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Concept Paper

Project A

Enhanced Wind Turbine Adapted for Changing Wind Direction

Overview of the Research Topic

This project alongside solar energy, geothermal energy and nuclear energy aims to make the most of naturally abundant resources to address the sustainable clean energy needs to ease the planet off fossil fuels. The project does not aim to reinvent the already existing wind turbine but rather to make it effective irrespective of the direction oncoming wind. If one looks at the already existing wind power projects, for example the Lake Turkana Wind Power Project to be precise, one common feature that all the turbines have is that the turbine blades are always unidirectional. Once the pillars are erected and blades mounted, they are fixed and stay that way their entire service life. Different wind directions need different adjustments of the turbine blades for enhanced performance.

Research Problem Statement

The broader problem that this project will aim to solve is climate change, and it will do so by maximizing wind power production to supply the national grid and power homes. Problems associated with changing wind directions on wind turbines are the specific problem aspects this project will tend to address. When wind changes direction, there are three major downsides; One, the turbine blades become misaligned and the total power output significantly reduces making the wind firms to operate at a loss. Two, changing wind direction changes the frequency electricity generated which may affect the functionality of home appliances designed to operate at constant electric current frequency. Moreover, if a wind power plant exhibits changing frequencies of the current generated, it makes it difficult to integrate it into the national grid. Last but not least, keeping the blades at different rotation speeds rather than a constant speed increases wear and tear on the turbine transmission gears hence high maintenance cost and reduced lifespan.

Justification of the Research Question

Right now, the planet is in dire need of clean and renewable energy sources to mitigate the impacts of climate change. The extensive use of fossil fuels such as petroleum products and coal has resulted into excessive emission of carbon (IV) oxide into the atmosphere thus leading destruction of the ozone layer. All this has led to many problems such as melted polar ice hence increased flooding in some areas, unpredictable weather patterns and drought, and to some extent skin cancer caused by ultraviolet sunlight radiation. So, this project will relieve overreliance on fossil fuels by maximizing wind power (renewable energy) production with the right characteristics at both small and large scales. Taking for example the Lake Turkana Wind Power Project which is projected to generate 310 megawatts, that alone can power tens of thousands of homes and many electric vehicles can plug into it thus reducing carbon emission by a lot.

Proposed Solution

Ideally, the project will be a series of sensors to sense the direction of wind and the send the signals to amplifies which then transmits it to an Arduino NodeMCU 8266 board for processing. The Arduino NodeMCU 8266 node through transistor arrangements is able to send a small current which switches on a large current through a transistor to power a motor which rotates the wind turbine to face the direction of the oncoming wind at all times. Such a set up ensures maximum power production, lower maintenance cost of the turbine (increased lifespan) and constant frequency of the generated electricity irrespective of the direction of wind at any given time.