
SMART HIGHWAY

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ABSTRACT

Our project aims to upgrade existing highway systems with respect to power generation, reliability, proper management of energy produced and to improve economic potential. Renewable energy sources have developed the technology of power generation though these energy sources cannot ensure a continuous supply of electric energy each alone, the reason why hybrid solar and wind power system has higher reliability to deliver continuous power than individual sources. We have utilized power generated in charging automobiles to ensure uninterrupted and smooth travel. IoT is the main aspect of our project which is used to control the intensity of street lights and for detecting soil intensity for automatic pumping of water in farms / Tress across road. Taking into consideration safety of human beings while travelling a buzzer is mounted on alternate street light which notifies on the control room when pressed.

I. INTRODUCTION

The applications with photovoltaic and wind energy have undergone a very great evolution recently since the rapid development of power electronics technology. By contrast, these two energy sources cannot ensure a continuous supply of electric energy each alone, the reason why hybrid solar wind power system has higher reliability to deliver continuous power than individual sources. With the swift increase in demand for electricity, the advancement of hybrid energy resources has played a significant part in power generation in recent years. The systems designed for the generation of energy from natural resources lack the proper management of the energy produced. There is no effective utilization of the resources, and there is also an issue of load shedding and energy crisis due to ineffective load management.

The effectiveness of the power generating system can be improved by enhancing the hybrid system. One approach is to improve it through the use of renewable energy sources (RES) to lessen the cost of convenient energy. Renewable Energy Source has great economical potential. The proportion of renewable energy was 25 % in 2015 in the power sector which would increase to 85% in 2050 in the world. For RES use, it is a favorable situation. For an efficient supply of energy, not just conventional, but also renewable energy technologies need to be used efficiently. A rational blend of conventional and renewable energy resources should therefore be established within the energy supply system with full of fault and help detection system with automatic control.

II. LITERATURE SURVEY

K. HAREENDRAN, T., 2020. Working With Solar/Wind Hybrid Energy & Arduino In this paper has an implemented and controls the power flow from the energy source to the load or from the battery bank to the load when needed, depending on the demand of the house owners. The proposed load management is based on a load profile of a typical residential house in a remote rural village that's why an survey of energy is presented.

Y.-M. Chen, Y.-C. Liu, S.-C. Hung, and C.-S. Cheng, "Multi-input inverter for grid- connected hybrid pv/wind power system," in this paper presents a management strategy design of load allocation for a typical residential house in a remote area by combining two renewable sources PV system and wind system to provide a better supply of electrical energy and by taking into consideration the load profile of the consumer after making an energy audit of the house, a special classification and prioritization.

P. Groumpos and G. Papegeorgiou, said that in "smart highways," paper The paper will deal with this part to ensure the best possible allocation even if the any fault coming from the hybrid system along with it . Although,

the proposed algorithm when any one press panic switch it start buzzer and some automatic street tree watering system included was simple to use, effective and has shown a good performance.

III. METHODOLOGY

The proposed system integrates solar, wind, and utility supply with battery storage. Sources are converted to DC which makes aDC bus. power generated is more than the demand, the excess power issupplied to the charging station and all other load that connected to system. Load is controlled by a controller Arduino (UNO) unit which can turn on and off the load according to the situation

The block diagram showing the relationship of each element of in a above Fig. The uno is the primary controller which coordinates and controls all control action using its ability . arduino It is taking inputs from Moisture , IR and LDR sensors also from help switch and fault switch and produce the output according on lcd , Buzzer and all the control circuits of charging , tree watering and street lamp control.

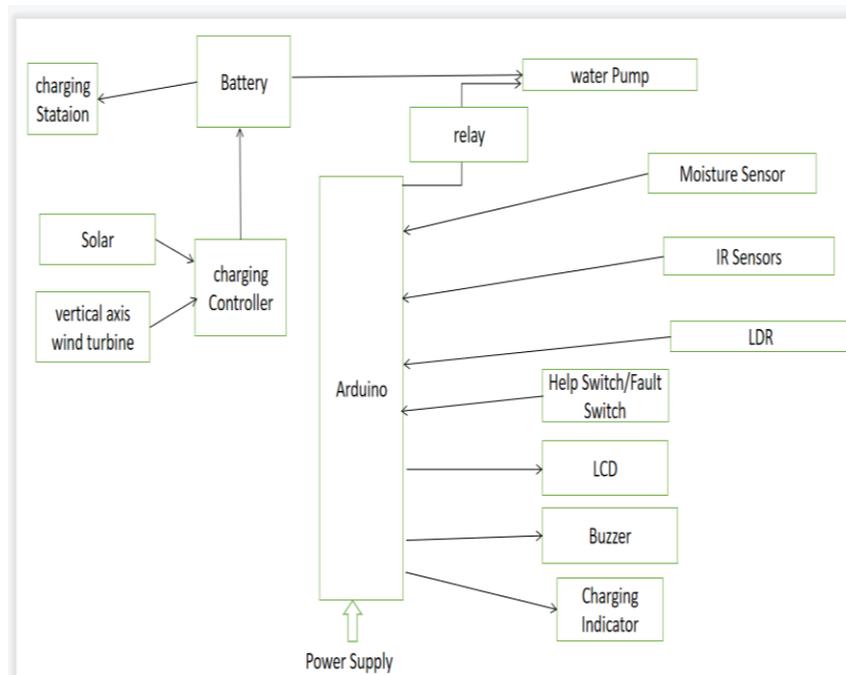
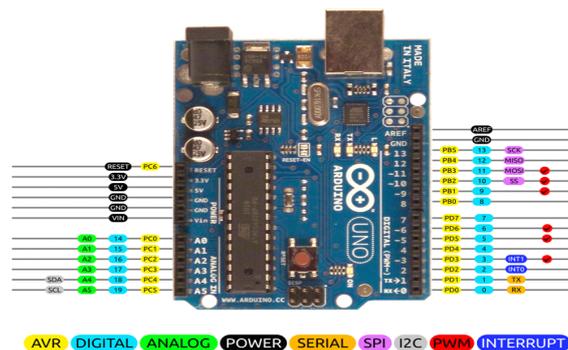


Figure 1: Block Diagram

IV. MODELING AND ANALYSIS

Arduino Uno

The Arduino Uno R3 is a microcontroller board with an open-source ATmega328 chip. The table contains14 digital input/output pins, 6 analogue input pins, an on-board 16 MHz ceramic resonator, a USB connector, an on-board DC power connection, an ICSP header, and the reset button for microcontrollers. Everything the microcontroller requires is supported. The board is extremely simple to use; simply connect it to a computer



AVR DIGITAL ANALOG POWER SERIAL SPI I2C PWM INTERRUPT
© 2014 by Board
Photo by Arduino.cc

Figure 2: Arduino Uno

DIRECT GENERATOR(wind turbine)

An electrical machine is a DC generator with the primary function of converting mechanical energy to electricity. The Faraday laws' electromagnetic induction principle is used to generate an emf when a conductor slashes magnetic flux.

**Figure 3: Dc Generator****DC BATTERY**

The battery is a power storage device that stores energy to be used when it is needed. There are many different sorts of batteries in today's technological world, including lead acid batteries for high power supplies. Batteries are used in automobiles and inverters because they are larger in size, have heavy construction, and store a lot of energy. Acid batteries are often larger in size.

**Figure 4: Dc Battery****PANEL FOR SOLAR ENERGY**

A photovoltaic panel or photovoltaic (PV) module has solar cells that are installed within a setup. Solar panels use sunlight as a source of energy to generate electricity. PV panels are made up of photovoltaic modules, and panels are made up of different systems. Photovoltaic panels use solar energy to generate electricity.

**Figure 5: Solar Panel****CONVERTER (DC-DC)**

DC-DC converters are electrical circuits that convert dc electricity into stable required direct current. They are used with a power input of 12v fluctuating voltage and output power is constant DC output is required.

**Figure 6: Dc-Dc Converter****MODULE RELAY**

Relays are electromagnetic switches that open and close circuits either electromechanically or electronically. A relay is controlled by a relay that has the ability to activate or deactivate a much larger electric current.



Figure 7: Relay Module

Relaxation operates similarly to certain electric items in that electric signals are received and a signal is sent to other devices by turning the switch on and off. Even when the contact is ordinarily closed or normally open, the relay contact is not energized. Only when the contacts are given an electric current will their status change. Relaxation is beneficial in a variety of situations. Different equipment for AC and DC is protected by electromagnetic relays.

LCD



Figure 8: Lcd

The term "LCD" refers to a liquid crystal display. It's a sort of electronic display module used in a variety of applications such as mobile phones, laptops, and televisions. This is employed. It's a display module for electronic devices. These displays are suited mostly for light-emitting diodes with seven segments. The main benefits of utilizing the module are that it is inexpensive, easy to program, and that there are no constraints on presenting individual characters, special animations, or even animations, etc.

INFRARED SENSOR

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion

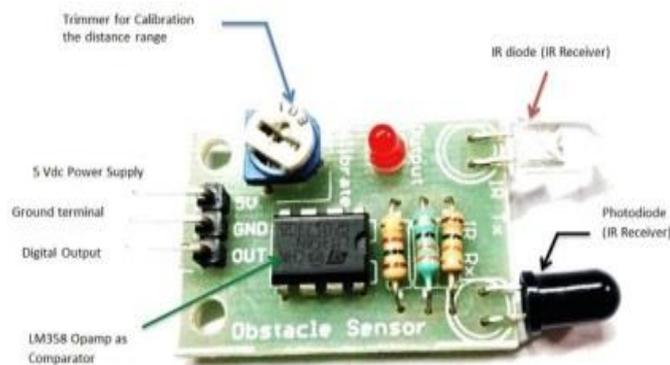


Figure 9: Infrared Sensor

These types of sensors measure only infrared radiation, rather than emitting it that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED and the detector is simply an IR photodiode that is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

BUZZER**Figure 10:** Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical. Including 1 feedback-electrode (the central, small electrode joined with red wire in this photo), and an oscillator to self-drive the buzzer. The vibrating disk in a magnetic buzzer is attracted to the pole by the magnetic field. When an oscillating signal is moved through the coil, it produces a fluctuating magnetic field which vibrates the disk at a frequency equal to that of the drive signal.

V. WORKING OF THE PROTOTYPE

Module 1: Automatic Street Light: -

Automatic Street Light Control System is a simple and powerful concept, which uses PWM to switch ON and OFF the street light automatically. It automatically switches ON lights when the sunlight goes below the visible region of our eyes. It automatically switches OFF lights under illumination by sunlight. This is done by a sensor called Light Dependant Resistor (LDR) which senses the light actually like our eyes. By using this system energy consumption is also reduced.

Module 2: Help Switch

In this prototype's street pole Emergency Button is provided for Emergency condition. If the Emergency condition occurs that is Buzzer pressing moment happens it will show on the LCD display and Buzzer will start buzzing. simply one switch is there we need to press it that giving signal to the Arduino and accordingly Arduino produce an output on LCD and buzzer.

Module 3: Charging Station

The charging station in prototype using intelligently by connecting it with the automatic controller system. As soon as the vehicle enters at charging station the status indicator lamp will glow and lcd showing the status . With a charging station, the plug can simply be taken from the wall holder and plugged into the electric car.

Module 4: Fault switch

Inserted one switch in light connection to create the fault that switch input given to the arduino whenever the fault is occurs switch goes low and that signal data received by arduino and accordingly It display details on LCD screen and buzzer buzzes .

Module 5: Tree Watering Application

Moisture Sensor is a simple two electrode used to sense the moisture in the soil. This sense the value of moisture is given to microcontroller as input on which relay operates. If the moisture sensed by the probes is 100% then microcontroller sends a signal to stop the motor. This operate on stored power in batteries The main function of pump is to suck the water from the reservoir and to provide the water to tree watering purpose.

VI. ALGORITHMS

Algorithms

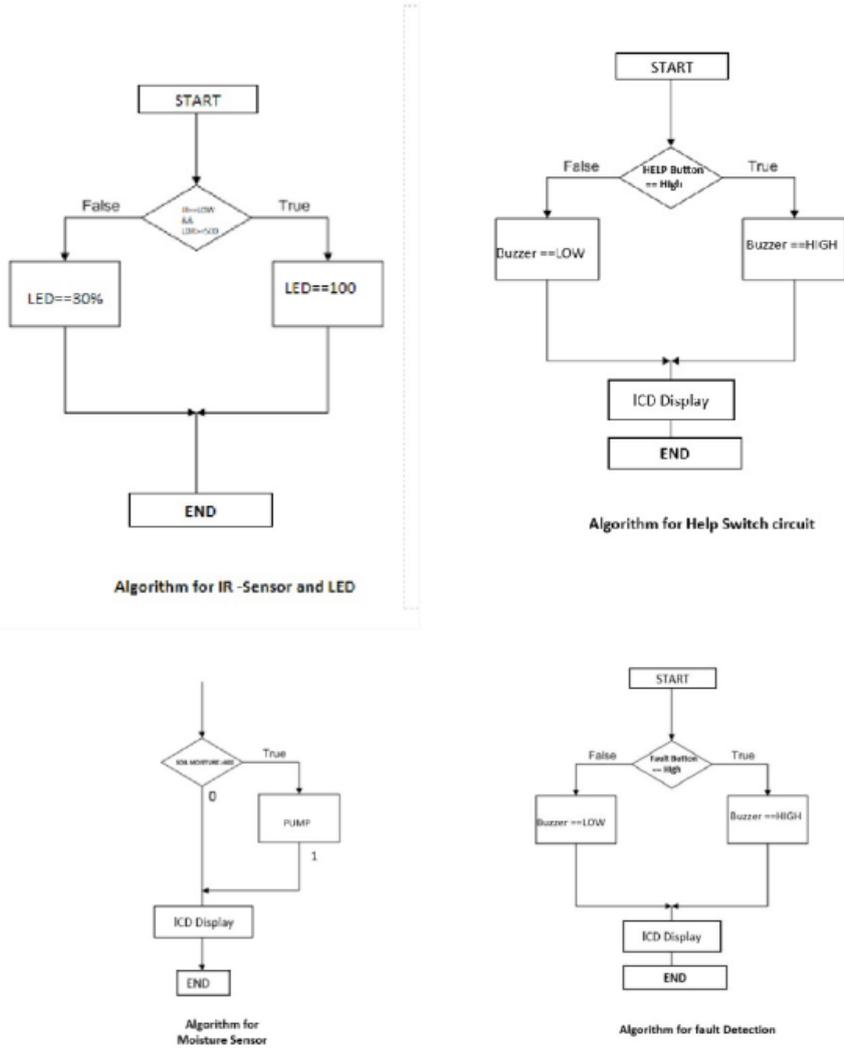


Figure 11: Algorithm

VII. RESULT ANALYSIS



Fig 12



Figure 13: Designed Prototype



Figure 14: Charging Status When Charging Is On



Figure 15: Fault Switch Output



Figure 16: Tree watering



Figure 17: Tree watering



Figure 18: Need Help

VIII. ADVANTAGES

- Saving of overall Energy as well as Fossil Fuel.
- It is economic friendly.
- Here we are using micro controllers so there is error free.
- This It is relatively simple to design and install.

- This is very useful to all climatic conditions.
- This makes increase in productivity and reduces power consumption.
- This is safest and less manpower is required.

IX. DISADVANTAGES

- Installation cost is high.
- Require frequent maintenance after fault for efficient operation.
- Since this entire system is mainly depends on hardware, a small failure in single hardware can affects entire system.

X. APPLICATIONS

- Highly applicable on street lighting system, charging stations, irrigation purpose.
- Must require applicable in Industrial use, water reservoir, fuel pumps.
- Applicable in the sectors where there is first priority to electricity as a fuel.
- Industrial/Commercial purpose.

XI. FUTURE SCOPE

As all the sources of Energy are temporarily in Nature except Renewable it's our responsibility and duty that we need to save conventional Energy Sources to maintain the bio-diversity and Green House Effect. By using proper Energy Management use can move a step towards green evolution and also by installing such Energy Management programme. Future tests can be performed for different case scenarios and control algorithms for research in the field of hybrid renewable energy microgrid systems.

XII. CONCLUSION

This report elaborates "smart Highway" and control implemented using rapid control prototype using controller. Since all the renewable energy resources are not necessarily accessible at all times, the integration of traditional energy resources (utility supply) enables us to encounter the demand. By combining two renewable sources PV system and wind system to provide a better supply of electrical energy The experimental results show that the system is flexible and accommodates the different variations in the renewable energy sources. The controller allows the effective implementation of the energy management system where, the design and construction of automatic street control circuit works properly to turn street lamp ON/OFF. LDR sensor and the photoelectric sensors are the two main conditions in working the circuit. If the two conditions have been satisfied the circuit will do the desired work according to specific program

XIII. REFERENCES

- [1] M. H. Nehrir et al., "A Review of Hybrid Renewable/Alternative Energy Systems for Electric Power Generation: Configurations, Control, and Applications" IEEE Trans. on Sustainable Energy, vol. 2, no. 4, pp. 392-403, Oct. 2011.
- [2] P. Garc'ia, J. P. Torreglosa, L. M. Fernandez, and F. Jurado, "Optimal energy management system for stand-alone wind turbine/ photovoltaic/hydrogen/battery hybrid system with supervisory control based on fuzzy logic," International Journal of Hydrogen Energy, vol. 38, no. 33, pp. 14 146-14 158, 2013.
- [3] Kohsri, S., & Plangklang, B. (2011). Energy management and control system for smart renewable energy remote power generation. Energy Procedia, 9, 198-206.
- [4] Marioli, E. Sardini and A. Taroni, Ultrasonic distance measurement for linear and angular position control, IEEE Trans. lustrum. Meas. Vol.37, N.4, December 1988, pp.578-581.
- [5] Borowy, B. S., & Salameh, Z. M. (1996). Methodology for optimally sizing the combination of a battery bank and PV array in a wind/PV hybrid system. IEEE Transactions on Energy Conversion, 11(2), 367-375.
- [6] A. Ogunjuyigbe, T. Ayodele, and C. Monyei, "An intelligent load manager for pv powered off-grid residential houses," Energy for sustainable development, vol. 26, pp. 34-42, 2015.

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- [7] C. Kalaivani, D. Divyalakshmi, and N. P. Subramaniam, "A standalone hybrid power generation system," in Proc. Int. Conf. Comput. Power, Energy Inf. Commun. (ICCPEIC), Mar. 2017, pp. 800806.
- [8] C.S. Ioakimidis, C.Camus, P.C.Ferrão, "The Introduction and use of Plug-in Hybrid Electric Vehicles in the energy and fleet mixture in the island of São Miguel", paper in submission General of Power Sources.
- [9] "2010 Nissan Leaf electric car: In person, in depth - and U.S. bound", Aug 1st 2009, <http://www.autoblog.com/2009/08/01/2010-nissan-leaf-electric-car-in-person-in-depth-and-u-s-b/ Renault Portugal, www.renault.pt>