Decoder)
4. IC 7404 (not gate)
5. LED (Light Emitting Diode)
6. General Circuit Board
7. Connecting Wires
8. Soldering Iron
9. Resistors (510 Ω)

BLOCK DIAGRAM

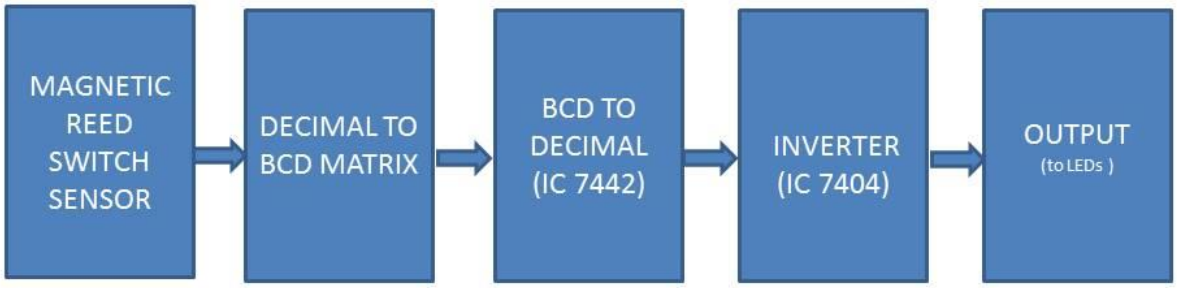

Fig: Block Diagram of Project

CIRCUIT DIAGRAM

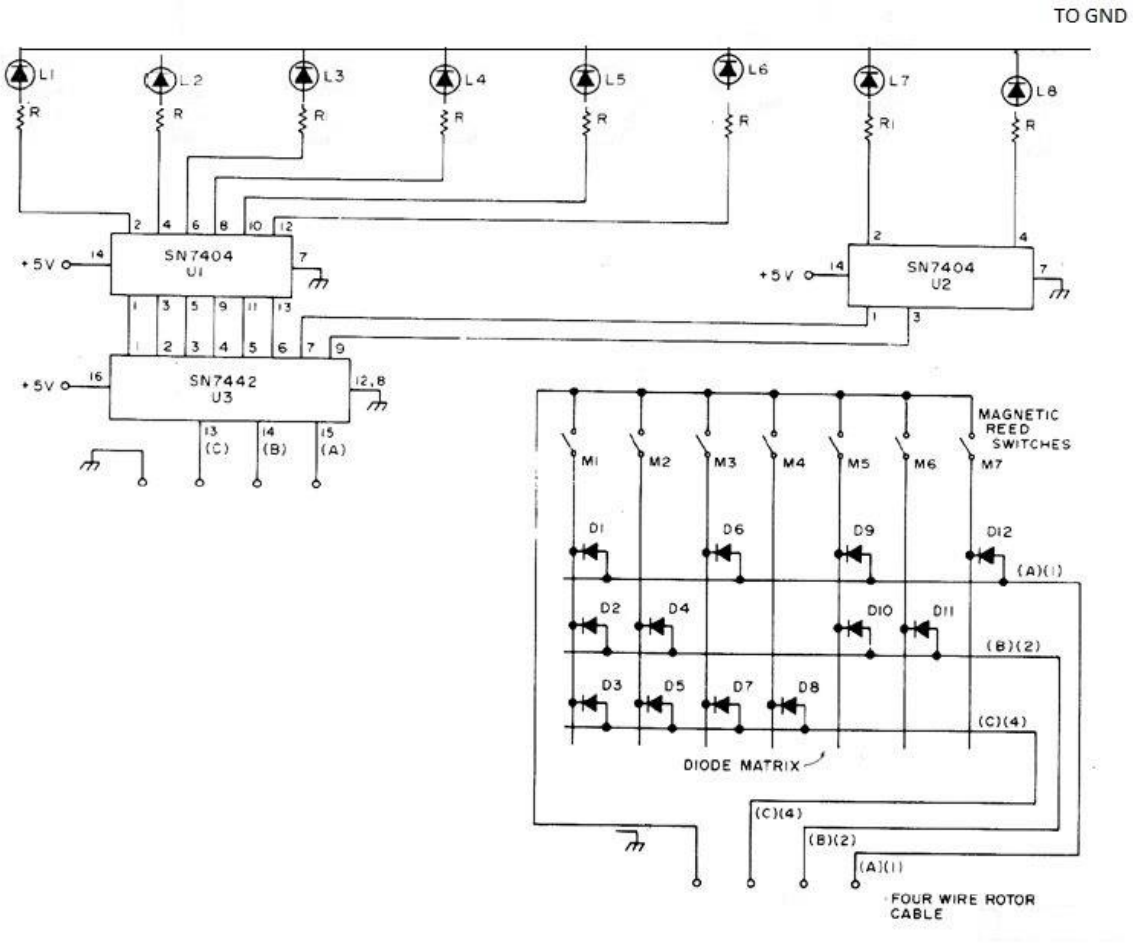

Fig: Circuit Diagram

THEORY

REED SWITCH SENSORS:

The sensors which we have used are magnetic reed switch. There is some small distance between the two poles of the magnetic reed switch. When they are exposed to external magnetic field the magnetic reed switch which have two the opposite poles are attracted towards each other and the contacts close when the force exceeds the spring force of reed switch.

Reed switches come in two varieties called normally open (normally switched off) and normally closed (normally switched on).

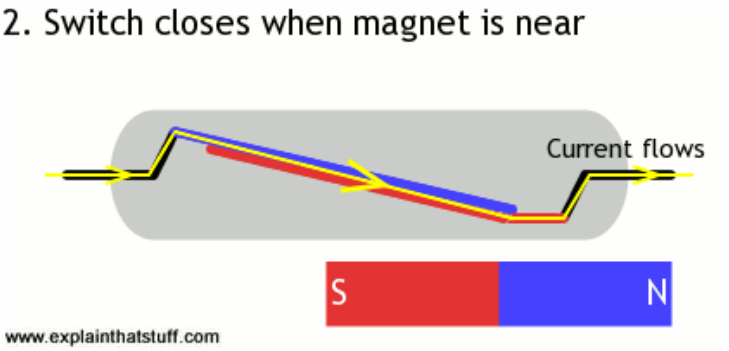

Fig:Normal State of Normally Open Switch

Normally open

In a reed switch, the two contacts (which look like metal reeds) are made from magnetic material and housed inside a thin glass envelope. (You can see this quite clearly in our top photo.) One of the contacts (sometimes called "blades") is a magnetic north pole, while the other is a south pole. As you bring a magnet up to the switch, it affects the contacts in opposite ways, attracting one and repelling the other, so they spring together and a current flows through them. A reed switch like this is normally open (NO) (normally off), unless a magnet is positioned right next to it, when it switches on.Take the magnet away and the contacts—made from fairly stiff and springy metal—push apart again and return back to their original positions.

Normally closed

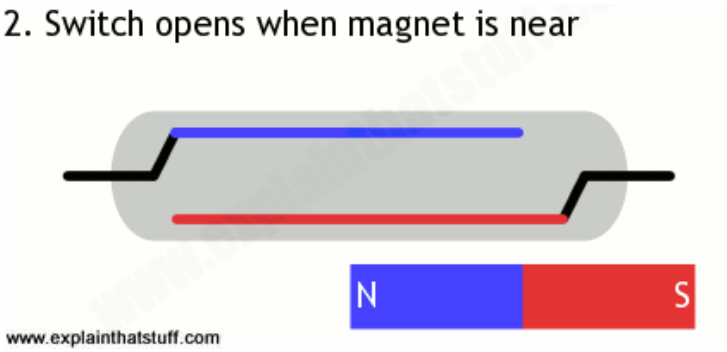

Fig: Normal State of normally closed switch

You can also get reed switches that work the opposite way. The two contacts are normally snapped together. When you bring a magnet up to the switch, the lower contact is attracted to the magnet, the upper one is repelled, so the contacts split apart, opening the switch and breaking the circuit. Reed switches like this are called normally closed (NC) (normally switched on), and they switch off when you bring a magnet up to them.

Although reed switches can be designed in various ways, generally *both* contacts move (not just one) and they make a flat, parallel area of contact with one another (rather than simply touching at a point), because that helps to extend the life and reliability of the switch. Also, where I've exaggerated the movement of the contacts to make it easier to see, real reed switches have contacts that are only a few microns (millionths of a meter) apart—roughly ten times thinner than a human hair—so the movement isn't visible to the naked eye.

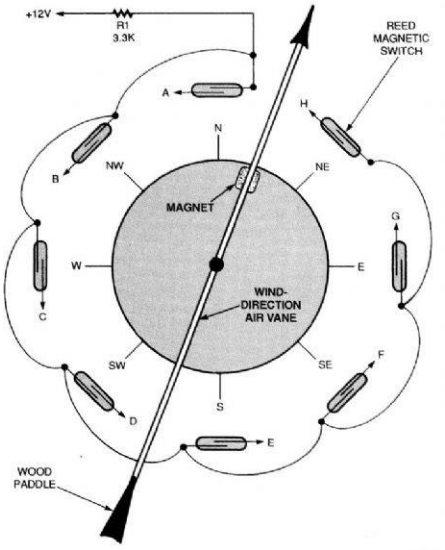

Fig:Arrangement Of Sensors

DIODE MATRIX LOGIC:

Diode matrix is used as control store or micro program in many early computers. At any instant any single row oof diode is active. Here diode matrix is used as a encoder. The output of diode matrix is in the form of bcd.Suppose M1 switch is closed so values ofA,B,C will be 111 so 0111 will be at the output of diode matrix.

Where encoders are needed for non-standard applications, they can also be implemented using a diode matrix, such as the decimal-to-BCD_{2421} encoder.

In this example, as any one of the ten switches is closed +5V is an applied to just one of the horizontal line. Any diode that has its anode connected to that horizontal line and its cathode connected to a vertical line (that is held at zero volts by a resistor connected to Gnd) will conduct.

When current flows through any of the resistors, the top of that resistor will be at +4.4V (i.e. +5V minus a 0.6V drop in across the diode), which will be seen by the output as logic 1.

For example if switch 6 is closed, the two diodes connected between line 6 and columns X_3 and X_2 will conduct, making outputs X_3 and X_2 logic 1 and giving a $binary_{2421}$ output word of 1100_2 (or $2+4 = 6_{10}$).

This particular diode matrix will therefore give an output in $\underline{BCD}_{2421}$ code from 0000_{2421} to 1111_{2421} for closure of switches 0 to 9.

Many other output sequences are possible therefore, by using different arrangements of the diode positions.

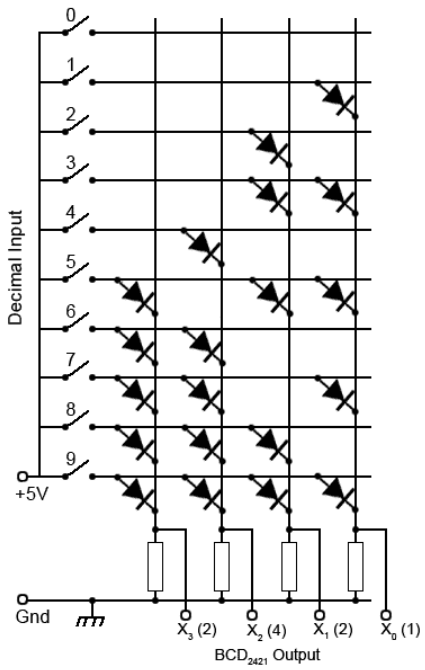

Fig: Circuit of Diode Matrix

Table 1.6.1				
	MSB	BCD_{8421}		LSB
Decimal	8	4	2	1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

Fig: Truth Table of Diode Matrix

BCD TO DECIMAL DECODER

IC SN 7442:It is a 16 pin decoder IC. In sn7442 decoder the output of diode matix works as an input to it, so as we have taken example of closing of m1 switch the available input at pin 13,14,15 will be 0111 so the pin no 7 will be having low level and rest all others will have high logic. so as we know that in decoder sn7442 the low level logic will be treated as positive logic.The pin no 7 will be at logic '0' and rest all others pins will be logic '1'.

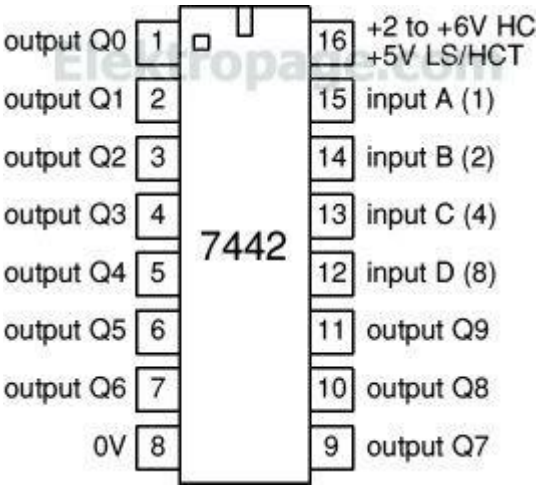

Fig: Pin Diagram of IC-7442

BCD Input				Decimal Output									
A	*B*	*C*	*D*	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	1	1	1	1	1	1	1	1	1
0	0	0	1	1	0	1	1	1	1	1	1	1	1
0	0	1	0	1	1	0	1	1	1	1	1	1	1
0	0	1	1	1	1	1	0	1	1	1	1	1	1
0	1	0	0	1	1	1	1	0	1	1	1	1	1
0	1	0	1	1	1	1	1	1	0	1	1	1	1
0	1	1	0	1	1	1	1	1	1	0	1	1	1
0	1	1	1	1	1	1	1	1	1	1	0	1	1
1	0	0	0	1	1	1	1	1	1	1	1	0	1
1	0	0	1	1	1	1	1	1	1	1	1	1	0
1	0	1	0	1	1	1	1	1	1	1	1	1	1

Fig: Truth Table of BCD to Decimal

HEX INVERTER

IC7404: This is the simple not gate IC whose output will be an inverted form of input. As we have taken example of closing of m1 switch. We concluded from the above blocks that the input low is available at pin no 7 of the sn7404 IC then we provide not gate so available output from ic7404 not gate will be high. And then the output is feed to LED.

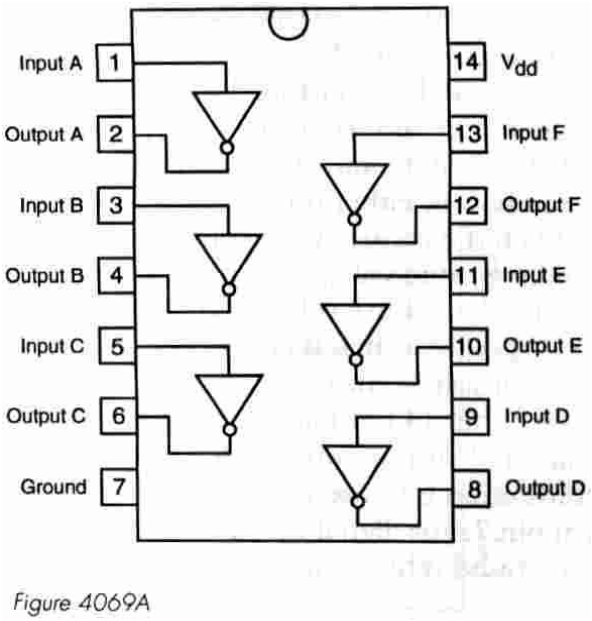

Fig: Pin Diagram of IC-7404

LED's: The available high output from the not gate is connected with the led so thus if any switch is closed then according to above blocks the led will be glow. We have taken 8 LED's as we all know that there are 8 directions so corresponding to different directions different led will glow.

Fig: Electronic symbol for LED

CONCLUSION

The goal of this project was to design and implement wind direction detector using magnetic reed switch sensor. After analyzing the whole system step by step for optimization, a circuit was designed and implemented. Experimental results showed that significant improvements in terms of data transfer from sensors to the output LED's by encoding decimal to BCD to reduce the number of data wires.

By implementing the project we understood the working of magnetic reed switch sensor and its application in finding the direction of wind. We also learned about diode matrix, how it converts decimal to BCD.

MODIFICATION AND SCOPE OF IMPROVEMENT

After implementing the above project we can also add some additional features like wind speed and wind pressure by using wind gauge as sensor and microcontroller to digitize the output which also helps reducing the size of project by removing the encoder and decoder circuits as controller can be programmed to convert Decimal to BCD and also display the wind speed which is not possible in this project.

BIBLIOGRAPHY

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