ISSN (ONLINE): 2454-9762
ISSN (PRINT): 2454-9762
Available online at www.ijarmate.com

International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE)
Vol. 8, Issue 6, June 2022

IoT based Windmill Monitoring System using NodeMCU

D. LogeshKumar, N. Manoj

UG Scholar, Dept. of EEE, Sree Sowdambika College of Engineering, Tamil Nadu, India

UG Scholar, Dept. of EEE, Sree Sowdambika College of Engineering, Tamil Nadu, India

ABSTRACT:

Wind energy is used as an alternate form of energy to meet the increasing energy crisis. Wind farms are set up in highly exposed sites. Wind is fluctuating in nature and hence a continuous monitoring system is needed. The wind turbine is used for converting wind energy into a useful form of energy. In this project the various parameters of wind are measured and monitored by setting up an instrumentation system. Due to environmental conditions, the remote location of wind farms, and the vertical height of the nacelle, it is expensive to physically visit wind turbines for maintenance and repair. So, we proposed the system to monitor the status of wind turbine from anywhere in the world using Internet of Things (IoT) technology. In our present work, it is declared that the system with IoT and Universal Asynchronous Receiver/Transmitter (UART) to monitor and diagnose the problem in the wind turbine application. The work deals with the data transmission between two units in the exact time without any disturbance.

Keywords — **NodeMCU , IoT, Wind turbine.**

I. INTRODUCTION

In front of the huge increase demand in energy over the world, and in order to search a substitution kind of energy against the prices rise of the energy fossil fuel resources and then its exhaustion reverse in the long term. The development of this alternative is encouraged because it offers natural, economic, clean and safe resource. Monitoring and diagnosis become essential to reduce maintenance costs and ensure continuity of production, because stopped a wind installation for unexpected failures could lead to expensive repair and to lost production. This operating system stopped becomes critical and causes very significant loses , for this reason there is an increase need to implement a lot efficient maintains, This online surveillance allows an regular early detection mechanical and electrical faults; it must able to prevent major component failures the wind turbine becomes an important topic in scientific research and industries. The main objective of this project is to study the design of a real time monitoring and controlling system for state supervision of wind generator machine.

RELATED WORK

"Energy can neither be created nor be destroyed" Today because of an increase in human resources the need for energy resources is also increasing. The surplus amount of resources has been decreasing. Hence there is an urge to find any alternate resources .Energy can be renewable and nonrenewable. The use of nonrenewable energy resources reached a particular extent. It is better to use any renewable form of energy resources. Among the renewable energy resources wind energy is widely used. It has its own advantages such as availability, non-polluting, no greenhouse gas emission etc. Wind energy can be converted to a useful form of electrical energy using wind turbines. For any process to get the perfect results the process should be controlled and monitored at regular interval of times. The importance of instrumentation system lies here. The various parameters like wind speed, temperature, direction are measured periodically and monitored to check if any deviations occur.

i. SMALL WIND TURBINE

ISSN (ONLINE): 2454-9762
ISSN (PRINT): 2454-9762
Available online at www.ijarmate.com

International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE)
Vol. 8, Issue 6, June 2022

A wind turbine is a device that converts kinetic energy from the wind into electrical power. A wind turbine used for charging batteries may be referred to as a wind charger. The result of over a millennium of windmill development and modern engineering, today's wind turbines are manufactured in a wide range of vertical and horizontal axis types. The smallest turbines are used for applications such as battery charging for auxiliary power for boats or caravans or to power traffic warning signs. Slightly larger turbines can be used for making small contributions to a domestic power supply while selling unused power back to the utility supplier via the electrical grid. Arrays of large turbines, known as wind farms, are becoming an increasingly important source of renewable energy and are used by many countries as part of a strategy to reduce their reliance on fossil fuels. A small wind turbine is a wind turbine used for micro generation, as opposed to large commercial wind turbines, such as those found in wind farms, with greater individual power output. These turbines may be as small as a fifty-Watt generator for boat, caravan, or miniature refrigeration unit.

ii. CHALLENGES IN WIND TURBINES

The Major Challenges in designing the application for monitoring the wind turbines conditions are given as follows.

1. Power

The power is one of the major challenging issues in wind turbines; the power is not constant on daily basis. It differs based on the wind direction and speed. The Phase sensors that we use here for the monitoring of phase voltage produced by the wind turbines monitor the output phase voltage produced by the wind turbines. If the power generated by the wind turbine is low due to low wind speed then there is no necessity of transmitting the power from one place to another.

2. Noise

Under certain circumstances, when the distance is higher than 2.5 Km then we hear it low. On the other hand when the distance is less than 1 Km then we can hear more sound which makes the humans nearby a lot of disturbances and leads to a severe health problems.

3. Environment

Due to the implementation of the Wind turbines, we face some environmental problems that are addressed below. It does kill some birds and does the destruction of native vegetation and possible problems connected with buildings and hard stands. There will be some worries like killing up of birds, bats, which become an unusual fashion.

4. Vibration

The Vibration is sometimes more in wind turbines and it makes the displacement of sensors placed in it for monitoring the vibration. The Accelerometer is a sensor used to monitor the vibration that occurs often in wind turbines. The sensors are tried to place inside the rotor parts on a closed surface.

5. Temperature & Speed

We use Temperature and RPM sensors to monitor the turbines speed and Temperature surrounded by it. We place the sensors near the gear box for temperature monitoring and above the rotor for monitoring the RPM. Vibration of the turbines may affect the sensors placed in and around the turbines that need to be taken care.

These are the Major Challenges that we face in wind turbines, while we implement the sensors over them. The challenges are overcome by implementing our novel idea which addresses almost all the Issues of Wind Turbines.

iii. PROBLEM DEFINITION

Valid Wind Power Problems->There are many claimed, but unjustified, problems with wind power; much of this page deals with these claims. This section lists some of the real problems and will redirect the reader elsewhere (mainly on this page) for details. The problems can be placed into several categories.

Noise Problem->Turbines can, under some circumstances be heard at distances at least as great as 2.5km. While the sound is not loud, some people find it annoying, and at smaller distances (perhaps 1km or less) it may stop some people from sleeping and lead on to anxiety and stress in some people; this, in turn, can lead to

ISSN (ONLINE): 2454-9762
ISSN (PRINT): 2454-9762
Available online at www.ijarmate.com

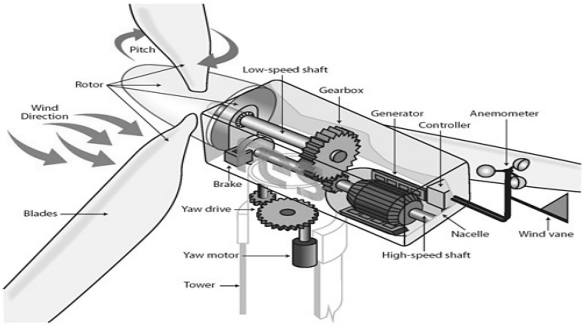
International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE)
Vol. 8, Issue 6, June 2022

health problems.

Power Availability and transmission Problem->The wind does not blow all the time. When the wind is not blowing wind turbines do not generate power. At times of peak electricity demand winds tend to be lighter than average. When any type of generation is not in the same place as consumption there is the need to transmit the power from one place to another. This requires very expensive high capacity, high voltage, and transmission lines. For example, South Australia has much more wind power per capita than other states; if wind generation is high and consumption is low in SA then the power must be sent interstate.

Environment problem->There are a number of environmental concerns that are perfectly valid. Wind turbines do kill some birds and there are problems involved with the necessary destruction of remnant native vegetation and possible erosion problems connected with the building of roads and hardstands. It seems that wind turbines kill a worrying number of bats, but there is a lack of research on this; birds are pretty and visible, bats are rarely seen and are not 'cute and cuddly'.

At least some wind turbines (and much other modern machinery) use magnets based on a group of elements called rare earths; the mining of rare earth minerals in third world countries has been carried out with little concern for environmental damage. Much of the world's rare earths come from China; see the Guardian Weekly for a description of some of the environmental damage there. [2] discussed about a system, GSM based AMR



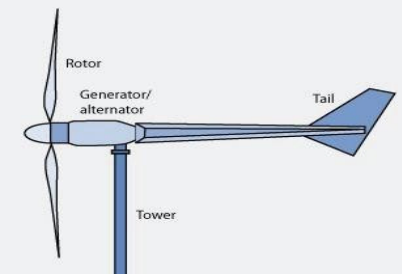
has low infrastructure cost and it reduces man power. The system is fully automatic, hence the probability of error is reduced. The data is highly secured and it not only solve the problem of traditional meter reading system but also provides additional features such as power disconnection, reconnection and the concept of power management. The database stores the current month and also all the previous month data for the future use.

II. DESIGN GOALS

Smaller scale turbines for residential scale use are available. They are usually approximately 7 to 25 feet (2.1–7.6 m) in diameter and produce electricity at a rate of 300 to 10,000 watts at their tested wind speed. Some units have been designed to be very lightweight in their construction, e.g. 16 kilograms (35 lb), allowing sensitivity to minor wind movements and a rapid response to wind gusts typically found in urban settings and easy mounting much like a television antenna. It is claimed, and a few are certified, as being inaudible even a few feet (about a meter) under the turbine. The majority of small wind turbines are traditional horizontal axis wind turbines, but vertical axis wind turbines are a growing type of wind turbine in the small-wind market. Makers of vertical axis wind turbines such as WePower, Urban Green Energy, Helix Wind, and Windspire Energy, have reported increasing sales over the previous years.

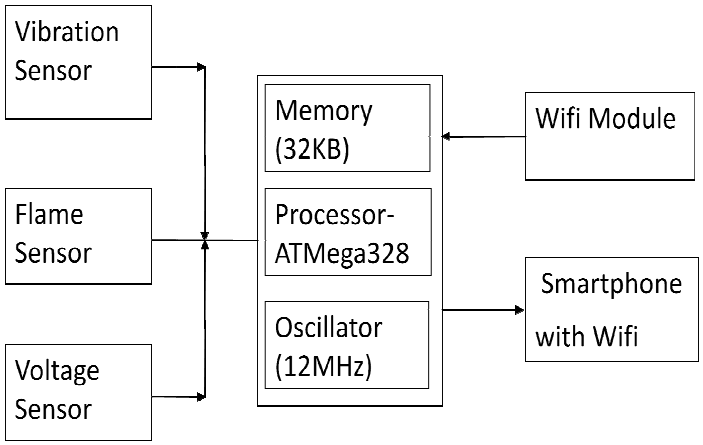
ISSN (ONLINE): 2454-9762
ISSN (PRINT): 2454-9762
Available online at www.ijarmate.com

International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE)
Vol. 8, Issue 6, June 2022



The generators for small wind turbines usually are three-phase alternating current generators and the trend is to use the induction type. They are options for direct current output for battery charging and power inverters to convert the power back to AC but at constant frequency for grid connectivity. Some models utilize single-phase generators.[9] Dynamic braking regulates the speed by dumping excess energy, so that the turbine continues to produce electricity even in high winds. The dynamic braking resistor may be installed inside the building to provide heat (during high winds when more heat is lost by the building, while more heat is also produced by the braking resistor). The location makes low voltage (around 12 volt) distribution practical. Small units often have direct drive generators, direct current output, and lifetime bearings and use a vane to point into the wind. Larger, more costly turbines generally have geared power trains, alternating current output and are actively pointed into the wind. Direct drive generators are also used on some large wind turbines. [8] discussed about a project, in this project an automatic meter reading system is designed using GSM Technology. The embedded micro controller is interfaced with the GSM Module. This setup is fitted in home. The energy meter is attached to the micro controller. This controller reads the data from the meter output and transfers that data to GSM Module through the serial port. The embedded micro controller has the knowledge of sending message to the system through the GSM module. Another system is placed in EB office, which is the authority office. When they send "unit request" to the microcontroller which is placed in home. Then the unit value is sent to the EB office PC through GSM module.

III. PROPOSED METHOD



We plan to use Arduino Uno, the open source and user friendly hardware, with Wifi connectivity portable to laptops and PCs. The datas such as Voltage Generated, Occurrence Flame, Occurrence of vibration from the essential components of turbines such as shaft, gear box are monitored by the above setup placed on the windmill station. The condition for abnormality is identified and the notification is sent to the owner. Amount of Voltage generated is also stored in online database (ThingSpeak) for future reference.

ISSN (ONLINE): 2454-9762
ISSN (PRINT): 2454-9762
Available online at www.ijarmate.com

International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE)
Vol. 8, Issue 6, June 2022

IV. COMPONENTS USED

A. VOLTAGE SENSOR

Voltage sensor is a device that converts voltage measured between two points of an electrical circuit into a physical signal proportional to the voltage. Monitor input voltage ranging from 3to 500v DC

B. TEMPERATURE SENSOR

Temperature sensor is a device that generates electrical voltage which is directly proportional to Changes in temperature for temperature measurement. LM35 is a precision IC temperature sensor with its output proportional to the temperature. Temperature sensor is frequently provided in IC to detect

when the operating temperature limits have been exceeded. Temperature can be measured more accurately than with a thermostat.

C. VIBRATION SENSOR

A piezoelectric sensor is a device that uses the piezoelectric effect to measure pressure, acceleration, strain or force by converting them to an electrical signal. Vibration sensor can also be used to harvest wasted energy from mechanical vibration.

D. NODE MCU

It is the WIFI module combined with the processor unit commonly known as ESP 8266 used to connect with sensors with the internet inorder to upload the data to online database and to send notifications.

V. CONCLUSION

A step-by-step approach in designing the microcontroller based system for WIND Turbine Monitoring of the four essential parameters to Monitor Speed, Current, Voltage, Vibration has been followed. The results obtained from the measurement have shown that the system performance is quite reliable and accurate. The system has successfully overcome quite a few shortcomings of the existing systems by reducing the power consumption, maintenance and complexity, at the same time providing a flexible and precise form of securing the wind monitoring. The continuously decreasing costs of hardware and software, the wider acceptance of electronic system in Major areas, will result in reliable monitor the systems that will address ever all aspects of quality and quantity of production. Further improvements will be made as less expensive and more reliable sensors are developed for use in Wind Mill production. Although the enhancements mentioned in the previous chapter may seem far in the future, the required technology and components are available, many such systems have been independently developed, or are at least test data prototype level. Also, integration no fall these technologies are not a daunting task and can be successfully carried out. It will possible to monitor the Multiple wind turbines with sensor interconnected.

VI. REFERENCES

[1] Joshua D. Freeman1, Melvin Sabu2, Balakrishnan Shankar3 “Wind Monitoring” IEEE Comm. Magazine, vol. 40, no. 8, pp. 102-114, Aug. 2002.

[2] Christo Ananth, G.Poncelina, M.Poolammal, S.Priyanka, M.Rakshana, Praghash.K., “GSM Based AMR”, International Journal of Advanced Research in Biology, Ecology, Science and Technology (IJARBEST), Volume 1,Issue 4,July 2015, pp:26-28

[3] Subha Palaneeswari M., Abraham Sam Rajan P.M., Silambanan S., Jothimalar, "Blood lead in end-stage renal disease (ESRD) patients who were on maintainence haemodialysis", Journal of Clinical and Diagnostic Research, ISSN : 0973 - 709X, 6(10) (2012) pp.1633-1635.

[4] Sharmila S., Rebecca L.J., Saduzzaman M., "Effect of plant extracts on the treatment of paint industry effluent", International Journal of Pharma and Bio Sciences, ISSN : 0975-6299, 4(3) (2013) pp.B678-B686.

[5] Jeyanthi Rebecca L., Dhanalakshmi V., Sharmila S., "Effect of the extract of Ulva sp on pathogenic microorganisms", Journal of Chemical and Pharmaceutical Research, ISSN : 0975 – 7384 , 4(11) (2012) pp.4875-4878.

ISSN (ONLINE): 2454-9762
ISSN (PRINT): 2454-9762
Available online at www.ijarmate.com

International Journal of Advanced Research in Management, Architecture, Technology and Engineering (IJARMATE)
Vol. 8, Issue 6, June 2022

[6] Sharmila D., Saravanan S., "Efficacy of lead on germination growth and morphological studies of Horse Gram (Dolichos biflorus Linn)", Journal of Chemical and Pharmaceutical Research, ISSN : 0975 – 7384 , 4(11) (2012) pp.4894-4896.

[7] Saduzaman M., Sharmila S., Jeyanthi Rebecca L., 'Efficacy of leaf extract of Moringa oleifera in treating domestic effluent", Journal of Chemical and Pharmaceutical Research, ISSN : 0975 – 7384, 5(2) (2013) pp.139-143.

[8] Christo Ananth, Kanthimathi, Krishnammal, Jeyabala, Jothi Monika, Muthu Veni, "GSM Based Automatic Electricity Billing System", International Journal Of Advanced Research Trends In Engineering And Technology (IJARTET), Volume 2, Issue 7, July 2015, pp:16-21

[9] S. Samarah, A.S. Habyalimana, and A. Boukerche, "Target-Based Association Rules for Point-of-Coverage Wireless Sensor Netwoks," Proc. 14th IEEE Symp. Computers and Comm., pp. 938-943, 2009.

[10] Advanced Micro Devices, A.M.D., 1996. Magic packet technology application in hardware and software. Publication, 20381.

[11] Thooyamani, K.P., Khanaa, V., Udayakumar, R., "Wireless cellular communication using 100 nanometers spintronics device based VLSI", Middle - East Journal of Scientific Research, v-20, i-12, pp:2037-2041, 2014.

[12] Vanangamudi, S., Prabhakar, S., Thamotharan, C., Anbazhagan, R., "Dual fuel hybrid bike", Middle - East Journal of Scientific Research, v-20, i-12, pp:1819-1822, 2014.

[13] Udayakumar, R., Kaliyamurthie, K.P., Khanaa, Thooyamani, K.P., "Data mining a boon: Predictive system for university topper women in academia", World Applied Sciences Journal, v-29, i-14, pp:86-90, 2014.

[14] Satheesh, S., Lingeswaran, K., "High efficiencytransformer less inverter for single-phase photovoltaic systems using switching converter", Middle - East Journal of Scientific Research, v-20, i-8, pp:956-965, 2014.

[15] Vijayaragavan, S.P., Karthik, B., Kiran Kumar, T.V.U., "A DFIG based wind generation system with unbalanced stator and grid condition", Middle - East Journal of Scientific Research, v-20, i-8, pp:913-917, 2014.