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Optimum Wind Direction Tracking Windmill

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Abstract— Wind energy is rapidly advancing as an important means of renewable energy resource. It is a form of solar energy. Wind energy (or wind power) describes the process by which wind is used to generate electricity. Wind turbines convert the kinetic energy in the wind into mechanical power. A generator can convert mechanical power into electricity The direction of wind dynamic and keeps on changing, accurately adjusting the dynamo in direction of optimum wind velocity will not only increase its efficiency but also decrease risks of damage due to over speeding of the generator shaft. This paper presents the designing of a wind tracking system which can track wind speed direction for optimum working of the windmill and to generate maximum electrical energy possible which is based on Arduino UNO. As a result of which we get more efficient system which is compact, low cost as well as easy to use.

Keywords— Arduino UNO, Windmill, Wind Energy, Servo Motor, Back emf .

I. INTRODUCTION

Wind energy have been attracting immense attention because of the cost increase, limited reserves, and adverse environmental impact of fuels such as coal, oil, or natural gas. In the meantime, advancements in technology, cost reduction, and governmental motives have made some renewable energy sources more desiring in the market. Among them, wind energy is the fastest growing renewable energy sources. Over the past two decades a variety of wind power technologies have been developed, which have improve the conversion efficiency reduced the costs for wind energy production. A wind energy conversion system transforms wind kinetic energy to mechanical energy by using rotor blades; this energy is then transformed into electrical energy by generator. "Due to the nature of the wind that is instantaneously changing, hence, there is only one optimal generator speed is desirable at one time that ensures the maximum energy is harvested from the available wind. Therefore, it is essential to include a controller that is able to track the maximum peak regardless of any wind speed."[1].

II. MPPT IN WIND ENERGY

The following section describes the various conventional methods of MPPT in WECS.

1. MPPT based on FLC[2].
2. Hill Climb Search (HCS) method[3]
3. Optimal Torque Control (OTC) Method [4].
4. Power Signal Feedback (PSF)[5].

III. BLOCK DIAGRAM DESCRIPTION

The main aim of the proposed system is to develop a cost effective instrument using an Arduino Microcontroller to track wind for optimum functioning of the wind turbine and generate maximum power possible. This is done by making use of DC motors which are placed as fans in four directions around the windmill. These dc motors operate as generators when rotated by wind generate a back emf whose value depends upon the speed of rotation of the armature of the dc motor which in turn depends upon the wind speed. The back emf hence being a function of the wind speed is used to calculate wind speed and windmill head is rotated in appropriate direction automatically using a servomotor and microcontroller. Block diagram of complete system is shown in Fig. 1 below which consists of power supply, Arduino Uno,DC Motors, servo motor, and Dynamo.

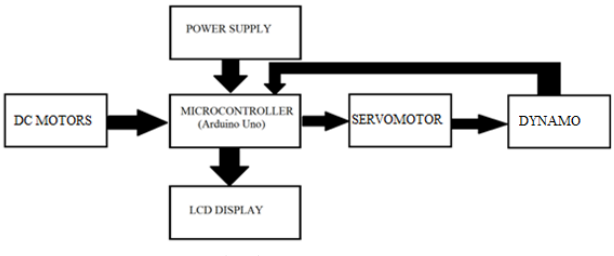

Fig.1 Block Diagram of System

A. Overview of Arduino

Arduino is an open-source electronics prototyping platform, mostly based on small, easy-to-use hardware and software [6-7]. It can affect devices, like lights, motors and other actuators by receiving input from sensor. All the action performed by Arduino is programmed to the microcontroller on the board via Arduino programming language and the Arduino development environment. Arduino projects can be stand-alone or communicate with other software applications running on a computer and other types of hardware.

Fig. 2: Arduino Uno Microcontroller Development Board

The Adruino Uno board as shown in Fig. 2. The Table.1 shows the specifications of Arduino Uno microcontroller board.

Table.1: Arduino Uno specifications

Microcontroller	ATmega328
Operating Voltage	5V
Supply Voltage (recommended)	7-12V
Maximum supply Voltage (not recommended)	20V
Digital I/O Pins	14(of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40mA
DC Current for 3.3V Pin	50mA
Flash Memory	32KB of which 0.5KB used by boot loader
SRAM	2KB
EEPROM	1KB
Clock Speed	16MHz

IV. FLOWCHART OF PROCESS

The given flow chart shows the order of steps taken in the process for designing and working of the system. The system is designed in order to respond to the wind speed and direction, according to which the movement of windmill head is done. Working of system is controlled by arduino microcontroller.

Fig. 3 shows the flowchart of the process. From the flow chart it can be seen that initially the position of windmill head is manually set to face north of the project, note that this is not geological north direction but is a reference point. After this as wind blows the fans place around the windmill in all four directions rotate and a back emf is generated by the dc motors which is directly proportional to the speed of rotation of the armature which in turn is directly proportional to the wind speed. The back emfs are then compared and windmill head is rotated in direction to receive maximum wind flow. However, an upper limit is set in case the wind speed exceeds safe working limits of the windmill. The four dc motors placed around the windmill are named, **N**orth, **S**outh, **E**ast and **W**est and their back emfs are represented by N, S, E and W.

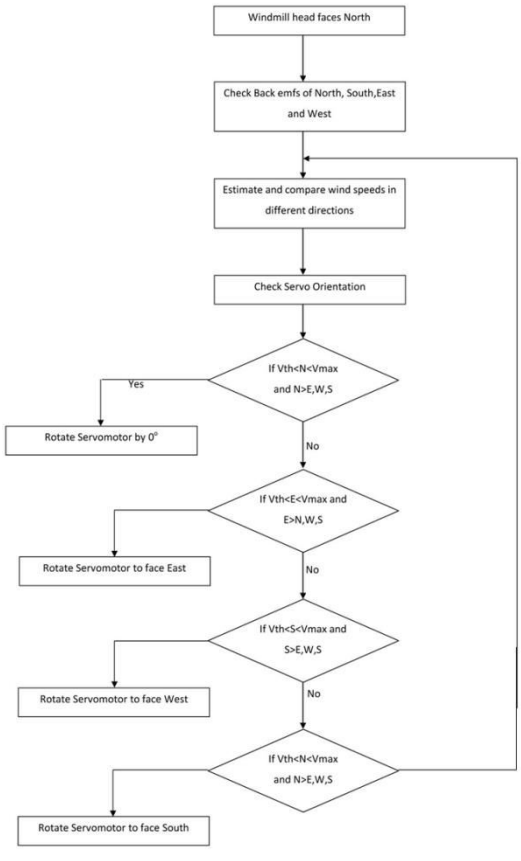

Fig. 3: Flow Chart of Process

V. RESULTS AND DISCUSSION

After designing, developing and implementing of the Optimum Wind Direction Tracking Windmill, improvement of efficiency, compact and low power system is successfully done. System is tested at different times of a month in presence of varying wind speed and direction detect the optimum wind speed in different conditions. The output is taken with the help of dynamo movement according to maximum efficiency. The developed system provides results and output in real time on a 16X2 LCD display.

VI. CONCLUSION

The aim of this project was to design a system that will keep track of windspeeds in different directions and automatically rotate the windmill head in desired direction. Further the advantages and disadvantages were also studied. The disadvantages were the challenges that had to be overcome. From this study the main conclusions are:

i. Proposed system is low cost and compact.

ii. It is very easy to program and modify because it is Arduino based and no external programmer is required.

iii. The designed system is easy to use and provides better efficiency of the wind energy system.

iv. In the developed system real time data is retrieved on the android device.

REFERENCES

[1] Majid A. Abdullah ; A.H.M. Yatim ; Chee Wei Tan, "A study of maximum power point tracking algorithms for wind energy system", IEEE Conference on Clean Energy and Technology (CET), 2011.

[2] Ali El Yaakoubi, Adel Asselman, A. Djebli, El Hassan Aroudam," A MPPT Strategy Based on Fuzzy Control for a Wind Energy Conversion System, 9th International Conference Interdisciplinarity in Engineering, INTER-ENG 2015, 8-9 October 2015, Tirgu Mures, Romania

[3] Shrikant S Mali , B. E. Kushare," MPPT Algorithms: Extracting Maximum Power from Wind Turbines", INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING Vol. 1, Issue 5, August 2013

[4] O Zebraoui1 and M Bouzi1," Comparative study of different MPPT methods for wind energy conversion system", International Conference on Renewable Energies and Energy Efficiency (REEE'2017).

[5] Jogendra Singh Thongam and Mohand Ouhrouche (2011). MPPT Control Methods in Wind Energy Conversion Systems, Fundamental and Advanced Topics in Wind Power, Dr. Rupp Carriveau (Ed.), ISBN: 978-953-307-508-2

[6] M. Amir Abas, M. Hilmi Fadzil S, Samsudin A.Kadir, A. Khusairy Azim, "Improved Structure of Solar Tracker with Microcontroller based Control ",Second International Conference on Advances in Computing, Control, and Telecommunication Technologies, pp. 55-59, 2010.

[7] Dipti Bawa, , C.Y. Patil, "Fuzzy control based solar tracker using Arduino Uno "International Journal of Engineering and Innovative Technology, Vol. 2, No. 12, pp. 179-187, June 201