PROJECT TEAM LINEUP & PROJECT WORK DISTRIBUTION

Although Each member of the group had contribution virtually to each and every part of it, then for the sake of co-ordination individual member had his / her own responsibilities. Here is the project team line-up and individual specialized contribution.

☑ 9710039 S. M. Mahbub Murshed

Project software developer and co-ordinator, was responsible mainly for the software and computer interfacing.

☑ 9710024 Sadiq M. Alam

Responsible for the electrical side. Also contributed to the mechanical side.

☑ 9710066 Chandra Nath

Responsible for the mechanical side. Also contributed to the electrical part.

☑ 9710007 Farzana Husain

Contributing to the project by supporting and helping in different sections and also preparing the report.

☑ 9710054 Lubna Mehrin

Contributed to the project by supporting and helping in different sections.

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Acknowledgement

This project may not come to this stage if these people were not with us. No great work is done without some devotion of some people and these kind of help are not always rewarded. But we must show gratitude to them.

Dr.Md.Zahurul Haq, Assistant Prefessor - Without the energy of this man we would not be able to start up with this project. He gave us dreams unlimited, hope in each step and a divine light to pass easily our ways. Friendly mentality to solve our problem, close connection with each of us about the current status of our projects, wise solution of each problem that occurred while doing the project, breaking of the first fear about electronics – really we would not be able to pass through without his help. Hats off to you sir.

Md.Zakir Hossain, Lecturer - Our good luck that we got another energetic teacher in this project. It may not always possible for Dr. Jahurul Haque sir to give us time. Jakir sir then came promptly and solved our any kind of problem. Even he just sitted with us like close friend and asked about our problem, listen keenly, think with us about the problem and provided solution.

Masudur Rahman, Assistant Engineer ,Instrumentation & Control Engineering Lab - This man while working in the measurement lab helped us very much. In each circuit problem he came toward us and asked if we need help. He provided all kind of support he could give. Even when he needed some kind of special electronic part, he promptly collected it for us. Without seeing his comfort he opened the lab on some holidays on request.

Sadi Khan & Class Mates - Sadi, This great class mate of us helped a lot solving problem of our electronic circuits. Without him we would only have circuit diagrams in papers, not the working ones. Other classmates also helped us providing

support. Whenever they went to buy their project material, they bought ours also, if needed. Always inquiring about current status, suggesting where we can get best work – everyone helped us lot.

One of the main parts of our mechanical portion was to fit two bearing on shaft and base. We went to the machine shop and asked Mr. Abdul Karim ,Superentent & Chief Instructor, Machine shop - to help. He pointed out some of our conceptually wrong idea and promptly corrected them and advised what to do. Whenever we went there he helped us as much as possible.

Mr.Abdul Kader, Operator, Machine Shop - We disturbed him, we make him to do the same thing twice – he smiled. A thanks goes to him also.

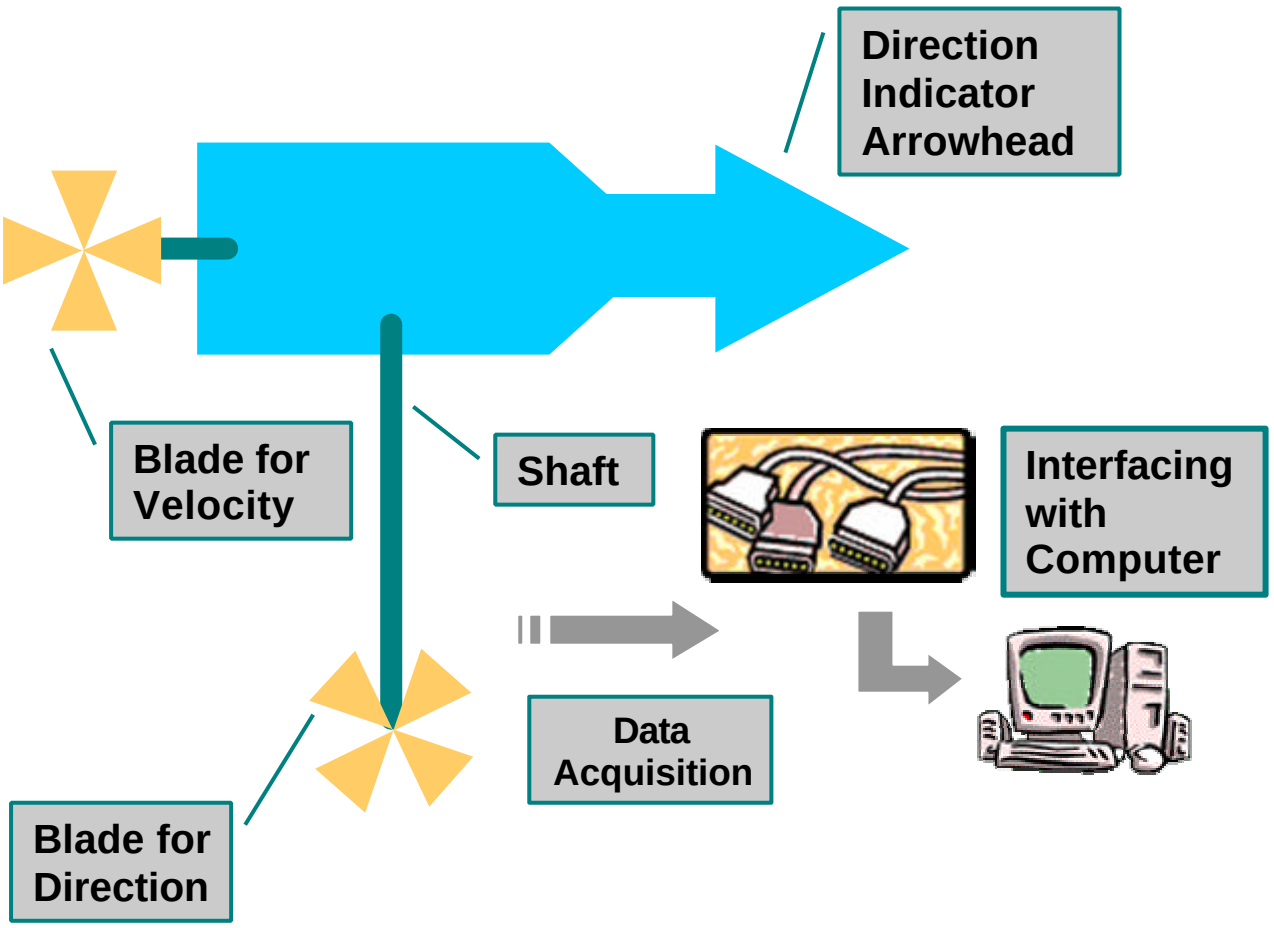
M.M. Sarwar ,Assistant Foreman instructor, Welding shop - When we needed to size the base and weld a small rod on it to mount the bearing he helped promptly. But we were asked to collect some papers which was not that much necessary for this kind of small job. However afterwards we did some work again under his prompt help.

Mr. Abdul Aziz ,Shop Attendent,Welding Shop,The machine shop worker who welded and another one who made the arrow head also did promptly for us.

Abstract

In this project, we make a mechanism of that measures wind velocity and also indicates the wind direction. It is a mechatronics project where both electrical and mechanical conceptions are combined. The principle used here is quite simple and straight forward. We used couple of LDRs for sensing both the velocity measurement and direction indication of air. The blade cuts and exposes the LDRs alternately, it then gives voltage drop as it was connected in a source. By acquiring the data into the computer by parallel port and with a software we can display on-screen the velocity and direction of wind. This data can also be saved in computer for future analysis.

Project Setup Outline



The project mechanism and working principle at a glance

Working Principle

The total system is quite easy to understand and the working principle is putted here in quite simple way.

Basically the project consists of three parts.

1) Wind Velocity Measurement
2) Wind Direction Indication
3) Interfacing with Computer for data acquisition, record etc.

WIND VELOCITY MEASUREMRNT

It is based on the principal that light sensing device will produce a infinite resistance if it is shaded from the light source , otherwise will have certain amount of resistance depending on the light intensity. We will use a small, light and frictionless fan and expose it to the open air. It will rotate as airflows. A light sensitive device (say a LDR) will be placed such a way that during rotation the blade will shade the light sensor and then we will get a voltage drop as the LDR resistance now grows, which will be signaled using transistor to send +5 Volt to the output.

We can have an 'on' signal if one of the input pins of the LPT port of the computer is raised to +5 Volt. If the pin is grounded it will have 0 Volt and will have a signal 'off'. So the voltage difference from the circuit will be connected to the desired input pin (say pin 10).

Initially when the program starts it assumes that LDR corresponding to the wind velocity is under shed & wind velocity is zero. If the signal from LPT port is not equal to the previous status then the blade must have moved at least one blade. The fan we used has approximately 60° between each blade and each gap. So one state change, i.e. LDR state from light to dark or vice versa indicates a fan movement of 60°. So we know that the blade moved 60° in the time interval say t seconds. The angular velocity of the fan

$$w = \frac{q}{t} = \frac{p/3}{t}$$

And the speed

$$N = \frac{w}{2p} \times 60 = \frac{\frac{p/3}{t}}{2p} \times 60 = \frac{1}{6t} \times 60 = \frac{10}{t}$$

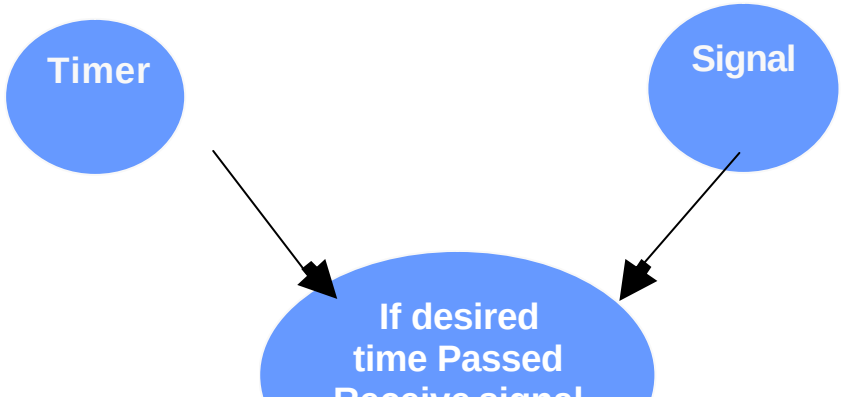
WIND DIRECTION MEASUREMENT

The wind direction measurement is very similar to the approach of velocity measurement system. Here two LDR and two input port, except the one used by velocity measurement LDR, is used. Two LDR say LDR1 and LDR2 are connected to pin 11 and 12 of the LPT port. So can sense its movement. Now say one blade has cut the LDR1 and then LDR2 one after another. So we can say that the blade has rotated to counter clockwise direction (see attached figure) to an angle equal to the angle difference of the blades.

SOFTWARE DEVELOPMENT

The software checks if a predetermined time interval is reached or not. After that time it looks at the signal of the LPT port. On the signal obtained it displays the manipulated output

We could choose old compilers with bare DOS interface. But this was avoided to give user a better view of the result. Microsoft Visual Basic – a easier programmer tool was avoided due to its lack of easy hardware interaction. Microsoft Visual C++ was used to develop 90% of the program. Due to better graph manipulation Borland C++ Builder was finally chosen.



Sample Flow Chart

Each data is stored in a file named on current date. Previously stored data can be viewed by averaging. The LED status of the circuit is shown. Direction is indicated through a arrow.

Literature Review

In this section we provide the description of different parts and also give the details of the mechanical construction, circuits and software used in the project.

MECHANICAL PART:

The setup had an important part that was purely mechanical. The mechanical part consists of a number of parts. These are

1. Direction Indicator Arrow Head
2. Two blades (fans)
3. Plastic shaft
4. Bearing
5. Base
6. Box

The direction indicator arrowhead mainly was used to indicate the wind direction. The indicator move to the direction of the wind due to wind thrust. The arrowhead was made by Aluminum piece. Aluminum was used in order to make the piece light.

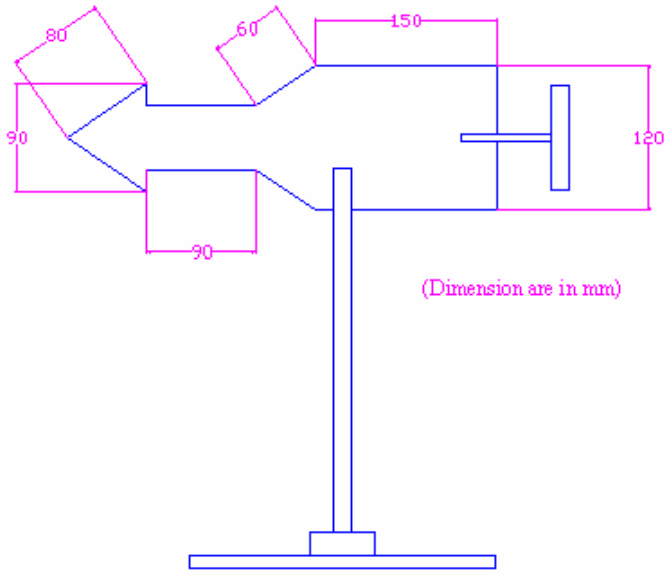
Two plastic blade fan was used for measuring wind velocity and wind direction. The light plastic blade was drilled through plastic shaft. Both the plastic fan was used to rotate around two separate plastic shafts with the help of bearing.

There was two shaft made of plastic material. We used plastic shaft for their lihghtness.

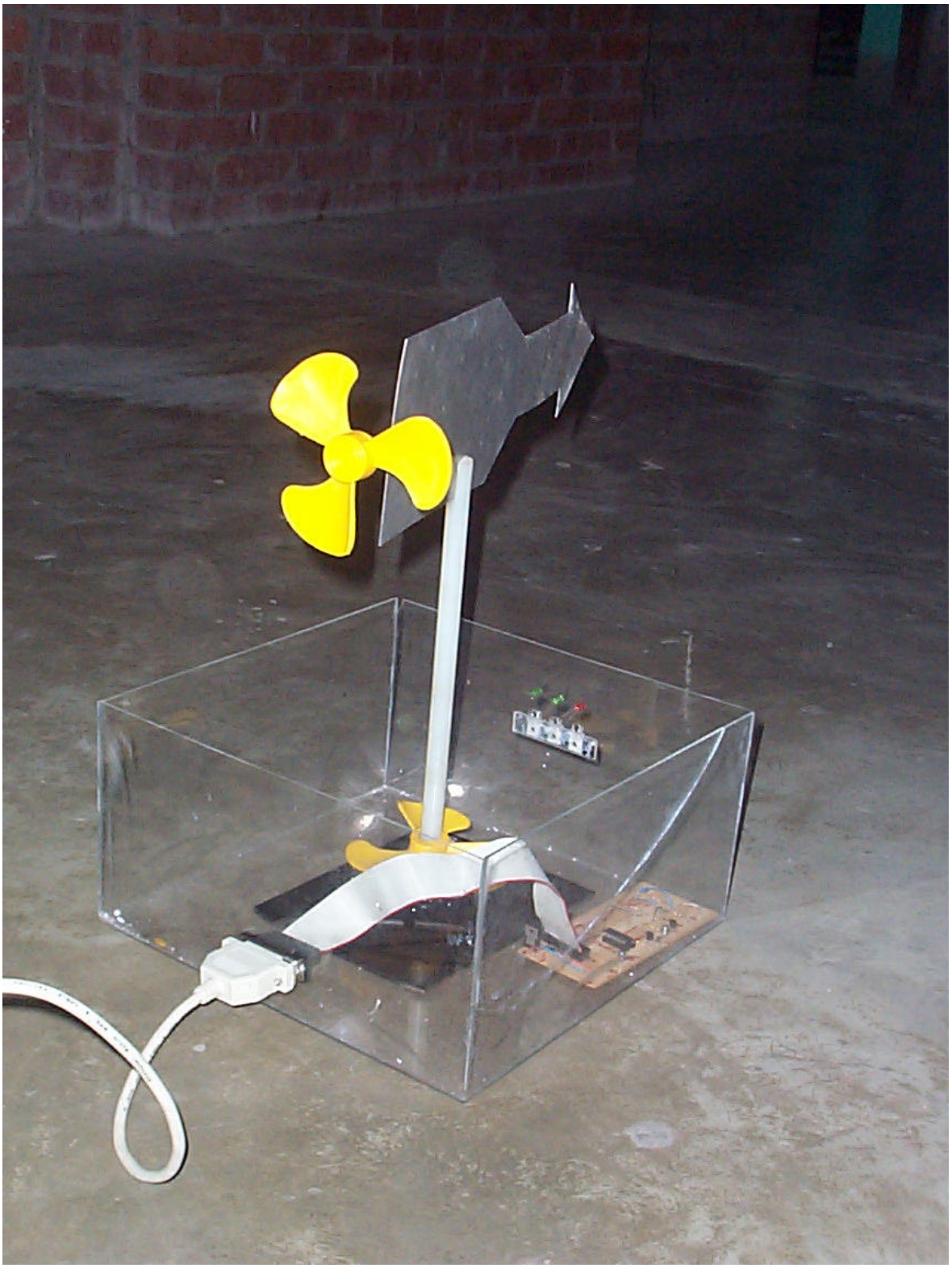
The base was used to support the vertical shaft, arrowhead etc. The base was metal sheet of about 3/8th inch thick so that it could bear all the weights of the arrowhead, fans, bearings etc.

Dimensions:

The dimension is shown below.



The Dimension



A View of the project

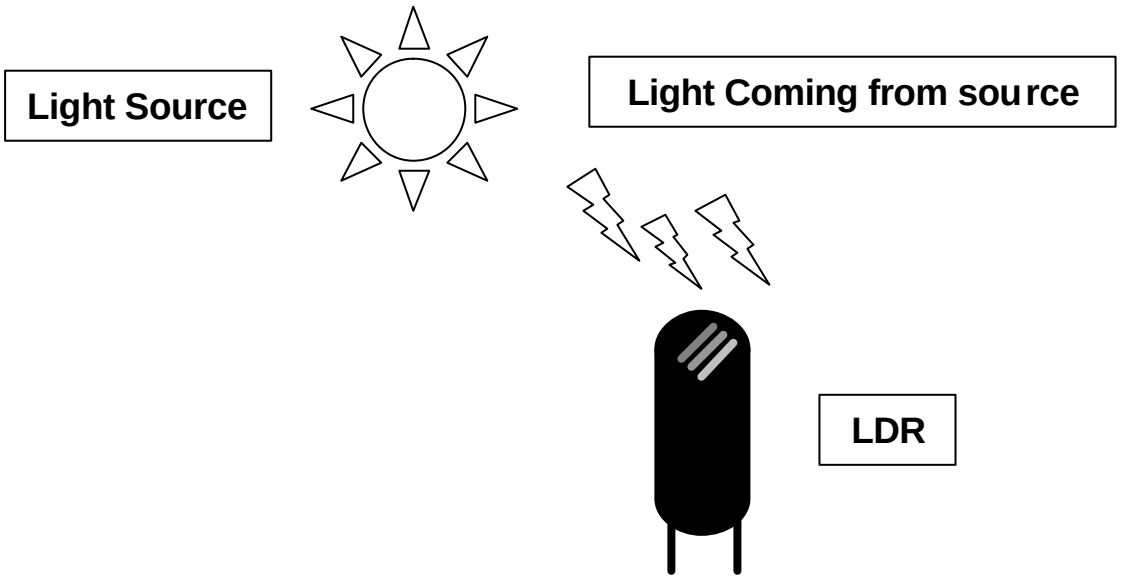
ELECTRONIC PART:

The electronic part has the following components :

1. LDR
2. Schmitt Trigger
3. Transistor
4. Regulator IC

LDR (LIGHT DEPENDENT REGISTOR)

LDR is a light sensitive electronic device .It can change its resistance by sensing light. So if we connect LDR with a multi-meter and imposed to light source then it will show some amount of resistance. When LDR is shaded from the light source, then the circuit becomes open and the resistance shown on multi-meter will be infinity. So under voltage input, LDR will give voltage drop when exposed to light and null when under shade.



Sample Working Principle of A LDR

MARKET NAME :- LDR

MARKET PRICE :- 15 taka to 30 taka.

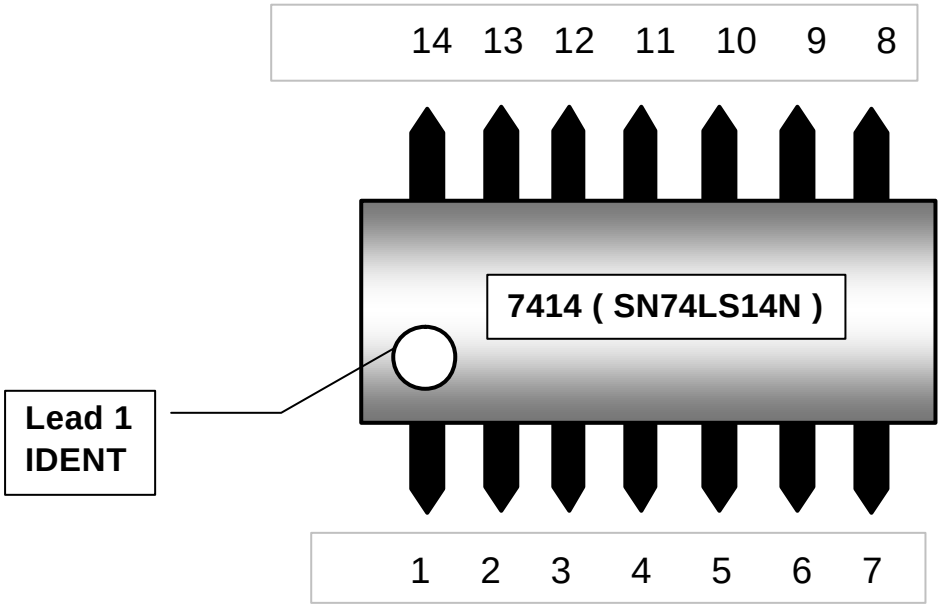
UNITS USED :- 3

SCHMITT TRIGGER

Schmitt Trigger is a single integrated circuit which is implemented in case of logical decision making process. It accepts a gradually rising or falling input but does not become conducting until its “TRIGGER LEVEL ” is reached. When it gets any input larger than its trigger level, then it becomes fully conducting and give a pulse. Otherwise its output is zero.

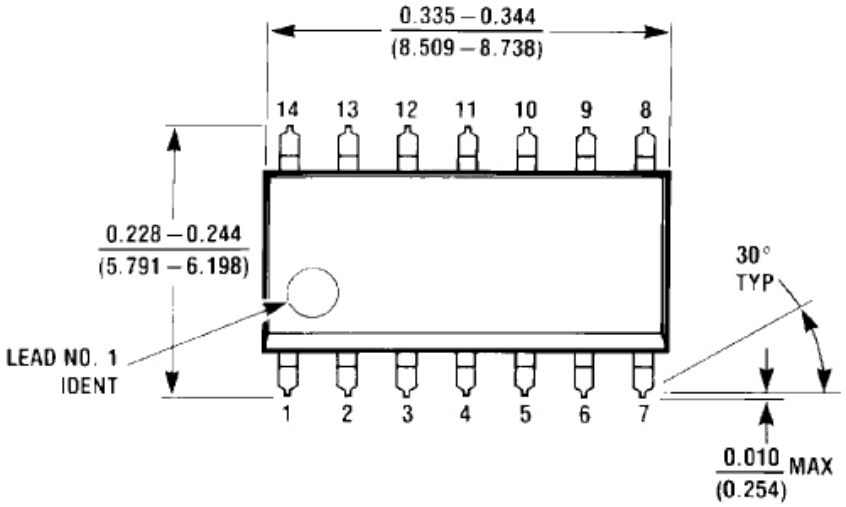
Basically it’s an electronic circuit that produces an output when the input exceeds a predetermined turn-on or threshold level. The output is maintained until the input falls below the threshold level.

MARKET NAME :- 7414 (SN74LS14N)
MARKET PRICE :- 15 taka
UNITS USED :- 1

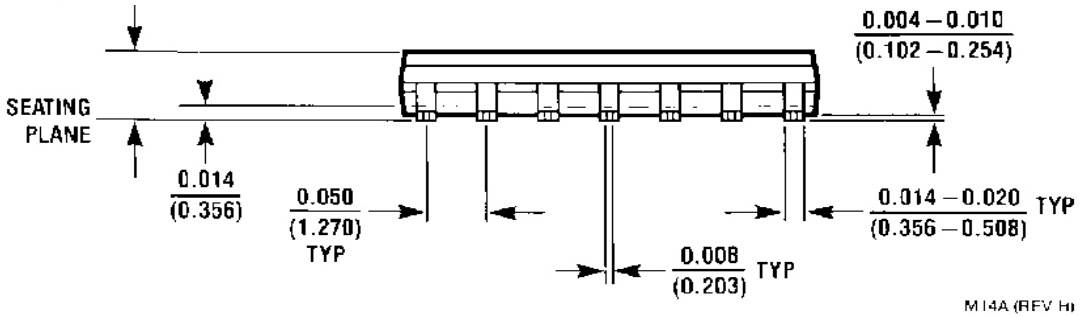


A Rough Schmitt Trigger Pin Settings

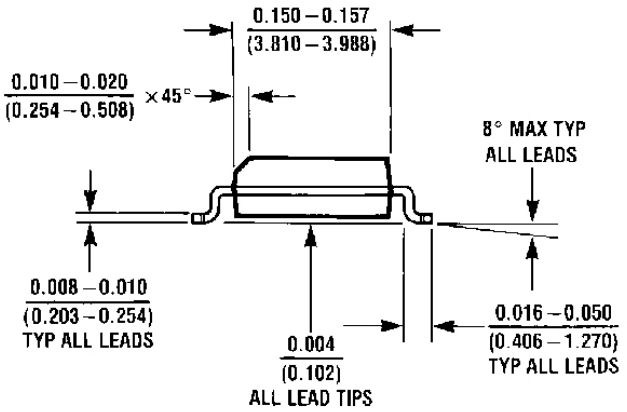
PHYSICAL DIMENSIONS OF SCHMITT TRIGGER



Top View



Front View

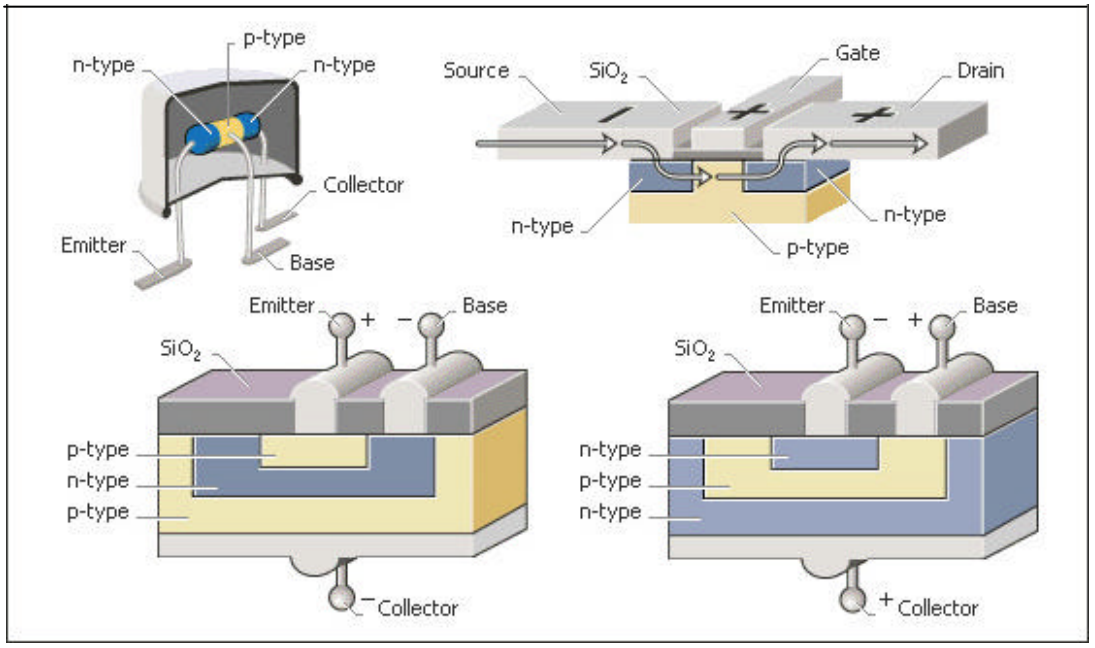


LHS View

Courtesy Texas Instrument

TRANSISTOR

The transistor is a three layer semiconductor device consisting of either two n-type and one p-type layers of material called npn transistor or two p-type and one n-type layers of material called pnp transistor. Transistor has three terminals --- base, emitter and collector. The emitter layer is heavily doped, base layer is lightly doped and the collector layer is just lightly doped . Transistor has tremendous use. But in our project we are concerned to use transistor as a switch. Transistor is a solid-state electronic device, a small low-powered solid-state electronic device consisting of a semiconductor and at least three electrodes, used as an amplifier and rectifier and frequently incorporated into integrated circuit chips.



Basic construction and working of Transistor

MARKET NAME :- 2222 (2N2222A)

MARKET PRICE :- 5 taka.

UNITS USED :- 6

REGULATOR IC

It is a special kind of IC whose function is to convert some amount of voltage in a certain amount of constant voltage. The output from it is a constant voltage drop which is indicated by the last two digit of the IC number. It has three legs. The first one is input terminal, the third one is output terminal and the middle is connected to ground.

Closeup Picture of an IC

MARKET NAME :- 7805

MARKET PRICE :- 25

UNITS USED :- 1

PROGRAMMING PART:

Receiving The Signal

The signal from the electronic circuit is received from the LPT port. Three input pin is connected , sending $2^3 = 8$ type of input signal. A software which listens to the port and on the signal does some sort of manipulations.

Interaction

As previously shown in the flow chart, the software checks if a predetermined time interval is reached or not. After that time it looks at the signal of the LPT port. On the signal obtained it displays the manipulated output.

The Algorithm : Determining The RPM

Initially when the program starts it assumes that LDR corresponding to the wind velocity is under shed & wind velocity is zero.If the signal from LPT port is not equal to the previous status then the blade must have moved at least one blade. The fan we used have approximately 60° between each blade and each gap. So one state change , i.e. LDR state from light to dark or vice versa indicates a fan movement of 60°. So we know that the blade moved 60° in the time interval say t seconds.
The angular velocity of the fan

$$w = \frac{q}{t} = \frac{p/3}{t}$$

And the speed

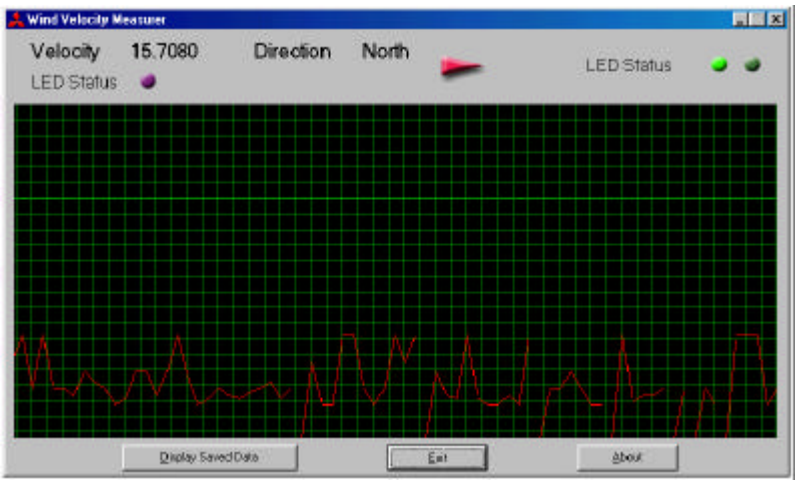
$$N = \frac{w}{2p} \times 60 = \frac{\frac{p/3}{t}}{2p} \times 60 = \frac{1}{6t} \times 60 = \frac{10}{t}$$

The Algorithm: Determining The Direction

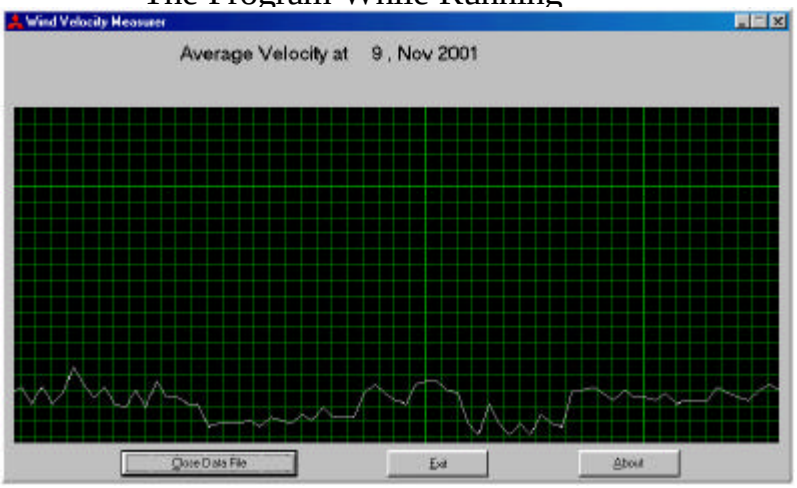
Two LDR sensor signal is observed named LDR sensor 1 and LDR sensor 2 (say). Primarily both are set under shade , i.e. Off state. If one LDR is exposed to light then the direction indicator is moving from other LDR to wards this one. Result is then displayed.

Options / Enhancements

Each data is stored in a file named on current date. Previously stored data can be viewed by averaging. The LED status of the circuit is shown. Direction is indicated through a arrow.



The Program While Running



The Program While Displaying Data

Cost Analysis

The project has a big advantage that it is designed in cost effective way. All the mechanical and electrical parts' estimated cost are listed below. The cost are based on local market but it may vary with time.

Serial	Conventional and Market Name	Amount Used	Unit Price (taka)
MECHANICAL PART			
1	Aluminium Piece	13"x13"	130 per sft
2	Metal Piece (Iron Sheet)	6"x8"	60 (approx)
3	Plastic Blade (fan)	5cm dia 2 nos.	8 each
4	Plastic Transparent sheet	6"x12"x4 & 12"x12"	45 per sft
5	Shaft (vertical)	14 mm dia	70 per pound
6	Shaft Horizontal	9 mm dia	55 per pound
7			
ELECTRICAL PART			
1	LDR (Light Dependent Resistance) Maket Name : LDR	3	15 to 30 taka
2	Schmitt Trigger	1	15 taka

	Market Name : 7414 (SN74LS14N)		
3	Transistor Market Name : 2222 (2N2222A)	6	5 taka
4	Regulator IC Maket Name : 7805 Variable Resistance	1	25 taka
5	LED (Light Emitting Diode)	3	3 taka
6	Resistances, wires and others	-	200 taka (appox)

Uses / Application

Advantages

(1) The main advantages of our project is that it is portable. So we can take this to any place easily for measurement. The size of the whole mechanism is not very big, so it's portability is a great advantage.

(2) In our project we can measure wind velocity & direction simultaneously. It's therefore can workout to serve two purpose at the same time.

(3) Another great advantages of our project is computer interfacing. So data can be stored through out a day. From this data we can easily locate any abnormal attitude if occurs any time of any day. Moreover as both the velocity and the direction can be gathered on the computer so it can be used remotely.

(4) No human observation is needed for this project. It makes the project more reliable and dependable.

(5) Using this equipment we can construct the wind profile of any particular area which helps us to know which region is suitable for building wind turbine and in which direction.

(6) Last of all it costs very little to construct this project.

(7) Maintaining and repairing cost is low.

(8) The system is rugged, physically resilient and mostly mechanical, so it doesn't require very sophisticated handling.

Limitation

(1) We use light sensitive device as sensor. So it may fluctuate to give reading on a sunny or rainy day.

(2) When the velocity of the wind is too high then it might cause some error in the data acquisition system.

(3) The system needs skilled manpower for it's maintenance and repairing.

Conclusion

In this report we provide a general information about the whole project. In completing the project we implied both mechanical and electrical concepts and made use of the both. This project provides a very good example how mechanical interface come together with electrical interface, and neither can work out alone.

The project lead us to many real life experience how things go. In doing the project it was a great experience that taught us how to do project management from basic concept, design, layout, making the mechanical structure, working out the electrical part, combining these two, bringing computer interfacing then again putting all together.

We think no matter how this project stands in quality or in standard, the experience and the project how-to that we learned will enrich our career in the future.

Reference

Texas Instrument Web Documents

Microsoft Encarta Encyclopedia Deluxe 2001

Other Mechatronic websites