Green Breeze Final Presentation

ECET 400 - Senior Project

About the Team

Kevin George

Shawn McHugh

Jarrett Bond

August Rosenberger

Project Organization

Jarrett Bond

- Studies electrical and computer engineering technology at NJIT.
- Accomplished electronic technician.
- Responsible for: Designing mechanical components, constructing converter, programming sensors

Shawn McHugh

- Pursuing a Bachelor’s Degree in Electrical and Computer Engineering Technology
- IT Technician by trade and experienced fabricator.
- Responsible for: Constructing base, measuring power output/efficiency.

Kevin George

- Studying Electrical and Computer Engineering Technology at NJIT
- Interested in the Computing side
- Responsible for programming and gathering statistics of device

August Rosenberger

- Majoring in Electrical and Computer Engineering Technology at NJIT
- Interested in hardware development and integration
- Responsible for hardware

Idea

In a world of increasing energy demands, renewable energy must be a high priority. This is why the team at Green Breeze is developing a way to harness mass amounts of unused energy from underground train systems. High speed train systems are spread across the globe and common in China, Europe, and Japan. These trains move in excess of 200 mph, leaving mass air currents pushed to either side. The ability to harness this kinetic energy will increase efficiency and potentially lower fares.

We strive to decrease energy demands in a clean and cost effective manor.

Concept

Efficient wind turbine to capture wasted kinetic energy from moving vehicles. Can be used on roadways or in subway systems and monitored effectively. These units will be easily installed and connected to either segmented or large scale power grids. Wind turbines are not a new concept by any means, however, there is no product ready for wide scale adoption like the Green Breeze. Our product will fit seamlessly into existing power systems with little professional expertise or training.

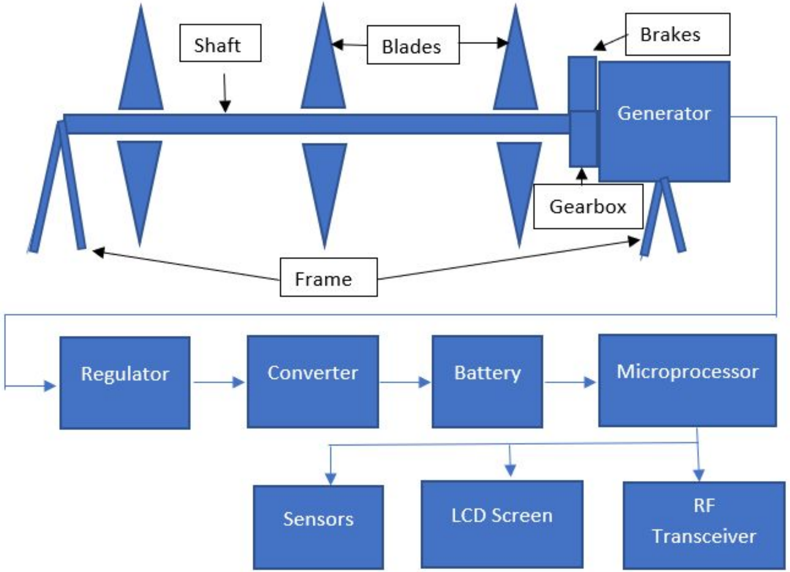
Functions

A horizontal-axis wind turbine. Three sets of turbine blades are staggered one foot apart on a single shaft. The second and third set of blades rotated 40 and 80 degrees clockwise (respectively) in relation to the first set of blades. Designed to be implemented within close proximity of moving automobiles and locomotives, the turbine utilizes the residual wind energy to produce electricity by means of an alternator. The electricity generated is then sent through a regulator to control power output fluctuations. Electricity is then converted to DC and sent to it’s battery. The battery powers all other electronics within the equipment. Additional electronics are used to control the device as well as monitor, store, transmit, and receive all pertinent data.

Functional Specifications

- The turbine produces electricity for the power grid by capturing kinetic energy produced by moving vehicles and converting it into electric energy.
- Can be used on roadways or in subway systems and monitored effectively.

- *Product Features:* Horizontal-axis turbine with multiple sets of blades, LCD screen, microcontroller, monitoring software, voltage regulator, battery pack, power converter, brake system,



Hardware

General

Although our design was meant to be larger and part of a subway system, for demonstration purposes it was scaled down and made into a model. General Concepts and Functionality remain the same.

Base/Mount

The Green Breeze will experience drafts that make proper mounting a requirement. For roadways, a simple circular base with a wider diameter than the turbine can be secured to the sides of the road in a parallel fashion.

In tighter situations like subways, the unit may have to be mounted to a wall due to limited ground space. This requires a horizontal mount that would secure both the top and bottom of the turbine against a wall.

Turbine/Shaft

A horizontal axis turbine with diagonally facing blades will create an efficient and space saving design. Once the design has passed the prototyping phase, it can be produced using recycled plastics to further reduce environmental impact.

Gearing

The gearing ratio must coincide with the desired placement. Air density and speed must be taken into consideration for either a high or low gear ratio. Prototypes will only include a single gear ratio.

Generator

Power generation will be accomplished with a direct current generator for ease of measurement and adoption. The output current will be ideal for small grid systems like subways. A transducer will be required for large scale alternating current grids, resulting in a minor efficiency loss.

Sensors

Proper instrumentation will require a mass airflow sensor, mass air density sensor, turbine crank sensor, and an output current sensor. Additional sensors can be incorporated for more accurate measurements.

Electrical

A central processing and control unit will collect all of the information from the sensors and determine system health and efficiency. Power will only need to be provided to said unit while it is processing or storing information, meaning that it is possible to power the electrical components with power generated exclusively onboard. A low capacity/high endurance battery can be used to ensure guaranteed data collection and storage.

Timeline

Work Breakdown Structure

Turbine Design, Electrical Design and Software Design will be done in parallel with each other taking the considerations of each of the member's strengths and weaknesses. Kevin will work on the software side, Shawn will work on the Electrical side, August will work on the Turbine Design and Jarrett will work on the Turbine Design

General Work Timeline

9/17/2020	Brainstorming and Idea Pitching	
9/22/2020	Functional Design and Concepts	
9/30/2020	Turbine Design	
9/30/2020 and 10/17/2020	Electrical Concepts and Electrical Design	
9/30/2020 and 10/13/2020	Software Programming	
10/25/2020	Turbine Design	
10/20/2020	Input from Mechanical Engineer	
11/28/2020	Implementation of Design as a demonstration	

Appendix A: Acronyms

Converter: A device that converts direct current into alternating current and vice-versa.
Gearbox: A train of gears used to change rotational speed or torque.
Generator: A device that converts mechanical energy into electrical potential.
Infrared Sensor: (IR sensor) A device that measures infrared light within its field of view.
Microcontroller: An integrated circuit that performs a specific function in an embedded system.
Microprocessor: An integrated circuit that performs all CPU functions.
Radio Frequency Transceiver: (RF Transceiver) a device that contains both a transmitter and receiver for communication using radio waves.
Rotor: A rotating assembly that drives the generator.
Turbine: A rotary engine that extracts energy from fluid flow.
Voltage Regulator: A device that takes a variable voltage and outputs a constant voltage.

Appendix B: Parts List

- Infrared sensor
- Temperature sensor
- RF transmitter/ receiver (2)
- LCD Display (2)
- Microprocessor (2)
- Generator
- Full Bridge Rectifier
- Voltage regulator
- Gearbox
- Rotary Blades
- Rotor
- Brake Assembly
- Turbine Frame

Appendix C: Cost Break Down Analysis

Battery:
Type: Voltus Battery VB12-5-T2 Cost: $20.00
Relays:
Charge Relay
Type: IDEC Corporation RH1B-UDC12V Cost: $11.48
Output Relay
Type: Grainger 5RLU7 Cost: $4.58
Buck Converter:
Type: Oiyagai DC to DC Voltage Regulator
Step Down Power Supply Buck Converter Module 6-40V to 5V 3A Dual USB Port Output
Cost: $ 8.50

Appendix C: Cost Break Down Analysis

3.3 Voltage Regulator:
Type: The LM1117
is a low dropout voltage regulator with a dropout of 1.2 V at 800 mA of load current.
Cost: $1.25
Wi-Fi Module:
Type: The smallest 802.11b/g/n Wi-Fi SOC module Cost: $9.43
Atmega 328 MicroController
Type: A low power, CMOS 8-bit microcontroller, with
a CPU throughput approaching one million instructions per second (MIPS) per megahertz
Cost: $1.90
Temperature Sensor:
Type: AdaFruit 3251 - 3.3-5v sensor capable of measuring temperature and humidity
Cost: $8.95

Appendix C: Cost Break Down Analysis

IR sensor:
Type: Parallax 28015 - 5v ultrasonic proximity sensor
Cost: $29.99
Display:
Type: CFAH1602B-TMI-JT - 4/8 Bit parallel
channel LED based text only display. Capable of displaying two 16 character rows of text.
Cost: $7.03

Total Cost: $103.11

Appendix D: Acknowledgements

We would like to thank the following for their input and participation of the overall project:

- Alex Blinder
- Vincent Santoro
- Marquise Perez

Thank you!