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Smart energy based automation system for future buildings

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Abstract - *The atmospheric level of carbon-dioxide has been increasing since the 1960. In 2021, the carbon-dioxide levels reached a high of 416.45 parts per million, in comparison to the 1960 level, which is about 316.91 parts per million. The major sources of these toxic gases, such as carbon-dioxide, nitrogen dioxide are coal-fired power plants, industries, refineries, as well as the chemicals included in building materials and solvents. To solve this problem of increasing pollution in the environment and to conserve power, green buildings are used. Green buildings play a vital role in protecting the environment form global warming. Mostly green buildings use smart grid sources for power generation. These sources cannot be recycled very quickly. Therefore, there will be lack in the energy generation. This proposed system uses the human population as the energy source so that the energy is obtained from the human and the same energy is transferred again to the human. That is a consecutive transformational approach. This system consists of both hybrid as well as automation systems. For generating energy, solar- pressure- based energy source is used. This energy from the source is used to automate the inside of buildings. This system also contains an application which allows the consumer to operate the system manually if the consumer is remote from the specified location*.

Key Words*: *Hybrid energy, automation, fossil fuels, rechargeable battery, grid power.

1. INTRODUCTION

[1] Green Building Technology is concerned with the integration of smart renewable energy-based technologies for the goal of automation.[2] The use of hybrid energy for energy creation is the key thought process behind this idea.[3] Solar panels are merged with pressure-based energy generation as a backup in the suggested system, which may be intelligently employed in stairwells, automobile parking spaces, and energy is stored in a rechargeable battery. [4] The energy so saved is put to use in the automation process. [5] In this case, a weather-based auto light setting system is used, which adjusts the light in the interior building in response to the weather outside, creating a pleasant working environment for the employers. In addition, if the temperature is high, our system will automatically lower the window screen.[6] Why Buildings that are automated with Grid Power are more likely to rely on fossil fuels in the future.[7] Because of their reliance on fossil fuels, emerging countries are falling behind on their net zero ambitions (for example, India's net zero target year is anticipated to be 2070). [8] However, from the base year of 2018, carbon emissions from fossil fuels have grown by up to 4.9 percent for the year 2020.) [9] The greatest approach for meeting sustainability and demand peaks is to develop a system that integrates various sources of renewable energy and automates it.

2. PROPOSED SYSTEM

The Proposed system is divided into two major domains, one side deals with energy storage and the other deals with automation. The energy generated in this system is a hybrid model approach, which contains solar power along with pressure- based energy generation. For Pressure based energy generation, the Piezoelectric title is placed in the staircase, parking slots and on the footpaths around the building. The pressure created due to movement spark a voltage that produces electricity. Both the energy generated is stored in a rechargeable battery and sent effectively for automation side. In automation side, PIR sensor is used to detect person's entry into the room and temperature- based lighting system will be turned ON. For Temperature based lighting system, A temperature sensor will detect the temperature outside the room and the automation will be done through Arduino UNO. When the temperature is low, the light will use Blue colored high intensity bulb will turn ON and the Fan will be turned ON. When the temperature is moderate or normal, the light will be green colored with normal intensity. When the temperature is too High, the red colored low intensity bulb will turn ON and a coolant screen with charcoal-based filters will be closed to prevent dust, smoke and harmful gases entering into the room to an extent. In addition to this, building automation module has Gas sensors to detect greenhouse gases and smoke. If the gas level extends beyond certain limit, the buzzer system will be turned ON. All the voltage generated through Hybrid system can be monitored through App, which is connected to the system through Blynk Cloud network and manual operations for lighting and coolant system can also be done through App.

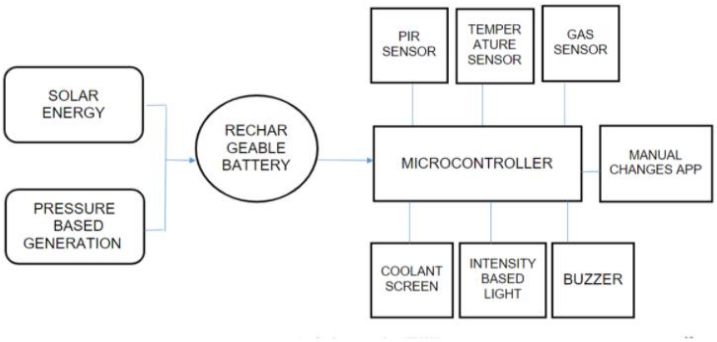
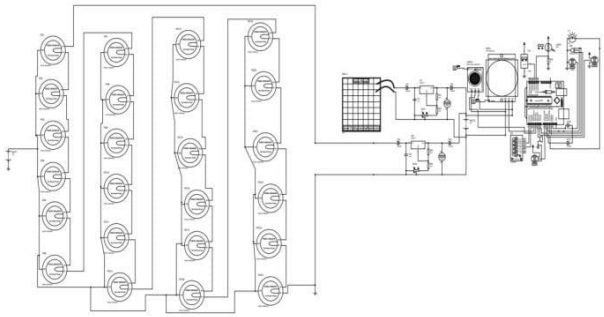


Fig -1: Block diagram

2.1 CIRCUIT DIAGRAM



3. EXPERIMENTAL RESULTS AND ANALYSIS

3.1 VOLTAGE GENERATION

The voltage generated across various sources are given below:

Incase of pressure-based energy, using an external battery supply the necessary power is provided. The output voltage generated is given by,

- Solar panel-12.3V
- Pressure- based system-5.25V

The piezoelectric tile used in this case is 6*4 tile base,

which is connected in series to provide voltage across the terminals. The pressure generated is thus proportional to the voltage.

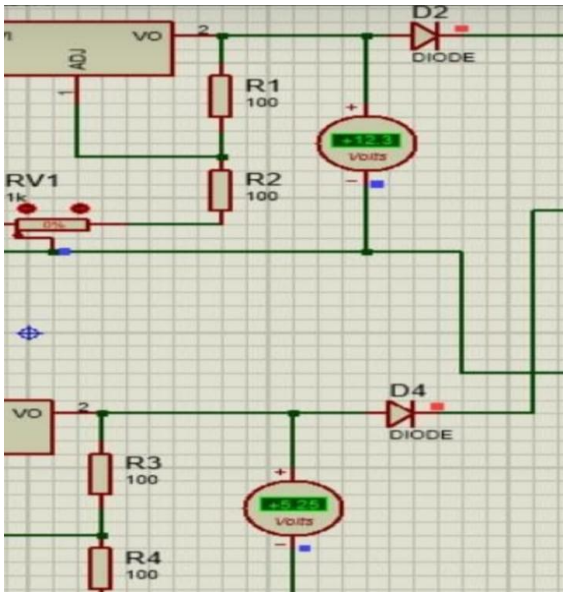


Fig-2: Voltage generation output

3.2 GAS SENSOR OUTPUT

Whenever the amount of gas in a particular room increases, the buzzer system will be activated and the exit doors get opened automatically. Here the door opening is denoted by servo motor which rotates by an angle of 90 degree.

3.3 MQ2 GAS SENSOR

MQ2 gas sensor is used to measure CO2, CO and other toxic smoke inside the room.

Fig-3: MQ2 gas sensor

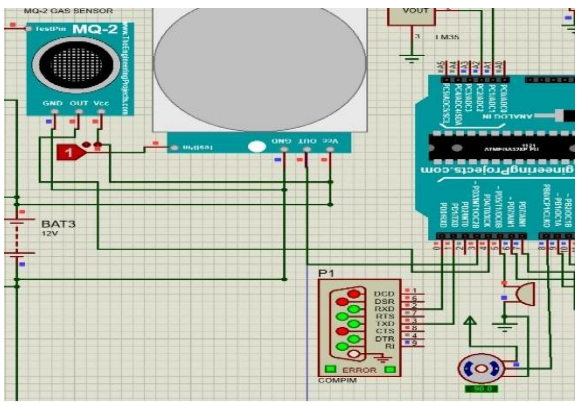


Fig-4: Gas sensor output

3.4 TEMPERATURE BASED LIGHTS

Whenever a person enters a room, his entry is detected by PIR sensor and it gets raised to the input value 1, lightning system will vary based on the temperature outside. This can be explained with the help of three test cases given below.

CASE 1

When PIR==1&& Temp<=25:

Temperature is low. Blue light turns on and fan rotates at a slower rate.

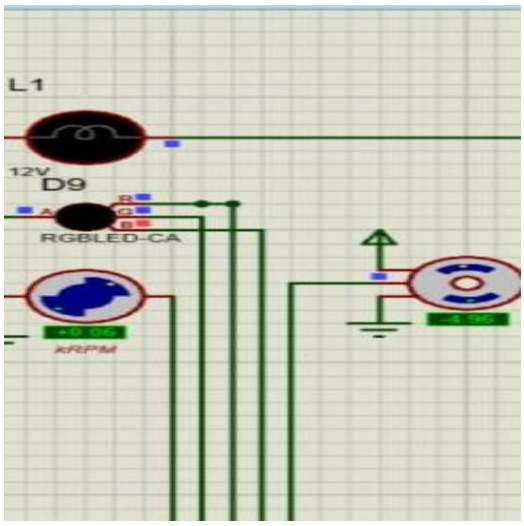


Fig-5: Case 1 output

CASE 2

When PIR==1&&25<temp<35:

Temperature is medium. Green light turns on and fan rotates at a medium rate.

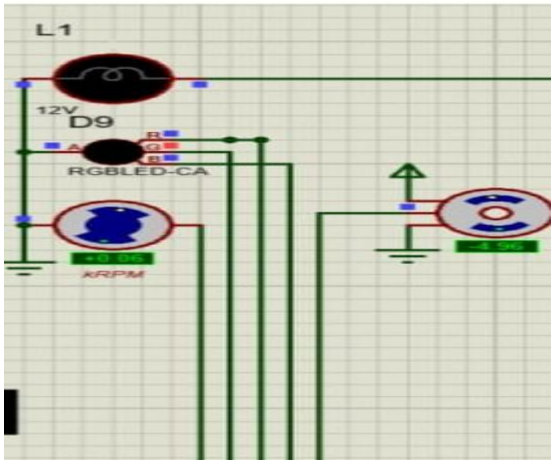


Fig-6: Case 2 output

CASE 3

When PIR==1&&Temp>35:

Temperature is high. Red light turns on and fan rotates at a high rate. In this case coolant screen will be automatically turned ON and this is indicated by the servo motor rotation by 90 degrees.

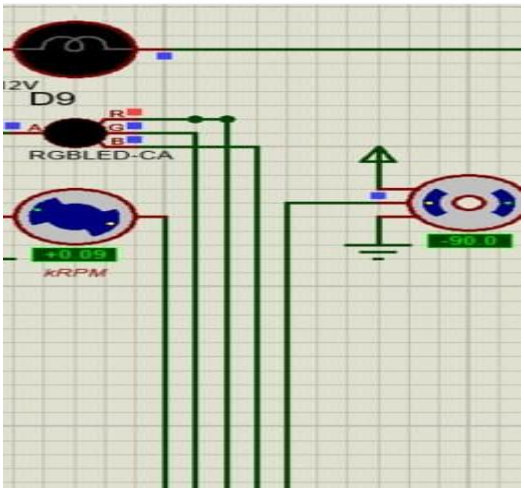


Fig-7: Case 3 output

4. OUTPUT WAVEFORM

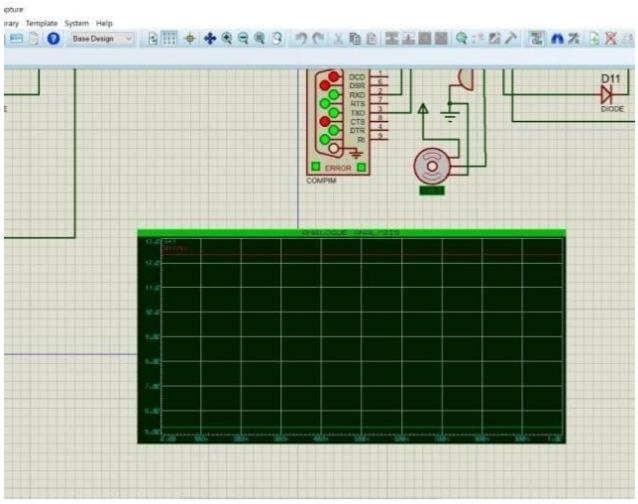


Fig-8: output DC waveform

Fig-9: waveform obtained from analog analyzer

5. CONCLUSION

In concluding, the power generation gets its necessary requirements from renewable sources without harming the environment. The main motive of the proposed system is to improve the occupant comfort, the efficiency of building systems, and reduce energy consumption. The benefits of this system will save enormous energy depending upon the fossil fuels and provide good indoor working environment. This green building automation system provides ease to people to control appliances saving electricity, time and money.

6. FUTURE SCOPE

- In future the system can be employed in the preservation of natural sites and surroundings as much as possible.
- It offers financial incentives to the builders and occupants. Promotes the use of efficient lights and air-cooling systems. Helps in maintaining good indoor air quality to next thermal comfort requirement.

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