WIRELESS WINDMILL DIRECTION CONTROL USING SERVOMOTOR

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ABSTRACT: Our project idea is to control the wind mill direction by using the servo motor and technical possibilities while building a wireless communication network for wind mill. At present the people who work with windmill are using a stepper motor for control the direction of wind mill. Compare to the stepper motor it is most effective for control the direction while replace the stepper motor is replaced by servo motor. The wind blades are moves depend upon the availability of wind force. The wind blades are not moves continuously because the air flows in a various direction in a time by time so this time wind blades are idle. Our system is used to optimize the idle time of the wind mill and produce the continuous power supply by using servo motor. The microcontroller is directly communicated with servo motor and microcontroller Programmed in a way such that will can trace out where the wind flow is occurs. Wireless network is utilized to transmit some measured environmental and physical parameters of and around the wind mill to the main receiver station. The purpose of measuring parameters like wind speed and measuring of the angle are transmitting them on wireless radio link is to monitor the wind mill status and conditions for further optimization and controlling.

Keywords: Servo-motor, RF Module, Wind Sensor

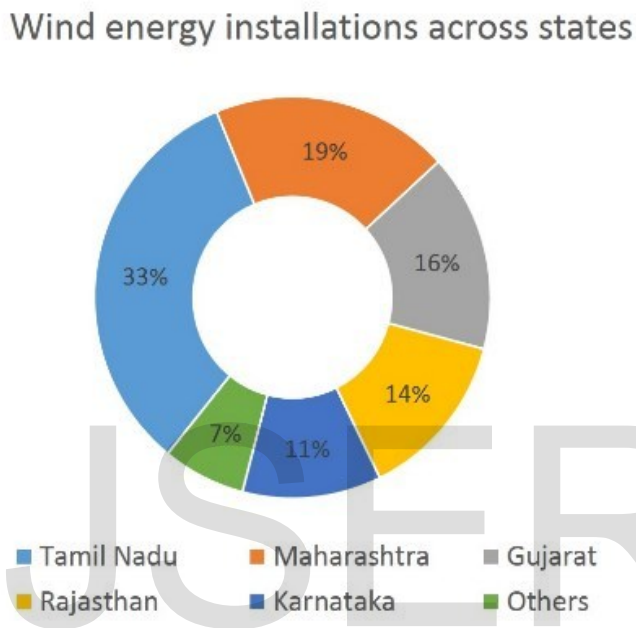
I. INTRODUCTION

The world produces carbon dioxide that is released to the earth's atmosphere. This increased content of carbon dioxide increases the warmth of our planet. To reduce global warming effect the alternative energy sources are used. A wind power is the one of the green energy source.

Wind energy has been the fastest growing renewable energy sector in India. Energy is vital for the country's economic growth and improving the life standard of its citizen. India has spent many resources on increasing its energy capacity since independence. As a result, country's generation capacity has increased considerably. Since natural resources are running out and the use of electricity is being increased in the casual life, mankind is forced to find new sources to produce electrical power and minimized electricity rate.

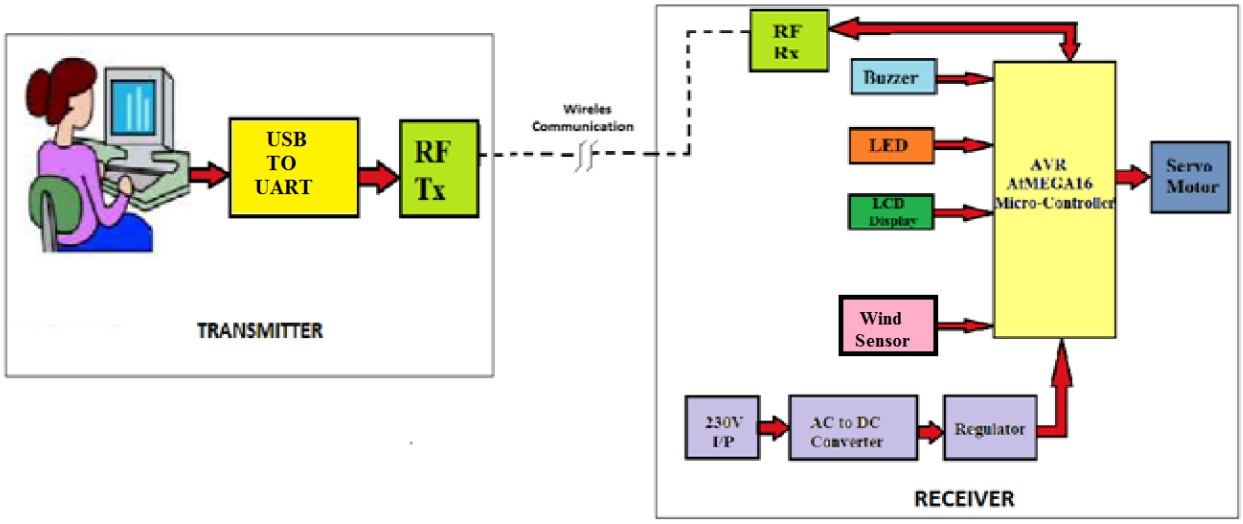
Wind power is a clean and renewable energy source and increasingly accepted as a major complementary energy source for securing a sustainable and green energy future in India.

The Indian government has aimed to fully utilize the abundant resources of this energy, which India has. The official assessment shows this country has potential to generate over 100,000 MW of wind energy. Till May 2014, generation capacity of 21,268.3 MW has been created through wind, which places India in the fifth place globally. This paper provides a detailed description of Indian wind power industry and discusses several developments which accelerated its growth.



The wind turbine blast is a identified as a major problem against green energy. It is not only threatening factor for the people but also causes dangerous hazard for human life. At the present days, wind turbine is replaced by servo motor in windmill.

II. BLOCK DIAGRAM



Basic Block diagram of PC based wireless windmill direction control using servo motor

WORKING:

Wind power has the great potential to provide pure and eco-friendly wherever wind is blowing. It is due to the proliferation of wind farms and their operation in supplying the national electric grid with low cost and clean resources. The wind mill is fixed on the wind specific area. Our project idea is change the direction of wind mill when the wind is came from any direction.

Our project consists of two sections data acquisition unit and control unit. At transmitter side we used PC based wireless communication system. The signal is simulation in PC base hyper terminal windows. The signal is transmit from USB to UART port through RF transmitter. That is necessary with a real-time wireless connection in offshore or inaccessible locations while the wired method has many flaws. The radio signal is transmitted the RF transmitter to the RF receiver through the wireless communication network.

AT the receiver side, a regulated 5V supply is given to the AVR ATMEGA16 microontroller.AVR is interfacing with servo motor, RF receiver, LCD display, LED, buzzer and variable port. The AVR is control the servo motor. Buzzer and LED are indicates the radio signal can transmitted successfully.LCD is display the information of wind direction, wind speed, date and time. A Servo motor is one of the most commonly used motor for

precise angular position. The merits of using a servo motor are that the angular movement of the motor can be controlled without any feedback mechanism. Servo motor working principle and operation is very simple, it consisted three wires where two of them (Black and red) used to provide power and the third wire is used to provide control signal. Pulse Width Modulated (PWM) waves are used as control signals and the angular movement is definite by the width of the pulse at the control input.

The Radio signal is received by the RF receiver than this signal is send to the AVR because of the analog to digital converter are inbuilt in AVR, so the signal is converted in digital form. Than the AVR which program to determine the airflow direction based on the input signal, Signal information is provides the position of the moving angle of the windmill which helps to find out the air flow direction. Finally the controllers trigger the servo motor on the air flow direction. When corresponding value is given in motor then the windmill is slightly rotate in correct direction.

III. SERVO MOTOR

Servo motors have been used for a long time and are utilized in a lot of applications. They are small in size but energy efficient. Servo motors are also use in industrial based applications, in line manufacturing, robotics and food services.

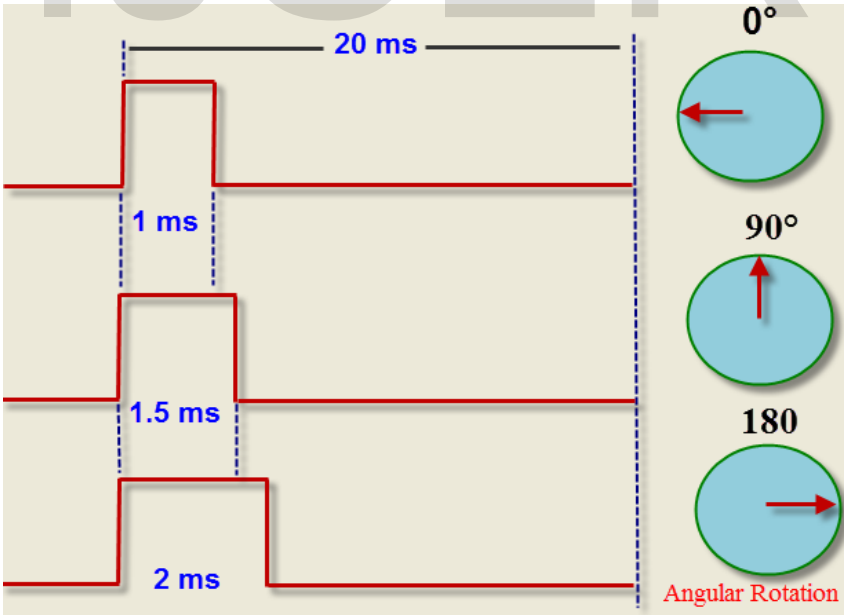
Servo Motor

- **Servomechanism**

Servo system is an automatic closed loop control system. It is generally consists of three components like a controlled device, a output and a feedback system. In this system, to control a device by sending the variable input signal. Then a device is controlled by a feedback signal to compare output signal with reference input signal. When reference input signal is apply to the system, it is compared with output reference signal which is produced by output sensor and other signal produced by a feedback system. This signal is known as an input signal of the controlled device.

This input signal to the device presents as there is a Logical difference between reference input signal and the output signal of the system. After the device gets its required output, there will be no longer the logical difference between reference input signal and reference output signal. Then the third signal produced by comparing theses above said signals will not remain enough to operate the device extra and to produce a extra output of the system until the next reference input signal or command signal is applied to the system. Hence, the primary task of a servomechanism is to keep the output of a system at the required value in the presence of any disturbance.

➢ Servos Timing



Timing diagram of servo motor

Servos are controlled by sending them a pulse. The pulse is of variable width. The parameters for this pulse are that it has a minimum and maximum width. A pulse of about 1.5 ms (micro- second) is the initial point for the servo. The rotation constraints of the servo where initial position. It is defined as the position where the servo has exactly the same amount of rotation and it rotates in the counter clockwise direction. It is important to note that different R-C servos will have different constraints on their rotation but important that they have a neutral position. That position is always around 1500 us.

These servos are active devices means when it commanded to move they will hold their position. So, if an external force is present to push against the servo, it will actively oppose ban external force. Servos will not hold their position forever till the position pulse must be repeated to instruct the servo to stay in position. When repetition timeout is expires then there has not been another pulse the servo de-energizes the motor.

When the pulse sent to a servo is less than 1.5ms, the servo holds its position of some number of degrees in anti-clockwise direction from the initial point. When the pulse is wider than 1.5ms then opposition occurs. The minimum and maximum width of pulse will instruct the servo to turn to valid position. The minimum pulse will be about 1ms wide and the maximum pulse will be 2ms wide. The on-time duration of the control signal varies from 1ms to 2ms. This on-time variation provides angular variation from 0 to 180 degree.

Another parameter that varies from servo to servo is the turn rate. This is the time it takes from the servo to change from one position to another. The worst case turning time is when the servo is holding at the minimum rotation and it is commanded to go to maximum rotation. This can take several seconds on very high torque servos.

IV. BASCOM SOFTWARE

Bascom Software is used with Bascom development tools for AVR based microcontrollers. With the Bascom tools, you can generate embedded applications for virtually every AVR derivative. The supported microcontrollers are listed in the Bascom-AVR.

Since Atmel's AVR microcontrollers are new to the market, they are not so well known as the 8051 controllers. Therefore this microcontroller family should be described in more detail.

Atmel's AVR microcontrollers use a RISC architecture which has been developed to take advantage of the semiconductor integration and software capabilities of the 1990's. The resulting microcontrollers offer the highest MIPS/mW capability available in the 8-bit microcontrollers market today.

Fig.6 Software Start-up

The architecture of the AVR microcontrollers was designed together with C-language experts to ensure that the hardware and software work hand-in-hand to develop a highly efficient, high-performance code.

The family of AVR microcontrollers includes differently equipped controllers - from a simple 8-pin microcontroller up to a high-end microcontroller with a large internal memory. The

Harvard architecture addresses memories up to 8 MB directly. The register file is "dual mapped" and can be addressed as part of the on-chip SRAM, whereby fast context switches are possible.

ROBOKITS AVR Programmers (STK 500):

We are using STK-500 loader to load the hex file of the program in the microcontroller ATmega16. It is done by means of ROBOKITS AVR programmer. This can also be used for various other microcontrollers. Here the snap shot of this software is shown in figure.

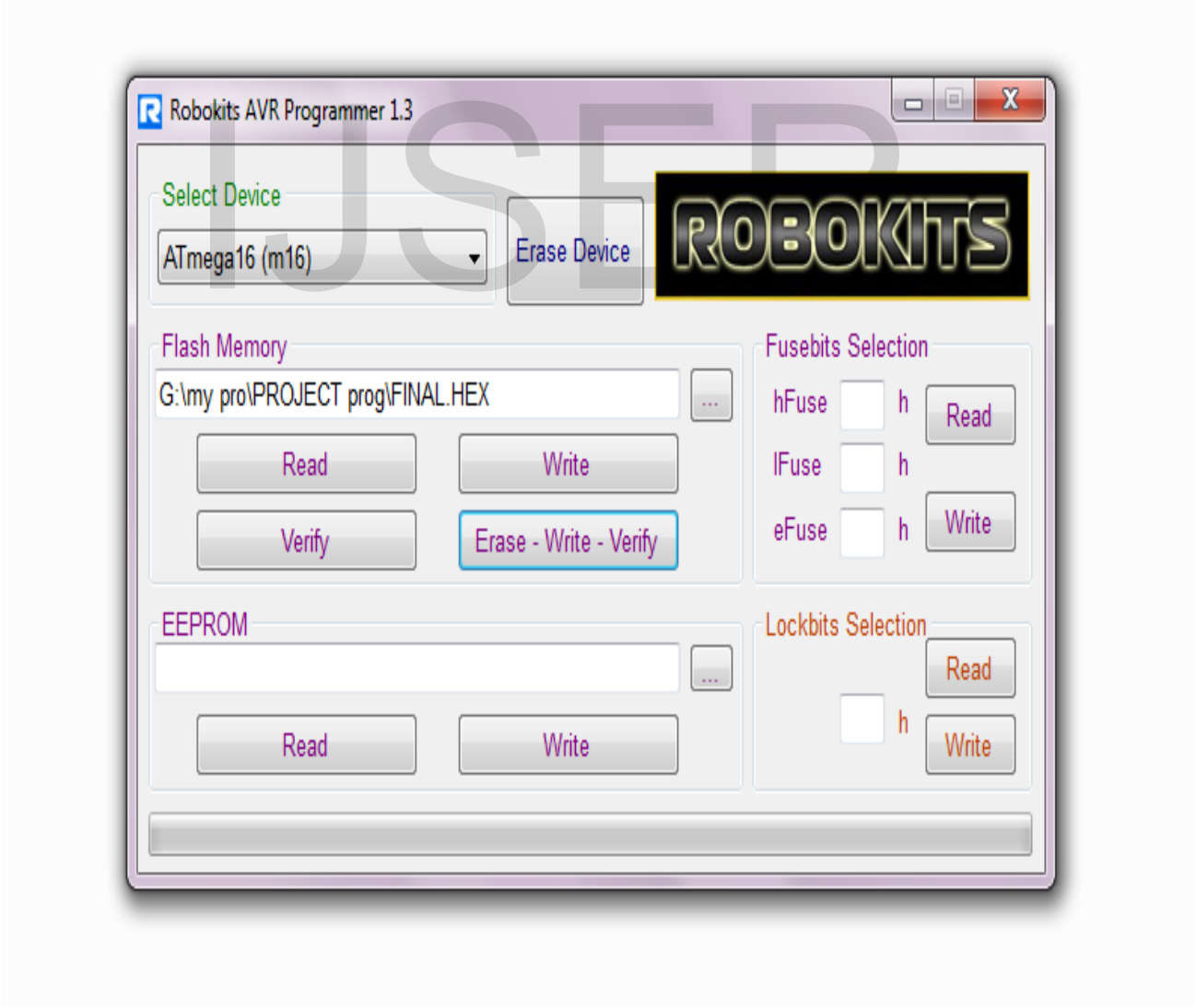


Fig.8 Robokits Loader

V. ADVANTAGES AND APPLICATION

Advantages

1. It can produce electricity in any wind direction
2. Energy is generated without polluting environment.
3. Collect maximum amount of wind energy
4. Smooth rotation at low speed.
5. Easy installation.
6. Low maintenance cost.
7. Windmill generators don't emit any emissions that can lead to acid rain or greenhouse effect.

Application

1. Small Scale Industries
2. Farm Houses
3. Water Pumping
4. Generating Power at Remote Sites
5. Boats and yachts
6. Agriculture application

VI. CONCLUSION & FUTURE WORK

By using of servo motor in wind mill it will provides the better performance when compare with Stepper motor. Our idea describes the concept of feedback system in electrical response. Every system is modeling in electrical signal will provides high accuracy. Here the stepper motor is replaced by servo motor interface for the betterment of high efficiency the AVR ATmega16 microcontroller. 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 are developed for use in Wind Mill production.

Power measure at every 10 degree

Change material easy to work system

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