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Solar Powered Hybrid E-Bike

[1] Manas Kumar Hati

[1] Department of Electronics and Communication Engineering, Galgotias University, Yamuna Expressway Greater Noida, Uttar Pradesh

Abstract: The hybrid-powered electric bicycle is a system that includes three different types of battery charging: solar power, dynamo and 220v AC charging. A solar-powered bicycle linked to a WSN (wireless sensing network) is proposed in this paper to monitor the transfer of solar energy to an electrical energy storage unit and to analyze its effectiveness. A solar-powered bicycle with a connected ZigBee and a wide-end wireless network control system is set up to achieve this goal. Experimental results shows that our prototype, a solar-powered bicycle achieve sufficient solar energy to charge a battery pack of two lead-acid battery. As a result, the user is updated with the data on the amount of immediate solar radiation, the degree of illumination, the ambient temperature, and the bicycle's electrical energy storage capacity information through an internet interface by using a wireless network during the period when the bicycle is parked.

Keywords: Solar energy, Remote power management, Electric bicycle.

INTRODUCTION

Typically the term "hybrid" indicates more than one source of energy. There are many types of bicycles in the world, such as ordinary bicycles that people need to paddle to move, motorized bicycles that use fuel as their primary power, and electric bicycles that can only be enough for an hour. The notion of a solar bicycle came to mind owing to some flaws in the life method. The idea is to make the cycle last longer and can be recharged continuously if the machine is not used by clean solar energy. The idea of solar energy is that the solar energy can produce a high torque engine on the bicycle. To generate the power, the portable solar panel must absorb the solar energy. The power that the panel had absorbed can be used by the motor directly if the power corresponds to the power requirement. If not, the engine will use a battery's capacity. The solar panel will charge the battery when the bicycle was not in use during the day. The system will make the bike more efficient to operate.

With the increasing range of renewable energy and wireless network infrastructure technologies, it is possible to replace the traditional Supervisory Control and Data Acquisition (SCADA) framework that utilizes power cable installation for remote terminal units and the data line network between the control node and the SCADA [1]host center. Taking advantage of renewable energy resources in the environment of a particular mode of transportation offers a power source limited by the physical survival of the mode of transportation rather than an adjunct source of energy. Integrating green photovoltaic energy with wireless network technology allows remote terminal units positioned in an accessible outdoor area to control on-site with photovoltaic power via a wireless ZigBee [2]module, transmitting data back to the SCADA host center without physical wiring.

This research further offers an in-depth understanding of the quality of photovoltaic energy in view of the unreliability of photovoltaic power systems. In addition, the unreliability of photovoltaic energy also makes it crucial for users to understand residual electrical energy. The network element of ZigBee is one type of wireless network agreement made primarily by the ZigBee Alliance. Its first cross-system platform, using the IEEE 802.15.4 standard, is the media access level as well as the entity level. Using the Global Mobile Communications Service (GSM)[3], a mobile phone may receive information about the generated electrical energy from an electric bicycle, feed the details into the remote monitoring center and follow orders from the monitoring center for the time being. First performed wireless data transmission using ZigBee under media access control (MAC) construction and used a system-on - a-chip (SOC) chip, Digital Signal Processor (DSP), Micro Control Unit (MCU), GSM, Bluetooth and Global Positioning System (GPS) for the application of this system's audio applications.

This study integrates renewable solar energy sources, WSN and three wireless internet units, and shortens the use of power lines and chargers for batteries. Using layers beyond the launcher of the sensor element of the solar-powered bicycle, the user can know the data of the immediate degree of illumination of the solar energy, the solar generates d electrical power, the ambient temperature, the electrical energy storage, and so on.

LITERATURE REVIEW

We focus specifically on a new type of e-bike in this paper, the so-called' solar-powered e-bike.' A review paper therefore discusses current literature findings for the use of solar energy in transportation, especially in e-bikes. This paper attempts to explore the status and perceptions of using e-bikes, in particular solar-powered e-bikes. This addresses work on e-bikes and solar-powered e-bikes as well as the solar e-bike's key technological features[4]. In this paper, an extended-range solar-cell hybrid and battery-powered bicycle is proposed to charge two lead-acid batteries via a wireless sensor network (WSN) for the extensive network monitoring of solar energy and the efficiency analysis. The key component of ZigBee used for a far-reaching wireless network monitoring system is set up to achieve this goal. Through adding a small solar panel to charge two batteries during idle or low power times, an extended-range hybrid bicycle can further expand its driving distance[5]. The paper presents a topological overview of hybrid powertrains for battery-powered, range-extended vehicles. First, high-energy versus high-energy battery tradeoffs are revealed. Then, different topologies of battery ultra-capacitor hybrids will be discussed, highlighting each configuration's pros and cons. This indicates the dominance of fully active hybrids, at the cost of decreased electronic circuitry strength, control energy, and performance. The second part of the paper reflects on two forms of range extensors: renewable energy and units dependent on coal[6]. The project is based on a microcontroller with automation technology, comprising of components such as ATMEGA328 and PIC30F2010 as a controller, three-phase inverter, solar panel, Hall Effect sensor, variable resistor, etc. In the existing system, a conventional bike is a two-wheel machine powered by a driver who produces 50% muscle power by pedals that rotate one of the two wheels[7]. A solar powered bicycle is suggested in this paper by a far-reaching network of wireless sensors (WSN) measuring solar energy to pass electrical energy storage and performance measurement. To achieve this goal, the far-end wireless network monitoring system is set up an embarked ZigBee by a solar-powered bicycle. Experimental results show that our prototype, the solar powered bicycle, is capable of managing the solar power to charge two Lead-Acid battery pack[8]. The study was carried out using an experimental method that includes controller systems design, manufacture and testing. In EEPROM microcontroller ATmega8535, the built fuzzy algorithm was planted. The charging current was set at 1.2 Amperes and 40 Volts was observed for the full charged battery voltage. The results showed that a fuzzy logic controller was able to maintain the 1.2 Ampere charging current around the set point with an error rate of less than 5 percent. The cycle of charging batteries from zero to fully charged electric bike lead acid was 5 hours[9]. By converting a normal bicycle into an electric bicycle, a prototype was developed. This prototype is also supposed to have an educational value for future students in the community as it is fitted with tools for e-bike tracking, regulating and data processing for post-trip study. The results consist of a configuration of an

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electric bicycle that meets the requirements and a sketch of an ideal e-bike for this project[10].

METHODOLOGY

Many outdoor solutions for WSNs seem to be very feasible. Nevertheless, removing their dependence on batteries and using solar cells as an exclusive source of energy would allow the daytime outdoor lights to be on constantly. With series and parallel connection, a simplified block diagram of a wireless router node operating on solar energy is shown in Fig. 1 and there's a fig. 2, correspondingly. A router node typically consists of an eight-bit microprocessor with sufficient resources to run its kernel. The microcontroller manages the power of the sensors and the elements of data acquisition as well as the response to the base station commands. A ready-to-use radio frequency transceiver with an eight-bit microcontroller and the device communicates in the 2.4 GHZ frequency band. The research results are explained in this section and at the same time a comprehensive discussion is given. It is possible to present the present result a Patent in figures, graphs, tables and other formats that allow the reader to understand it easily.

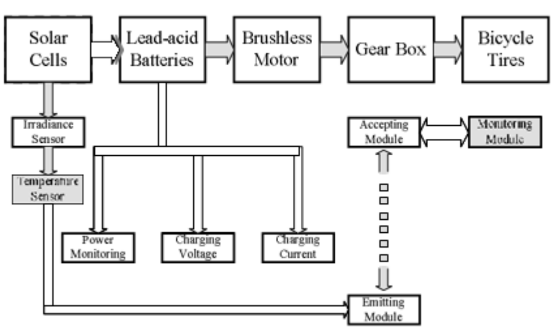

Figure 1: The Series Connected Monitoring Block

Wireless tracking idea of a solar-powered bicycle that can be used to track the degree of immediate illumination electricity, ambient temperature and details on the efficiency of electrical energy storage. It is obvious that for outdoor applications solar energy is the most effective natural energy source available. The use of solar energy services in the outdoor environment offers a power source that is constrained by the physical existence of the system rather than a supplemental energy source that requires electrical sockets or a battery charging station. However, due to the interaction of several factors such as the characteristics of energy sources and environment, the design of an efficient energy harvesting module involves complex tradeoffs. Therefore, in order to maximize the energy efficiency of the solar cell panel, it is important to thoroughly understand and use these variables judiciously.

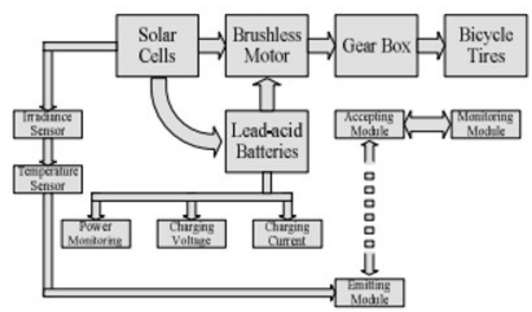

Figure 2: The Parallel Connected Monitoring Block Diagram

It is more convenient to allow electric bicycles to run on stable energy sources such as batteries because of the unstable characteristics of solar energy. The ZigBee's maximum data transmission range is about 100 meters [3]. Therefore, it may require additional nodes to return the data to the central monitoring location. In these WSNs, several such router nodes could be distributed; the number would depend on the size of the campus and the requirements for coverage. Router node in the network usually has a fixed position and its only role is to locate itself in the network and allow prompt data transmission to the nearest router node or base station. Clearly, these router nodes need to be disabled constantly so that data can be transmitted promptly. Thanks to the daytime processing of intermittent solar power outside, it is beneficial to collect continuous data for solar energy scavenging. This would save labor expenses and remove the need for batteries to be replaced.

Referring to Fig. 1 Again, in such networks the base station consists of a router which receives data and is connected to a server. To enable continuous monitoring, the data received by the base station is displayed and can be routed to the characteristics of the battery for easy access in real time. Similarly, ZigBee sensors can scavenge energy through overhead sunlight in the solar powered bicycle with the solar cells rather than using a battery charger. In reality, in such devices, ZigBee sensors could be mobile, so tracking the electrical power in the batteries by photovoltaic solar cells could be feasible and beneficial.

Table 1. Solar Cell Specifications

Solar cells	
Type	GE 50W 12V
Test conditions	
Irradiance	1000W/m2
Module temperature	25°C
Module size	835x540x35 mm
Module weight	6 kg
Maximum power	50W
Maximum power voltage	18V
Maximum power current	2.888A
Open circuit voltage Voc	23.556V
Short circuit current Isc	3.522A
Module efficiency η	η > 15%
Electric bicycle	
Weight	30-35 kg
Tire	22 inch
Maximum speed	35 km/h
Rated loading	<75kg
Lead acid batteries 2x	36Ah x2 (12V)
Noise	62dB
Rated Voltage	24V
Over-current protection	14A±1A
Motor type	Brushless DC motor
Dimension	1580x565x1075 mm

Until embarking on the construction of this solar-powered bicycle for wireless surveillance applications, two key issues have been discussed. First, an efficient energy scavenging system must harvest solar energy. Secondly, this harvested energy must be stored efficiently. The device must also accurately provide the stored energy data to the remote consumer so that the path he or she can use to drive the solar powered bicycle is made known to him or her. It ensures a smart power management strategy has to be in operation. Clearly, this technique must be mindful of how much of the stored energy can be used and where it is necessary to recharge the batteries. Such specifics are discussed in the next few sections along with design factors that impact on performance and the related tradeoffs. Table 1 shows the solar cell specification.

For the solar powered bicycle, an energy harvesting system was used. This consisted of a sufficient number of solar cells to charge the energy storage units, resulting in a controlled capacity to recharge a lead acid battery and another lead acid battery for discharge. The technique is likely to work well for an electric bicycle where the energy storage systems are filled with enough solar energy in the daytime. Nevertheless, solar energy from a 50W solar panel is fairly practical in many outdoor applications.

This strategy was used to get power in the daytime to drive or stop the bicycle. The heart of the energy harvesting module is the power management circuit that derives electricity from the solar panels and controls the electric motor's energy storage and control routing. Maximizing energy efficiency, increasing system stability, and expanding the range of the electric bicycle are the most important considerations in the nature of scavenging electricity. This system's power management circuit provides regulated power in lead acid batteries.

CONCLUSION

This study is conducted on a solar-powered bicycle with solar energy transferred to electrical energy storage and its efficiency analysis by the WSN far-end network monitoring. A solar-powered bicycle with a ZigBee attached and a wide-ranging wireless network monitoring system are set up to achieve this goal. As a result, the user may know the data on the amount of immediate solar lighting, ambient temperature and electrical energy storage capacity information via an internet interface through the wireless network during the parking time of the bicycle.

The electric bike with two sets of 36Ah lead-acid batteries and a 50-55 W solar cell in the back seat, which was checked during the sunny summer season.

The bicycle traveled for about 70 km only relying on the built-in batteries to run; but, if the solar cell is powered, the range rises to 100 km. The experimental results are 70 km and 90 km respectively in the winter. The experimental results have been shown to verify the feasibility of the proposed WSN far-end solar energy system monitoring network.

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