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HOME AUTOMATION SYSTEM WITH EFFICIENT POWER UTILIZATION WITH SMART ENERGY METER

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1.Abstract: The increased use of energy-hungry electrical equipment has given rise to intelligent Internet of Things (IoT) devices that efficiently manage and utilise energy. Home automation uses the Internet of Things (IoT) to make equipment smarter so that it is only used when necessary. This project aims to implement intelligent devices that can recognise motion, analyse the data, and take appropriate action. Through a wi-fi module, users are given access to manage the devices in their homes remotely. For effective wireless connectivity, the Wi-fi module is helpful. Ultrasonic sensors that monitor motion detect any movement. Algorithms interpret the data, and the results maximise the efficiency of the apparatuses. The endeavour provides a programme that enables users to access and manage devices by their requirements. Sensors and actuators control motion-based gadgets. The user is presented with a data graph following analysis. Users can analyse power use more easily thanks to the output graph. Ultrasonic sensors, which detect movement and turn on and off equipment, are used to implement power usage. The ability to control individual devices and view their usage statistics is also available. Additionally, the project allows consumers to receive messages concerning usage rates.

Power theft, which costs electrical boards a lot of money, is the main problem. In countries like India, these incidents occur more frequently. We can save a lot of electricity if we can halt these thefts. This is done by utilising a smart energy metre (SEM). The SEM can measure how much electricity is used to transport data thanks to a wireless protocol and an energy metre chip. This study gives the smart energy metre for an automated metering and billing system. The amount of energy utilised in this metre is displayed continually on the LCD and relayed to the base station in a controlled manner. The usage patterns of authorised and unauthorised users can be distinguished via user input, which helps to decrease power theft. The user/household and the substation communicate with one another via Zigbee. The GSM network transmits SMS messages about theft incidents to the local authorities. This enables both prepaid and postpaid usage. The suggested solution eliminates traditional metre reading techniques and allows the energy provider to remotely access current energy metres. They can check the metre readings regularly without going to every house.

Keywords: Electricity ,IOT,Zigbee,GSM module

2.INTRODUCTION

Higher electronic device usage results in higher power consumption. Equipment must be made to be both economical and practical. Wireless technology enables digital equipment and appliances to be linked to a network and communicates with one another. Scalability, user-friendly interface design, analysis, and upgrades are fallbacks when creating a home automation system. Both the software and the hardware components receive updates. The hardware is upgraded by including new features. More gadgets are also connected to expand the device for broader use. The user-friendly frontend design makes it easy for the user to configure, watch over, and manage the devices using the built-in model. This system includes an effective diagnostic mechanism that activates in the event of any internal faults. With all these advantages, the system must be quick and efficient while utilising wireless technology. We develop a Wi-Fi module for an intelligent home automation system as part of the project. The primary objective of the model is to increase equipment effectiveness. When efficiency increases, less electricity is utilised, which benefits both the environment and the economy. Making technology intelligent makes it easier to operate devices in daily life while utilising power efficiently. The project uses several sensors to record human or object movements, with gadgets responding to these inputs. This decreases energy waste by causing fuel to only be used when necessary. Additionally, it offers a tool for analysing how much energy certain household appliances use.

Energy use can be monitored by energy metre. To reduce high bill utilisation, the user is aware of the cost and frequency of Power usage. The client and electrical board receive information via the energy metre, which displays the number of units consumed, minimising the need for staff. The user may access and view their power usage anywhere, at any time. Using relay and Arduino interfaces, home appliances may be turned on and off over the Internet of Things. The objective of this system is to monitor how much electricity is consumed by the home. The eventual reduction in overall Power usage will be advantageous to both the distributor and the consumer. We frequently check the energy metre because we are concerned about our high monthly electricity costs. But what if we could track our electricity use worldwide and receive a notification via SMS or email if it goes above a certain threshold?

3.PROBLEM STATEMENT

IoT makes monitoring energy use more affordable than previous ways since it is more cost-effective. Daily consumption reports are created and available via a web portal or an Android app. It is a more dependable method, and technologies are used to acquire precise reading readings from energy metres. An Android app can be used to view real-time device readings. The lessons can also be seen online. The values of everyone are maintained on the central server to prevent human meddling. The secure communication channel makes it simple to spot electricity theft or tampering with energy metres. The value on the main server won't be updated if a glitch occurs. The reports are available from any location in the world because the values are kept in the central database. The server is also accessible 24/7. Access to various electronic devices, including embedded devices and web services, is possible via the Internet of Things. Ubidots is one of the free IoT platforms that enables business owners and entrepreneurs to prototype and develop IoT concepts into production. We can read and write

through the resources using Ubidots' REST API: data sources, values, events, and insights. Programmes track your location and a social network of objects that updates your status. With device-friendly APIs that enable speedy and secure data transmission to and from our IoT data performance-optimized time series, Ubidots offers its consumers a safe, white-glove experience.

4.LITERATURE SURVEY

The cost-effective IoT monitoring and automation solution suggested by A Survey on an Efficient IOT-Based Smart Home [3] likewise uses portable devices as a user interface. "Through an Internet gateway, portable devices can join a home automation network utilising low-power connectivity protocols like Zigbee, Wi-Fi, and others". This system attempts to utilise a smartphone to control home appliances using Wi-Fi as a communication channel and an Arduino Uno. The user will be able to direct communication with the gadget through a web-based interface, controlling home equipment like lights and fans. This study also covers the usage of numerous sensors, such as those for temperature, humidity, light, and level, to provide crucial information for automatically recognising and resolving any system difficulties. The Internet can be used to control home appliances.

This article[8] covers the topic of "Smart Home Automation Using IOT" is covered. A system's hardware is composed of three components: an Arduino controller, a PCB, and a humidity sensor. The PCB contains a relay, an LPT port, a transistor, and a diode resistor. The two devices connected to the PCB are a fan and a light. Arduino is connected to a humidity sensor. It can measure both humidity and temperature. The Arduino and PCB are connected to the PC. Arduino and PCB may talk to one another via the PC. They measured the humidity and temperature. They have established a timer for it so that it continuously measures the humidity and temperature. Every five seconds, it continuously senses the temperature and humidity. According to this research [9], home automation or workplace automation is made possible by advancements in electronics and connectivity. Using specifically designed portals, cloud computing systems make it simple for everyone to access anything from anywhere in the surrounding area at any time and place. As a result, IoT access uses the cloud as a front end. This expands the intriguing opportunities for improving the usability of household appliances for home automation reasons.

5. HARDWARE DESCRIPTION

Electricity metres, which are put in every home and business to monitor electricity use, are widely known. Here, we are developing an IoT-based energy metre project. In the past, we created an Energy Meter circuit that uses a GSM module to text you a bill reminder. The ESP8266 Wi-Fi module and Arduino are combined in this project to build an intelligent electricity energy metre that enables you to track your energy use at any time and from any location in addition to receiving an SMS or email with your power bill. We will talk about the Current Sensor ACS712 that was utilised to measure the energy usage in this case. To connect our Wi-Fi to SMS/E-mail notifications, we will use the IFTTT platform. We will also use the Android app MQTT Dashboard to track our energy usage.

The energy crisis is one of the main problems facing the globe. The energy issue can be partially reduced by properly regulating our energy consumption and avoiding energy waste. Power

theft is one of many issues people nowadays deal with. Power theft is potentially a significant crime that has an immediate impact on the national economy. This method makes energy theft easy to spot. This Internet of the Things power metre comprises a microcontroller called an Atmega 328, a WIFI module for IoT connectivity, and a GSM module for mobile communication. Information about this connection will be sent to users via SMS. SMS connections between mobile devices and the system are required for system configuration. In this intelligent power metre, the current sensor also transmits the current information to the microcontroller. In an emergency, the data will be sent to the specified phone. We have to determine the unit's price, which has four buttons. By using buttons, we may adjust the unit's price. A reading appears on the IoT panel when the machine is turned on. Reading will change over time. The IoT screen will display any attempts to syphon energy as soon as they are discovered. Even the information will be SMS-delivered to the specified phone. The operator can utilise IoT to disable the system after receiving the alarm to deter theft. Additionally, it describes how to disable the cell phone's message system.

5.1 Ultrasonic sensor:

As soon as the machine is turned on, the IOT panel shows a reading. There will be reading-related modifications throughout time. If an effort is made to steal energy, it will be discovered and displayed on the IOT screen. Even the information will be provided via SMS to the chosen phone. After receiving the alarm, the operator can use IOT to turn off the system in order to deter theft. The message mechanism on the cell phone is also explained in detail.

5.2 Motion Sensor:

Security systems and the documentation of object movement both rely heavily on motion sensors. It is possible to employ infrared-based sensors to find out whether there are any people around. This type of sensor detects the presence of humans using body heat. To monitor object movement, sensors based on microwave technology are employed.

5.3 Wi-Fi Module:

The project's internet access is provided by the ESP8266 Wi-Fi Module, a reliable, cost-effective, and user-friendly module. The Internet enables peer-to-peer data exchange and gives users a tool to view the results. The module has two separate modes of operation. One is the space where access points, or hotspots, can be constructed. It could also serve as a Wi-Fi station as an alternative. To fetch and store data in any mode, the module establishes a trustworthy connection. The model is programmed using the user-friendly and C-based Arduino IDE.

5.4 Relay Board:

"On a board known as a relay board, relays and switches are stacked in an array pattern. The relay board's primary function is to regulate voltage variations. Since they can only function properly at a specific voltage, devices can be harmed by high or low voltage. A relay board is used to maintain the proper voltage in order to prevent such accidents. Input and output pins are present to maintain the voltage supply. Temperature, lighting and other equipment are all controlled by these relay boards."

5.5 Jumper wires:

“Insulated connections known as jumper wires are employed to link sensors, microprocessors, and other hardware parts. The benefit of jumper wires is that they enable them to connect wires without using solder. In the model, various jumper wires are utilised. Jumper cables that connect male to male feature two projecting ends. Male-to-female jumper wires have one

protruding and one non-protruding end, while female-to-female jumper wires have two non-protruding ends. The pins of various modules are connected using the many types of jumper wire available."

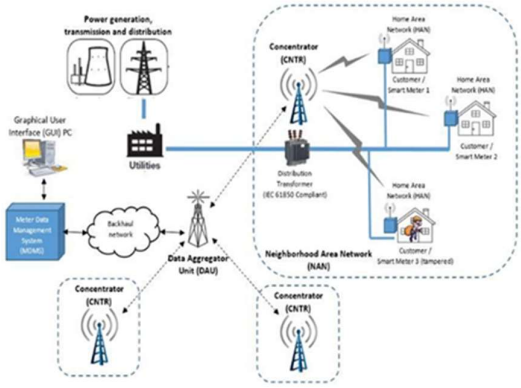
5.6 GSM Module:

"The purpose of the GSM module is to transmit communications from the owner's home to their current location. Users get a message that includes data on power usage. The SIM900a chip in the module is dependable and unbreakable. The GSM module contains the dual-band SIM900a chip. It is mostly used for fax transformation, SMS, data and voice. To send messages to the one specified number, a SIM card will be inserted into the GSM module."

6. SOFTWARE DESCRIPTION:

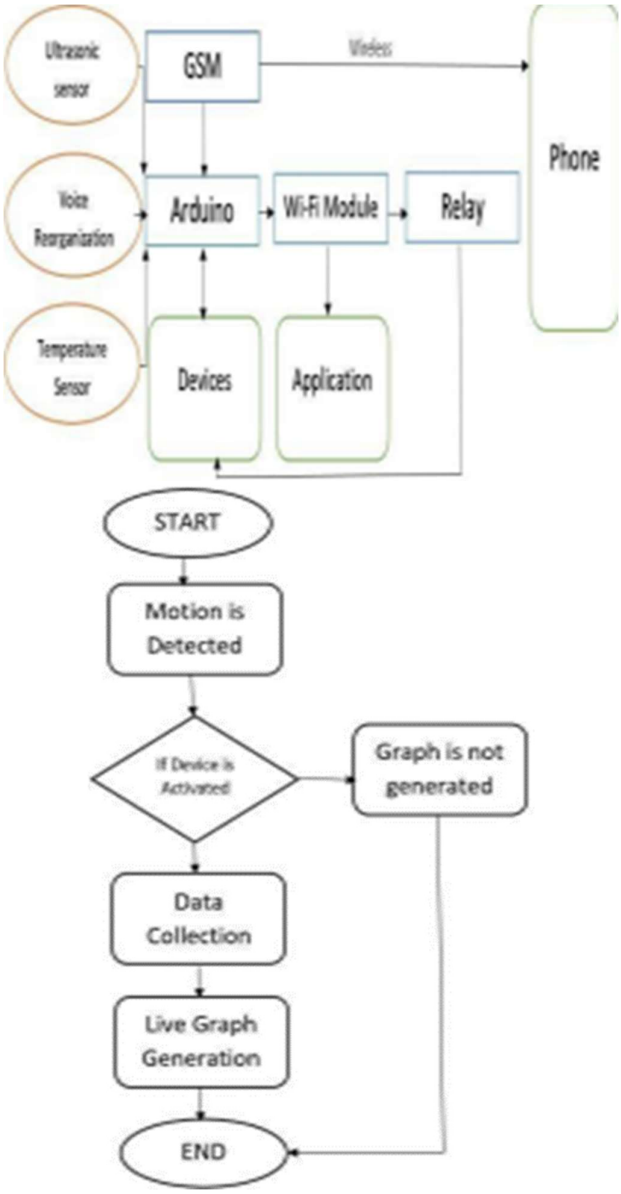
6.1 Application:

The project gives the customer access to an application that delivers a graph-based analysis of how the power is used by various appliances in their home. The application for accessing the devices and seeing the analysis reports using that application is made for this utilising an Arduino Bluetooth controller.

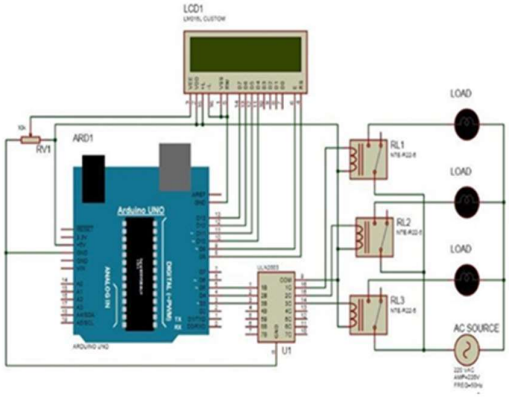


7. BLOCK DIAGRAM:

Power Consumption

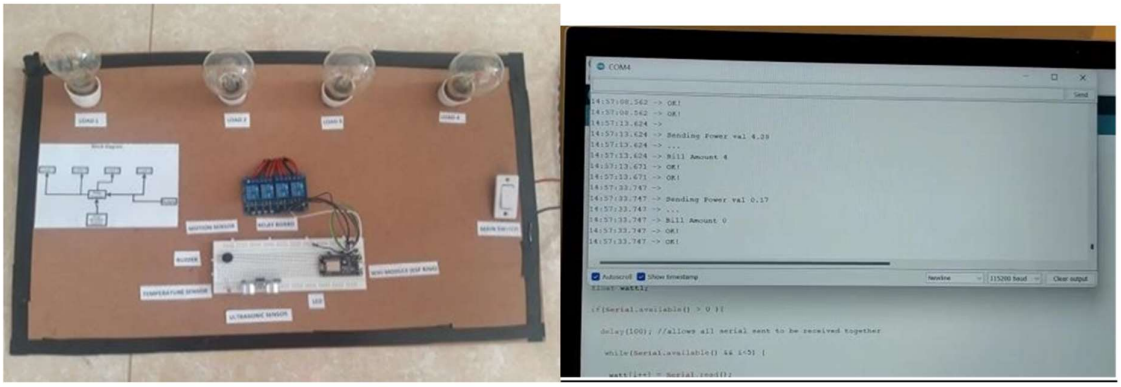


8. ARCHITECTURE

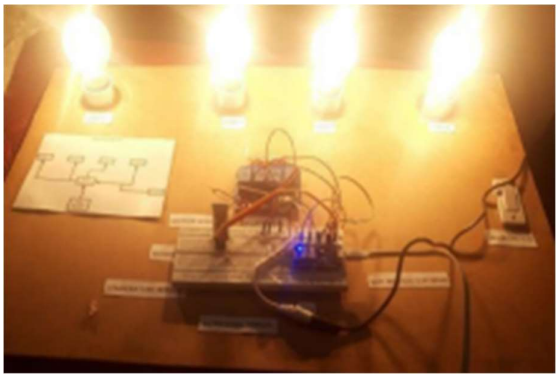


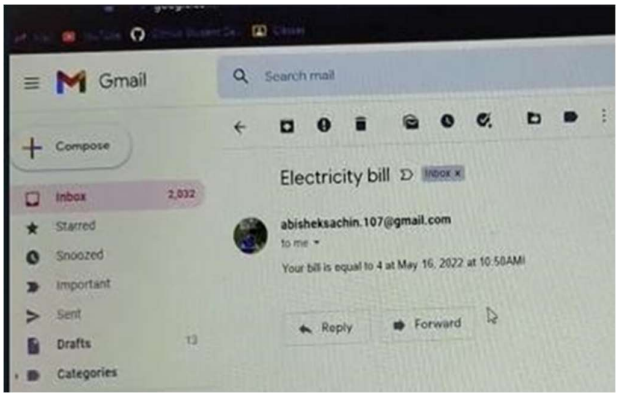
9. PROJECT SETUP

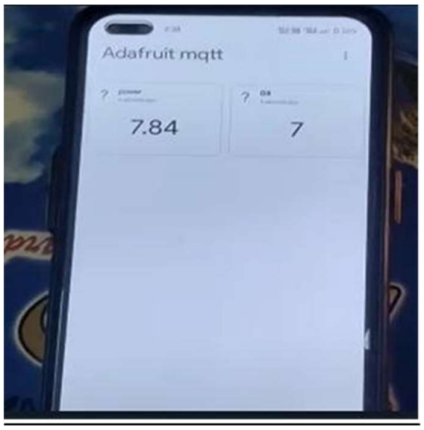
"Cables, a light, breadboard, relay board, breadboard, buzzer, Arduino, switches, GSM, temperature sensor, motion sensor, and ESP8266 WiFi module for remote control of home appliances are among the project's components. The cardboard, which serves as the base, is filled with all the components. The Main Switch, Relay Board, and WiFi module are connected to and control the power supply. The sensors are connected to the WiFi module, which stores the input data for processing.



10. RESULT:







As a result, we may use the programme to remotely access household equipment and view its current state. The apparatus may be operated automatically using the temperature and ultrasonic sensor input. A graph of the application's power usage for live broadcasting is also available for viewing. After the day, a message will also be delivered through GSM informing clients of the overall amount of electricity utilised.

11. LIVE STREAMING GRAPH

STAGE 1: No devices utilized

The device turns on instantly when motion or speech is sensed. The accompanying image's line through zero denotes that there are no active devices at the moment.

STAGE 2: One device utilized

The graph shows that a device is kept on when it travels away from the origin to a higher level and remains there for a specific period of time.

STAGE 3: Multiple devices utilized

The graph shows that several appliances are currently left on as the range of the graph increases.

12. USAGE MESSAGE NOTIFICATION

A GSM message with details on the total amount of electricity utilised that day is transmitted at the end of the day. The message is transmitted automatically each day at the appropriate time, thanks to a connection between the Arduino and GSM SIM900 module. C language is used there. There is a SIM in the GSM module that supports the message to be sent to one or more users.

13. CALCULATION USED:

"Calculation of distance between the object and sensor, D=1/2T C
D be the Distance
T be the Time
C be the Speed of sound
For calculation the power consumption,
P=VI
Where P is power utilized by device
V be the voltage used by device
I be the current used by the device"

CONCLUSION:

Physically handicapped people and the elderly can remotely use home equipment thanks to this prototype model, which enhances their quality of life. It also helps to learn about the power usage of various household equipment using a live streaming graph. The overall power usage message notification will be generated to best utilise it.

Understanding that clients are charged appropriately is crucial, making the necessity clear. To prevent this, we automate the system and give users online access to the energy metre readings. Our suggested solution uses an ESP12, Arduino UNO, and ACS712-30 Amp Current Sensor. It tracks energy use and warns the user through email when a specific value is reached. This allows the user to reduce energy use and receive an affordable electricity bill.

14.FUTURE SCOPE:

A vital extra responsibility is paying bills and computing totals while using power efficiently. Implementing an algorithm for figuring out and reporting the bill amount using the information on how much electricity was used will improve the project even more.

IoT-based intelligent power metres are built on cutting-edge technology to realise future promises. The suggested solution does away with manual intervention by automating the billing process and detecting tampering. Additionally, it enables remote energy metre monitoring. The presented technology can eventually be expanded to function as prepaid energy metres. These metres can be recharged as the user needs, sparing the billing system any additional fees.

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