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Vertical Column Wind Speed Measurement at PVAMU

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Abstract

This project was designed to report wind data such as speed, frequency, direction, and temperature for future plans to install a multitude of wind turbines at Prairie View A&M University. Useful information on wind data throughout the past 10 years at the University was found from The Natural Resources Conservation Service (NRCS). Information was used for selecting wind generators that can operate at minimal operation speed for power generation at PVAMU. A system of an anemometer developed in-house and a custom programming code was completed for microcontroller made very accurate data generation successfully. This project work will allow support for future research at PVAMU.

Introduction

Currently, wind energy is in increasing demand in developed and under-developed countries around the globe. It is an energy-efficient renewable resource many countries are installing wind turbines to replace traditional fossil fuel resources. Wind energy is easily the most applicable source of renewable energy for any location within the northern hemisphere.
The purpose of our research is to verify wind data provided by the Natural Resource Conservation Service (NRCS) if adequate wind energy is available on the campus for power generation (Figures 1 and 2). The in-house developed system for measuring frequency was very successful and also more accurate in data generation when compared to the commercially available systems. A mobile communication setup with the in-house developed system that will collect and communicate the wind data of three heights from a remote location in the agriculture field.

Project Description and Results

Wind speed and data analysis in the PVAMU area showed that the installation of wind turbines on campus would be a very good reliable source of energy during the colder months and also adequate throughout the year. The wind speed recommended for most wind turbines is around 3.5 m/s. In this research, it was found that the campus's wind data was above 4 m/s. Also, by being able to record data at different heights here at Prairie View and comparing it to previous years were consistent. A mast was set up to collect wind speed at different elevations (Figure 3). The system was developed for processing data faster (also combined utilized *Equation 1*) than the commercial system (Figure 4). It used the Inspeed Vortex Anemometer (Figure 5).

$$\frac{V_2}{V_1} = \left(\frac{H_2}{H_1}\right)^{\alpha} \qquad \text{…..Equation 1}$$

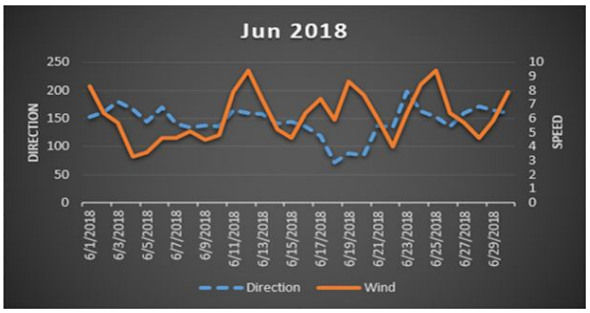

Figure 1: Wind speed during summer

Figure 2: Higher wind speed in winter

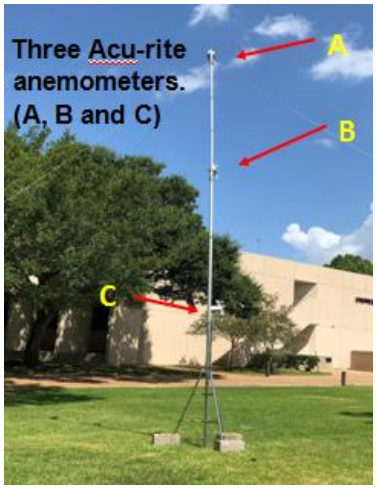

Figure 3: Wind speed mast

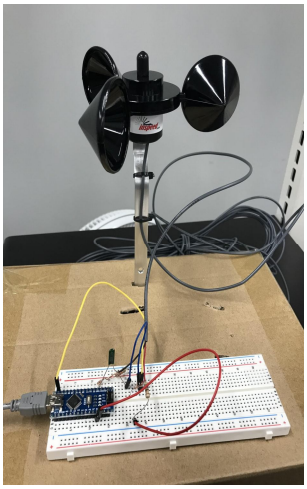

Figure 4: Developed system

```
 frequency=100/((sumH+sumL)/15);
 Speed = frequency*1.22;
}

//freqAvg = frequency/20;
//avgPrint = freqAvg;
//Serial.print ("Average frequency: ");
//Serial.print (avgPrint);


Serial.print ("Frequency: "); Serial.print (frequency); Serial.print (" Hz");
Serial.print ("    Speed: "); Serial.print (Speed); Serial.print (" mph;  |");
Serial.print (Speed/0.44704); Serial.println (" m/s");
   delay(5000);
frequency = 0;
Speed = 0;
sumH=0;
sumL=0;
}
```

Figure 5: Program for microcontroller

Summary and Conclusions

This research will help the university to set up wind turbines in the agriculture farmland at PVAMU. The next step would be to install the Inspeed Vortex Anemometer, equipped with Arduino hardware and software to collect real-time data. The campus has a lot of farms to place turbines as part of renewable energy to edge off the utility bill. Alongside the other energy resources in the smart grid can help secure a safer environment.

References

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