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Controlling of Loads using ESP-8266 NodeMCU in a Hybrid Energy System

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Abstract: ***In this paper authors have focused on determining the behavior of hybrid energy system using wireless control. Generation of the electric energy is done using available renewable and non-renewable energy resources. Non-renewable energy resources such as coal, petroleum etcare depleting day-by-day, therefore generation of electric energy using renewable resources such as solar, wind etc has large scope with increase in technology. A hybrid energy system consisting of solar and wind energy generates electricity. This generated power gains more concentration for its storage, maintenance and even controlling of system. The proposed hybrid energy system generates power using the solar and wind energy and the generated power is stored in a rechargeable battery for further utilization. Controlling of this hybrid system is carried out with a secured web server through the Wi-Fi module (ESP8266 NodeMCU). An inter-integrated circuit (I2C) protocol is used for communicating between Wi-Fi module and 16*2 LCD. It also reduces the hardware mesh for circuit. The system has a MQ2 gas sensor that detects the poisonous gases emitted and removes out of the system with help of an exhaust fan. This ensures an eco-friendly system and helps to keep environment healthy and safe.***

Keywords: Solar-Wind sources, ESP8266NodeMCU, Battery, LCD, MQ2 gas sensor, Arduino IDE.

I. INTRODUCTION

Electricity is most essential part of human survival. Generation of energy with renewable energy resources is gaining more importance in modern era. Resources such as solar, wind etc are profusely available in nature are used for generating electric energy and this can further be utilized for human consumption. Generated power is stored in a rechargeable battery. Hybrid energy system is combination of two or more energy systems. A solar-wind energy system attains more significance for generation, storage, maintenance and controlling of the system. Controlling of hybrid system is carried out with a secured web server using a Wi-Fi module. IOT(Internet of things) is used for control of hybrid energy system. The information is sent to the system through ESP8266 NodeMCU. The proposed system controls the loads remotely and manually that is AC and DC loads are controlled through a webserver. Wastage of energy can be minimized with controlling whenever we are far from the system. With this advancement it can provide flexibility to consumers.

II. LITERATURE SURVEY

Vipul Dhongade et.al,[5]proposed the "Hybrid Renewable Energy Systems for Efficient Energy Generation, Storage and Monitoring of Electric Vehicles at Remote Charging Stations". This paper uses PLC-SCADA which has capacity of storing, maintainence and controlling of electricity. This generated electricity is used for charging of solar vehicles.Suprita Patil,et.al,[4]proposed, "IOT based solar energy monitoring system" which consists of system using solar panel, Arduino, current sensor, voltage divider. Raspberry pi is the processor used for IOT monitoring of hybrid system. Arduino microcontroller displays the power data on the LCD. Kalaiarasi D et.al.,[3] proposed the " Enhancement of Hybrid power systems using IoT". This paper describe a novel & developing electrical power generation mechanism by integrating photovoltaic solar energy with nano- antenna & wind energy . In presents days the maintenance of power plant management is provided at center by using measuring sensor installed in system. To overcome this drawback managing of power system is used using IOT. Pallavi, Ravindrajoshiet.al., [2] Proposed the "IoT based smart power Management system using WSN". This paper describers the real time power management system to control and monitor power consumption. The data is transmitted wirelessly using Zigbee protocol using Ethernet. SaraswatiSaha et.al.,[1] proposed the "Data center temperature monitoring with ESP8266 based wireless sensor network and cloud based dashboard with real time alert system". This paper has a solution for monitoring temperature at different points of location in a data center. I n this ESP is connected to Ubidots clouds through its API.

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III. PREVIOUS WORK

A signal is selected from website i.e., solar on or wind on then from website a signal is sent through the internet to the ESP8266 Wi-Fi module to turn ON solar connection or to turn ON wind connection or to turn OFF external supply. The signal received from user will be manipulated by the ESP8266.

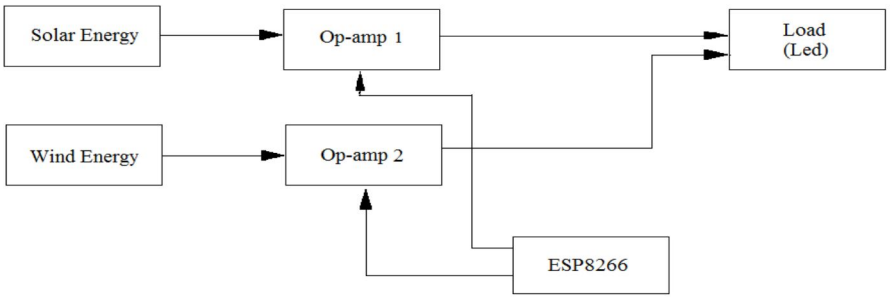


Fig: 1 Block Diagram of Control System

ESP8266: ESP8266-01 Wi-Fi module is used to connect to the internetand it is linked to the website through which we can operate supply from anywhere in the world. ESP8266 has 8 pins, which has two pins TXD and RXD, 2 GPIO pins i.e. GPIO 0 and GPIO 2, Reset, VCC and Ground. TX and RX pins are used to flash the embedded code, after uploading the program into the module GPIO pins, Reset, VCC and Ground pins are used.

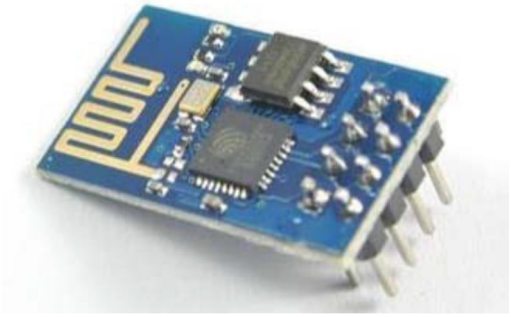


Fig: 2 ESP8266 Module

IV. PROPOSED SYSTEM

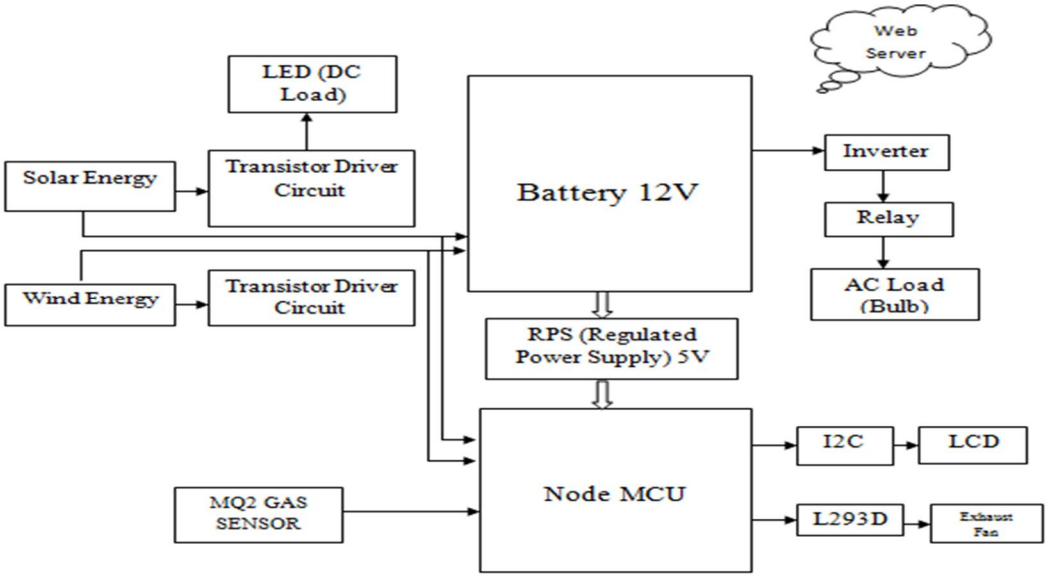


Fig:3 Block Diagram of proposed system

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The proposed system uses solar and wind energy sources for generation. A 12V solar panel consumes sunlight based on intensity and converts solar energy into electric energy with photoelectric effect. A DC gear motor converts wind energy into electric energy using a wind mill. Combination of solar-wind system is called as hybrid energy system. The generated energy is stored in a 12volt rechargeable battery and utilized for further AC and DC consumption. ESP8266 NodeMCU is used that sends the information through Wi-Fi. Loads are controlled manually and remotely through a secured webpage through aAdafruit application. Node MCU is the processor and Wi-Fi module. A 16*2 LCD is used to display the received information. A I2C (inter-integrated communication)protocol acts as a communication between NodeMCU and LCD. This proposed system is also capable of detecting the harmful gases emitted with the help of a MQ2 gas sensor and removes all the gas outside with help of an exhaust fan.

V. HARDWARE IMPLEMENTATION

1) *ESP8266 NodeMCU:* It is a open source IOT that includes that runs on ESP8266 Wi-Fi module from Espressif systems. It is a single-board microcontroller which is powered by USB.



Fig: 4 ESP8266 NODEMCU

2) *Solar-Wind Sources:* Solar panel and DC motor is used for generation of energy which consumes solar-wind energy.
3) *Battery*: Rechargeable battery is utilized to store the power. This power is provided to rest of hardware system.
4) *LCD (Liquid crystal Display)*: A liquid crystal display gives the display of the content such as generation of energy. A I2C (inter- integrated communication) protocol is used for connection between NodeMCU and LCD.

VI. EXPERIMENTAL SETUP

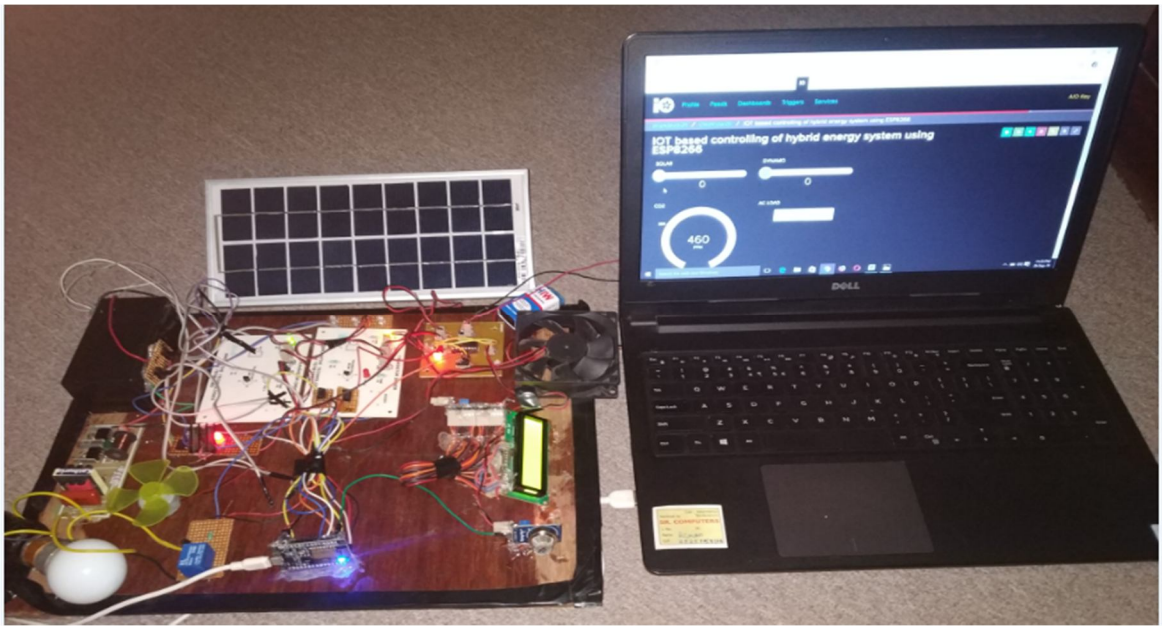


Fig:5 Experimental Setup of the Project

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VII. RESULTS

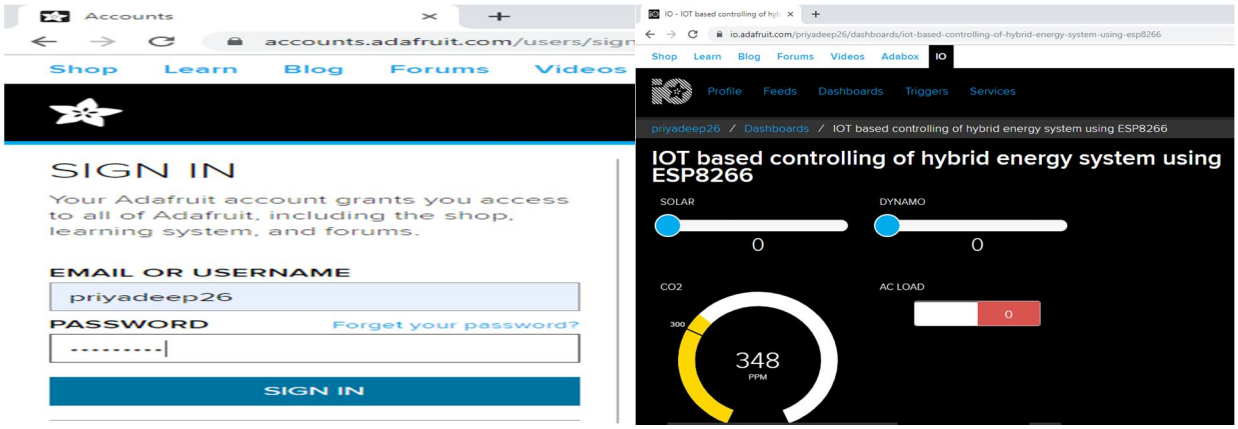


Fig:6 Login Web page



Fig:7 Welcome message

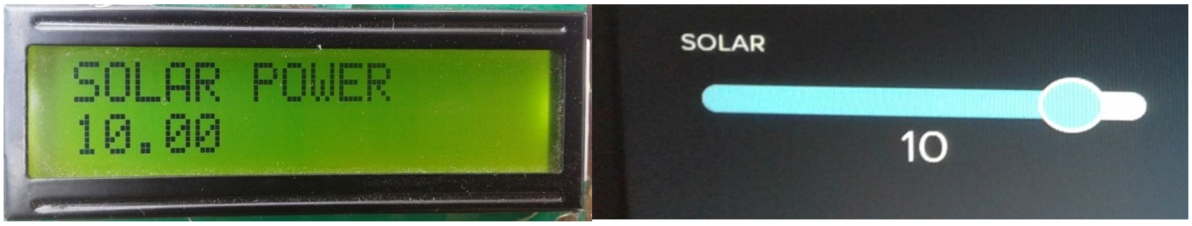


Fig:8 Generation of solar power

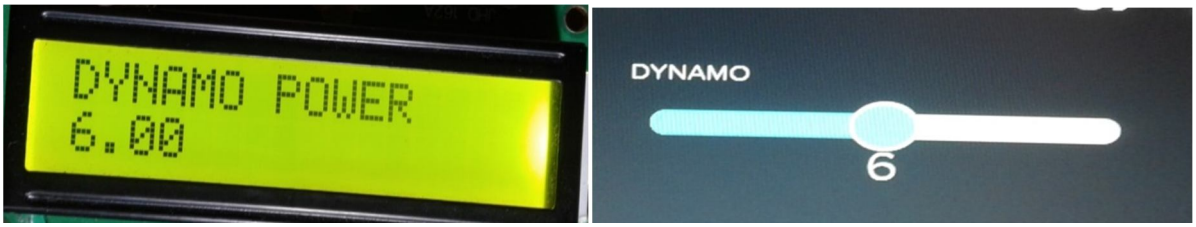


Fig:9 Generation of wind power

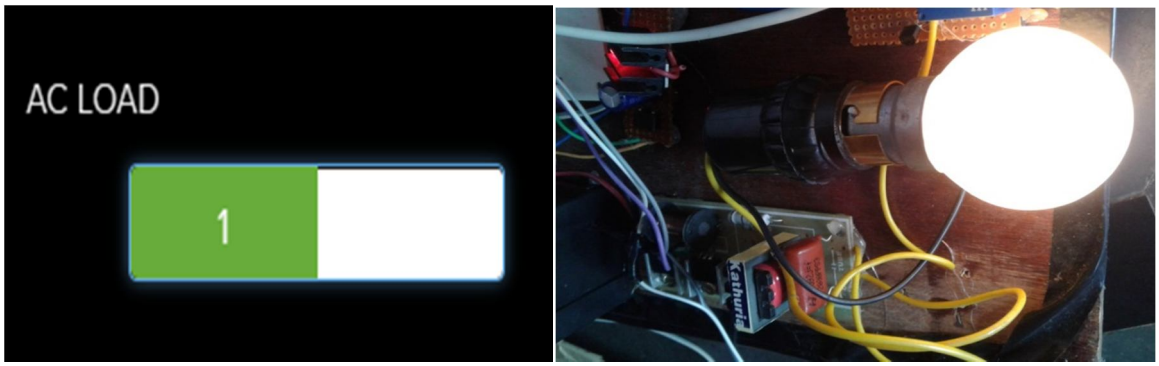


Fig:10 Controlling of ac load through web page

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Fig:11 Dc Output



Fig:12 Detection of excess of CO2 gas

VIII. CONCLUSION

This Hybrid system is very much effective in commercial area, by using this proposed system we can save the energy by controlling the loads through a secured web server .It reduces manual operations which saves the man power. This system is eco-friendly and is it a safe which detects harmful gases emitted from the system. Excess of gases is removed out from this system with the help of exhaust fan.

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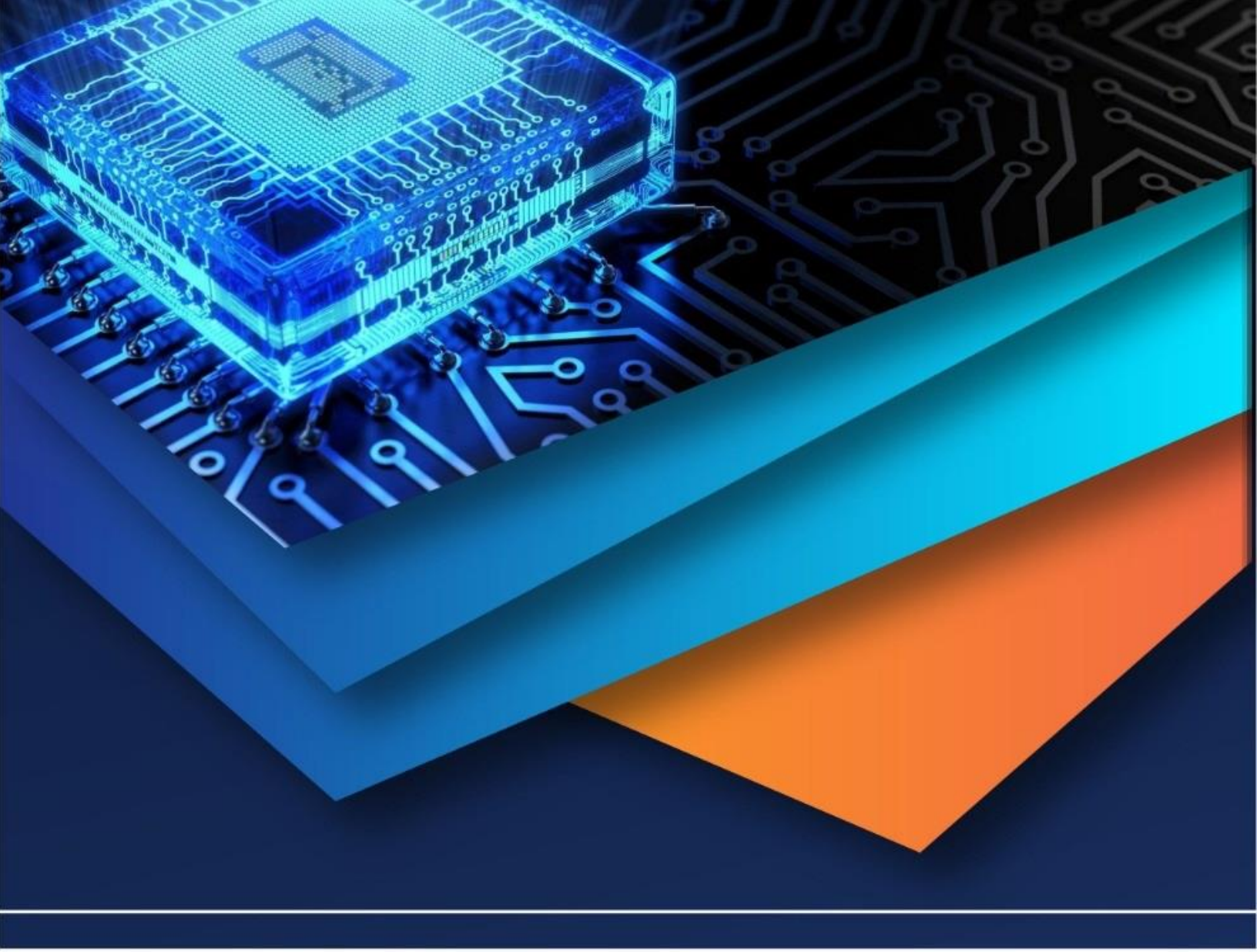
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