Implementation of portable mini wind power generator as renewable energy simulation media

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Abstract. This study aims to implement the portable mini wind power generator as simulation media, Indonesia as a country with two-thirds of its territory is the ocean, crowning the Indonesian nation as the world’s maritime axis. To face these challenges, the balance of technology and natural resources (oceans) is the responsibility of all Indonesian citizens, especially in the field of education which has a role to create and foster human resources. Vocational High Schools take an important role in creating skilled and competent students in their fields. The design functions to design the design of the system to be made, to sort out the functions and usefulness of the tool, as well as the components used so that there are no difficulties in making the system to be built. After the design is continued, the process of making and assembling tools. In the research implementation of Portable Mini Generator Wind Power as a simulation medium for alternative renewable electrical energy by making portable mini wind generator. Based on data from measurement and analysis results, it can be concluded that the working principle of portable mini wind power generators is to use wind as a mini generator drive, which in turn will result in a change in mechanical energy source motion into a renewable electrical energy source.

1. Introduction

Wind Power Generator is a renewable energy source currently used in most parts of the world to supplement with electricity needs [1]. Hydropower was first used in 250BC, and it was recorded that waterpower was used to power the clock. Since this time, hydropower has evolved from running a small clock to generating enough power to supply a large city [2].

The opportunity for vocational students to continue to develop technological developments today has entered a new phase, where every line of life is contiguous even dependent on technology which means technology provides a significant role and impact for human activities some of them in social life, economy and education [3]. Being the task of the field of education both formal and normal to develop human resources so as to be able to offset the rapid rate of growth in technology that is increasingly sophisticated and innovative. Formal education is prepared to offset the growth of technology, one of which is the Vocational High School. Because the responsibility of SMK creates students who have the ability and competent skills in their field.

The State of Indonesia region is a region with a vast sea so it is called a maritime country with 2/3 of the territory of Indonesia being an ocean region [1], Indonesia should also begin to think about the utilization of the Indonesian marine zone to be developed in various ways in accordance with the field of expertise and potential from the vocational high school. In line with what was said by President Joko
Widodo to make Indonesia the world's maritime axis. To realize the ideals of the Indonesian people must be supported by adequate human resources and technology. Indonesia as a maritime country, many of its residents earn a living as fishermen. Special attention needs to be paid to the performance of the fishermen. The role of technology will greatly help and improve the performance of fishermen in sailing.

The existence of Vocational High Schools gives hope to continue to develop technology so that it can go hand in hand with the natural potential of the Indonesian state, especially in the maritime field. With the enactment of the 2013 curriculum (K-13) it provides the ability of skills possessed in accordance with daily life. Vocational students must be able to think about energy needs will be very important for fishermen when sailing of course the source of electrical energy becomes a primary need. Bad things will happen to fishermen if they have to experience a lack of electrical energy. With the simulation of Portable Mini Generator Wind Power on this basic electronic material can provide understanding to vocational students to utilize natural power (sea wind) as a power plant itself, so as to save electricity usage while helping when the energy crisis and also be able to save on the use of diesel fuel to activate the diesel / genset. Where we know the source of electrical energy is very important to turn on electrical equipment during sailing.

With simulation media able to provide better understanding of students because students are able to learn according to the realities in the field, it has been proven that in recent years simulation media has been able to improve student learning outcomes. Application of Physics Learning with PhET Simulation Media in Style Subjects to Improve Student Learning Outcomes in Class VIII A of SMPN 6 Yogyakarta [4]. Research Phet Simulation and Simple Kit to Teach Students' Psychomotor Skills at the Subject of Optical Device [5]. Improving the Quality of Learning in Basic Electronics Subjects in Smkn 2 Salatiga by Utilizing Computer Multimedia was carried out [6].

In the implementation of the simulation of Portable Mini Generator Wind Power on basic electronic materials used design to provide an overview of basic electronic material about electricity obtained from wind power at sea. With the Portable Mini Generator Wind Power equipment students are able to know the electrical energy produced and can be used as an alternative energy source for electrical energy.

The purpose of this research is to build a tool or simulation medium in the form of Portable Mini Wind Power Generator on Basic Electronics as a prototype of basic electronic learning about electricity so that vocational students are able to know the working principles and application of portable mini wind power generators when sailing. Knowing the value of electrical energy generated from portable mini wind power generators. Knowing the benefits and effectiveness of portable mini wind power generators as an alternative source of electrical energy.

2. Literature review

2.1. Generator

A generator is a source of electrical voltage obtained by changing mechanical energy into electrical energy. The generator works based on the principle of electromagnetic induction, which is by turning a coil in a magnetic field so that an induced emf arises. The generator has two main components, namely the stationary part (stator) and the moving part (rotor). The rotor is connected to the generator shaft which rotates at the center of the stator. The generator shaft is usually rotated using an external effort that can come from a turbine, either a water turbine or a steam turbine and then proceed to produce an electric current [7]. This can be analogous to a water pump, which creates a flow of water but does not create water in it. Sources of mechanical energy can be in the form of reciprocating or steam engine turbines, water that falls through a turbine or waterwheel, internal combustion engines, turbines, hand crank, solar or solar energy, air that is used, or any other source of mechanical energy.
2.2. Joule Thief
Joule Thief is a circuit that utilizes the slightest energy source to light a lamp or other electronic device. The work system of Joule Thief utilizes the work system of the inductor. An inductor or reactor is a passive electronic component (mostly in the form of a torus) that can store energy in a magnetic field caused by an electric current passing through it. The ability of an inductor to store magnetic energy is determined by its inductance, in Henry's units. Usually an inductor is a conductive wire formed into a coil, the coil helps to create a strong magnetic field inside the coil due to Faraday's induction law. Inductor is one of the basic electronic components used in circuits where the current and voltage change due to the ability of the inductor to process alternating current [8].

2.3. Inductor and toroid
Toroid inductors are inductors made on a core or cores shaped like a donut. If the cylindrical inductor is usually elongated, the toroid is circular. Usually always use an iron core (core) which is also circular in shape like a donut [3]. One of the advantages of toroidal inductors is that they can be inductors with larger inductances and relatively smaller dimensions compared to cylindrical inductors. Also because the toroid generally uses a circular core, the induction field is closed and relatively does not induce other adjacent components in one pcb. Applications of Toroid Inductors Toroid inductors can be found on
radio devices or switching power supply. The toroidal inductor in the power supply circuit functions as a filter. At this time the toroidal inductor can also be found in the form of transformers, especially transformers in large power amplifier power. Advantages of Toroid Inductors Closed magnetic fields, so that the magnetic field produced by the toroid inductor will not interfere with other electronic devices. Smaller physical form for the same inductance value as other types of inductors. This small physical form gives the efficiency advantage of the inductor assembly. The magnetic field is stronger, so that the toroidal inductor can save the number of turns in making the toroidal inductor.

Figure 3. Toroidal inductor.

2.4. Ferris wheel
This section is the main component to get the maximum possible wind gusts. This part is the most difficult part to build. Experiment continuously with patience so that the suitability is obtained between the strength of the wind, the size of the propeller and the ability of the generator [9].

Windmills here as the main source of energy that is used as a generator and combined with a series of joule thief. In this case the windmill is used instead of battery, the small voltage generated by the windmill generator will be adjusted and optimized with joule thief to be able to produce enough energy. The principle of joule thief, utilizing the slightest source of energy.

3. Research methods
The design functions to design the design of the system to be made, to sort out the functions and usefulness of the tool, as well as the components used so that there are no difficulties in making the system to be built. After the design is continued with the process of making and assembling tools,

The workings of the Portable Wind Generator Mini are the first to take advantage of energy sources from nature, namely wind power, which will move the propeller or windmill on the generator. Utilizing changes in mechanical energy and electromagnetic motion in the generator, electrical energy will be produced. No matter how small the electrical energy produced by the generator will be maximized with a joule thief chain, which will later be used as an energy source to supply electronic devices.

To make Portable Mini Wind Power Generator needed materials: Support poles, dc motors + propellers, Toroid, Electrolyt Capacitors (330uF/20V), BD 139 Transistors, LEDs, connecting cables. Then the assembly is carried out with the circuit scheme used in the Portable Mini Wind Power Generator as follows:
4. Results and discussion
The results of the measurement parameters of energy from portable mini wind power generators are as follows:

**Figure 5. Portable mini wind power generators.**

Power source: Wind gusts
Generator output: $V = 0.5V$ DC; $I = 500$ mA in category very good
Input joule thief: $V = 0.5V$ DC; $I = 500$ mA category very good
Output joule thief: $= 1.5V - 3V$ DC; $I = 500$ mA category very good
Output power: 1.5 Watt category very good

5. Discussion
The working principle of portable mini generator wind power is to use wind as a mini generator drive, which in turn will produce a change in the source of mechanical energy into electrical energy. This energy change utilizes electromagnetic induction in an electric motor. In this tool, to maximize the energy source from the mini generator, a circuit called a joule thief is used. Called the energy thief, because the working principle of the circuit that takes the slightest input energy from the source, will be maximized as output.

Joule thief works with the principle of electromagnetic induction of a coil of wire to a toroid, which is passed on to a transistor as reinforcement. In order to obtain the maximum electrical energy, output to generate electronic devices.
6. Conclusion
Based on data from measurements and analysis, it can be concluded that the working principle of portable mini-wind power generators is to use wind as a mini-generator drive, which will later result in changes in mechanical energy source motion into electrical energy sources. In other words, it would be very effective if installed on a ship for the purpose of sailing the fishermen, because the wind at sea is very enough to drive the wheel / propeller to generate a mini generator and joule thief circuit. With portable mini wind generator, it can be used as a simulation medium as a renewable energy

Suggestion
In making this tool there are still many shortcomings so we need constructive criticism, some things we can suggest on the design and components that can still be developed again by making attractive casing and good components to improve the work and quality of the tool.

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