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SMART ENERGY MANAGEMENT SYSTEM

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Abstract: A smart Energy Management System (EMS) can contribute towards cutting the costs while still meeting energy demand. The evolving technology of Internet of Things (IoT) can be utilized to better manage energy consumption in residential, commercial, and industrial sectors. This system includes, the home appliance which is interfaced with a data acquisition module that's an IoT object with a singular IP address leading to a wireless network of devices. With these techniques, household energy consumption can be monitored in real time, also being able to record information including operating time and power consumption information for each device. The Android interface provides the users with to watch and alter their electricity consumption habits in order to optimize the energy efficiency.

1. INTRODUCTION

The project is designed for optimum energy management based on counter, light intensity and temperature sensor. The system also counts the number of persons entering and leaving the room and displays that information on LCD display. Depending on person's entry as well as exiting condition the room appliances will play their role. The ultimate objective of this system is to save the energy as well as to design automatic room light controller by turning off all the appliances when nobody is there in the home. In this project we are using Arduino UNO, LDR sensor, DHT-11 sensor, IR sensors, LCD display, fan and lamp. There are two pair sensors, each kept at certain distance from the other. One pair of sensor consists of a transmitter and a receiver, kept exactly opposite to each other. The transmitting part emits modulated IR light which is received at the receiver end and fed to a microcontroller of Arduino UNO family.

2. PROJECT OVERVIEW

Objective:
The objective of a smart energy management system (SEMS) is to optimize the generation, distribution, and consumption of energy in a more efficient, sustainable, and cost-effective manner. Here are the primary objectives of such a system.

Components:

1. Arduino UNO:
- The Arduino UNO is a small, programmable microcontroller board that allows beginners to create interactive electronic projects easily by writing and uploading code via a computer.
- It features various input and output pins to connect sensors, actuators, and other components for diverse applications.

2. 2596 buck converter:
- A buck converter is an electronic circuit that steps down voltage from a higher level to a lower level efficiently, commonly used in power supplies for various devices like smartphones and laptops.
- It works by rapidly switching a transistor to control the flow of current through an inductor, resulting in a stable output voltage.

3. IR Sensor:
- An IR sensor is a device that detects infrared radiation, which is invisible to the human eye, and converts it into an electrical signal.
- commonly used in remote controls, motion detectors, and proximity sensors.
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4. Temperature Sensor:

- A temperature sensor is a device that measures the heat of an object or environment and converts it into a digital or analog signal for interpretation by electronic devices.
- It helps in monitoring and controlling temperature in various applications like weather forecasting, industrial processes, and home appliances.

5. LCD Display:

- An LCD (Liquid Crystal Display) is a flat panel technology that uses liquid crystals to create images by varying light patterns.
- It's commonly used in devices like TVs, monitors, and smartphones for displaying visual information.

6. LDR:

- An LDR, or Light Dependent Resistor, is a component that changes its resistance based on the amount of light it's exposed to.

7. Relay Module:

- A relay module is a device that acts as a switch, allowing you to control high-power electrical devices with a low-power signal, like from a microcontroller.

8. Dht 11 sensor:

- The DHT11 sensor measures temperature and humidity in the environment, providing digital output for easy integration into various projects like weather stations or home automation systems.

3. LITERATURE SURVEY

1. Introduction to Smart Energy Management Systems (SEMS):
Understand what SEMS are and why they're important for saving energy and money.

2. Smart Grids and Energy Infrastructure:
Learn about smart grids, which are advanced systems for delivering electricity efficiently.

3. IoT and Sensor Networks:
Explore how devices connected to the internet (IoT) and sensors help monitor and control energy usage.

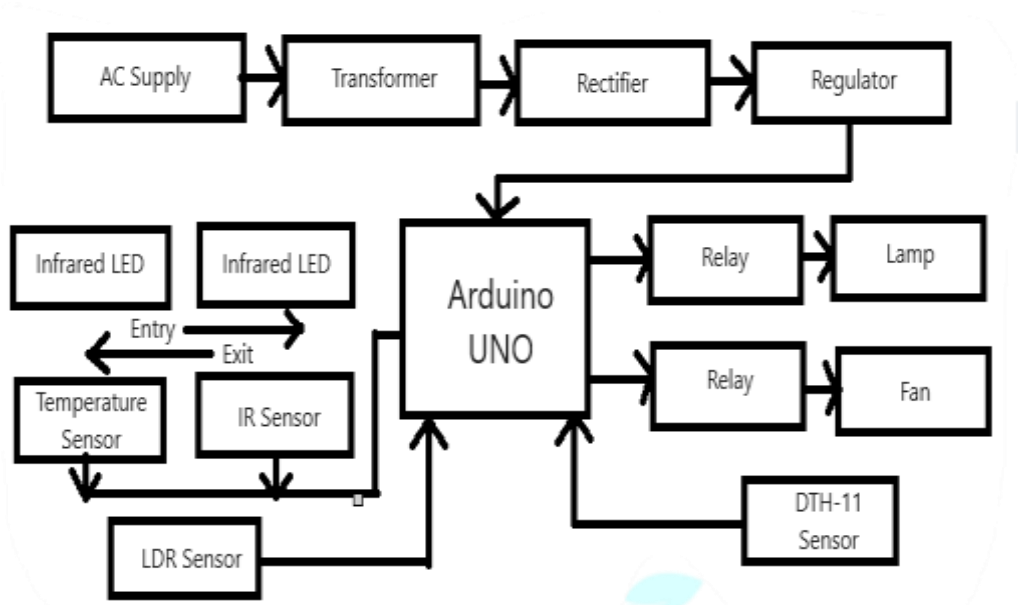
4. Data Analytics and Machine Learning:
See how computers analyze data to predict energy needs and make smart decisions.

5. Optimization Techniques:
Discover methods for making energy systems work better and save more power.

PROBLEM STATEMENTS

Design and develop a Smart Energy Management System (SEMS) to efficiently monitor, control, and optimize energy usage in residential and commercial buildings. The system should integrate various sensors, meters, and smart devices to gather real-time data on energy consumption and production. It should provide users with insights into their energy usage patterns and offer recommendations for reducing energy waste and optimizing usage. The SEMS should also support automation features to adjust energy usage based on demand, preferences, and external factors like weather conditions. The goal is to help users reduce their energy bills, minimize environmental impact, and enhance overall energy efficiency.

4. PROPOSED SYSTEM MODEL



1. Arduino UNO:

Arduino Uno is a small computer that you can use to make all kinds of cool gadgets and projects. It's like the brain of your project, controlling how everything works. You can connect sensors, lights, motors, and other things to it to make them do what you want. Arduino Uno is easy to use, even if you're new to electronics and programming. You write simple code on your computer, then upload it to the Arduino Uno, and it starts doing what you programmed it to do. It's a great tool for learning about electronics and making your own inventions.

2. 2596 buck converter:

A 2596 buck converter is a type of electronic device used to change one voltage level to another. In very simple terms, it's like a magic box that takes in one voltage (let's say a high voltage) and transforms it into a lower, more usable voltage(like the one you need for charging your phone). This can be really handy in many electronics where you need to power things with different voltage requirements efficiently. So, the 2596 buck converter helps make sure the right amount of power gets to the right places without wasting energy.

3. IR Sensor :

An IR (Infrared) sensor is like a special eye that can see heat instead of light. It senses heat radiation emitted by objectsand converts it into an electrical signal that tells us if something is there or not. It's often used in devices like remote controls, motion detectors, and even in some smartphones to detect when something is close to them.

4. Dht 11 sensor:

The DHT11 sensor is a tiny device that measures temperature and humidity in the air around it. It's like a little weather station that you can connect to your electronics projects. You can use it to find out how hot or cold it is and how humid the air is. It's really easy to use and great for beginners who want to start experimenting with sensors.

5. LDR:

An LDR, or Light Dependent Resistor, is a special type of resistor that changes its resistance based on how much light shines on it. When it's dark, the resistance is high, meaning electricity can't flow through it easily. But when it's bright, the resistance goes down, allowing more electricity to pass through. People often use LDRs in things like automatic night lights or cameras that adjust their settings depending on the light around them.

6. Temperature Sensor:

A temperature sensor is a tiny gadget that can tell how hot or cold something is. It's like a little thermometer that can be put in different places, like inside a room or outside. When it gets warmer or cooler, the sensor notices the change and sends that information to a computer or another device. This helps people know what the temperature is and can be used in things like weather stations, thermostats, or even in cooking appliances to make sure food cooks at the right temperature.

7. Relay Module:

A relay module is like a switch for controlling electronic devices. It lets you turn things on or off using a low-voltage signal, like from a microcontroller or a sensor. It's kind of like a remote control for your appliances or lights. When the relay gets the signal, it switches the power on or off to the device it's connected to. It's handy for automating things or controlling them from a distance.

5. ADVANTAGES

1. Energy Efficient
2. Cost Saving
3. High energy conservation
4. Automatic control system
5. Reduce human efforts

6. CONCLUSION

In conclusion, the Smart Energy Management System project represents a significant step forward in sustainable energy utilization. Through meticulous monitoring, intelligent algorithms, and real-time adjustments, the system optimizes energy consumption across various sectors, resulting in substantial cost savings, reduced environmental impact, and enhanced operational efficiency. As energy management becomes increasingly critical in today's world, this project offers a promising solution to address the growing demand for efficient energy utilization, paving the way for a more sustainable future.