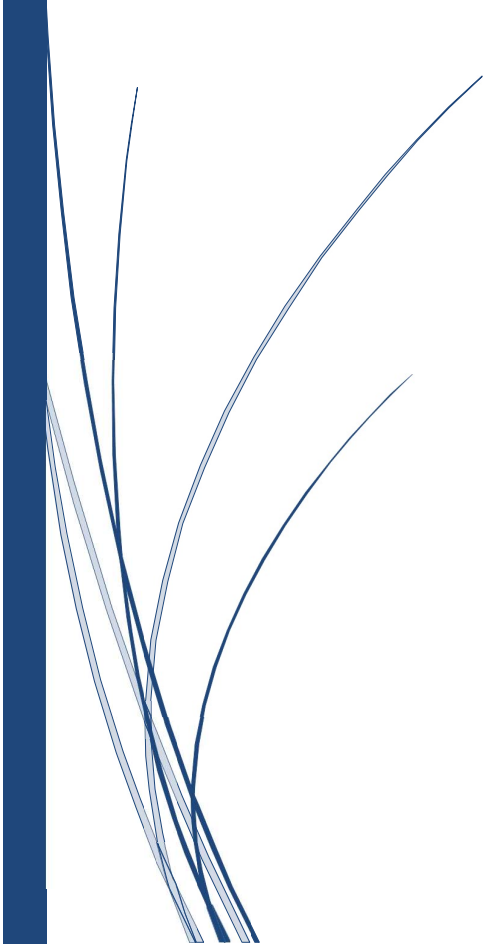
IoT based smart Energy monitoring system

FOR SAVING ENERGY



TITLE PAGE

IoT based smart energy monitoring system

By

Name	Roll No.
Rahul Lal	**210280111521**
Jatan Mandaliya	**210280111519**
Farhan mansuri	**210280111522**
Muskan Gidwani	**210280111509**

A comprehensive project report has been submitted in partial fulfillment of the requirements for the degree of

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in

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Under the supervision of

Mrs. Sima N Gonsai

Assistant Professor

L. D. College of Engineering

Ahmedabad, Gujarat, India

Department of Electronics & Communication Engineering
LD college of engineering, Ahmedabad

ACKNOWLEDGMENT

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INDEX

Table of Contents

ACKNOWLEDGMENT **2**

ABSTRACT **4**

CHAPTER-1 ..... **5**

CHAPTER-2 ..... **6**

CHAPTER-3 ..... **9**

CANVAS **10**

REFERENCE **12**

ABSTRACT

Our project proposes a smart monitoring and control system (SMACS) for household appliances. The application's significance is to monitor household appliances electricity usage using hardware and the Internet of Things (IoT) methods.

The significance of SMACS is that it creates an opportunity for the consumers to control their power consumption practices and help them manage their power consumption practices and save money too.

CHAPTER-1

INTRODUCTION

The purpose of this project is to monitor the energy consumption of each and every node of the home. The user has the ability to track their energy usage in real time, as well as review past records. This can be useful for identifying which items are using the most energy and taking steps to reduce your energy consumption.

This data will be displayed in an application that connects to a cloud and a controller. The application also offers a feature that predicts the user's electricity bill for the current month based on their usage, promoting energy conservation. This can help identify discrepancies, such as overcharging, and take steps to resolve them.

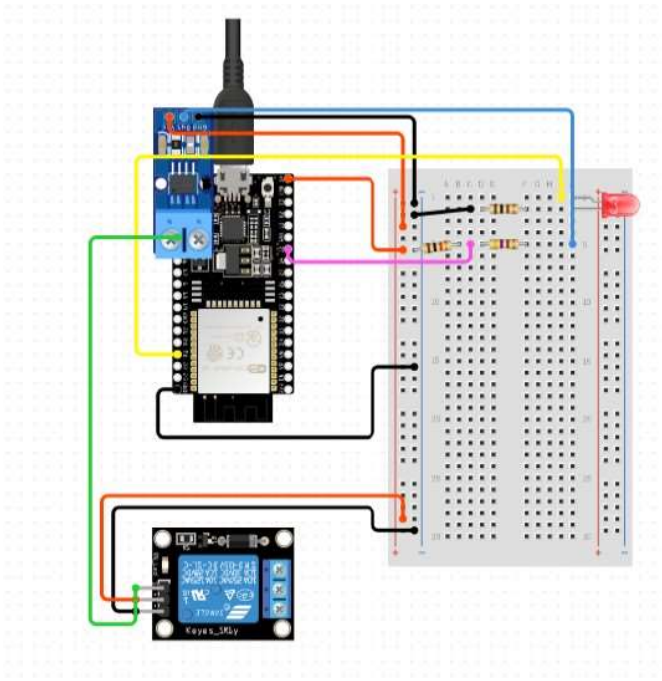
The controller can be updated wirelessly through OTA updates that are reflected in the app. The app will produce an estimate of the cost of the units that have been used. Additionally, a door lock is included that automatically turns off unnecessary appliances when the user leaves their home.

By use of the data provided by the device to identify potential issues that may affect your energy usage. For example, if individuals see that appliances or devices is using significantly more electricity than usual, it may be a sign that the appliance is experiencing a malfunction or is in need of repair. By identifying and addressing these issues, one can prevent them from causing more significant problems and potentially save money on energy costs.

CHAPTER-2

DISCRIPTION

Circuit diagram: -



Working: -

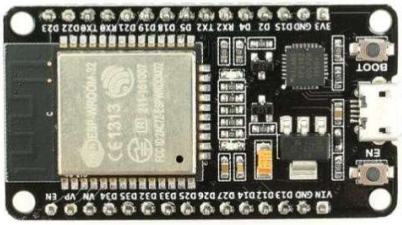
The working of device is very simple. ACS712 (current sensor) and ZMPT101b (voltage sensor) measures current and voltage from each and every node of the house. The data is then used to calculate the power (in kwh). This data is shown and stored on app in regular interval of time. An algorithm is set to calculate the approx. bill for different electricity provider, for example, torrent, GEB etc.

Component list: -

- Node MCU(ESP32)
- ACS712
- ZMPT101B
- RELAY MODULE
- Jumper wires

Hardware and description: -

- ESP32:-



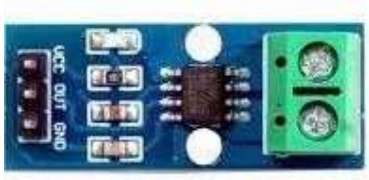
ESP32 is a low-cost, low-power Microcontroller with an integrated Wi-Fi and Bluetooth. It is the successor to the ESP8266 which is also a low-cost Wi-Fi microchip albeit with limited vastly limited functionality.

It is an integrated antenna and RF balun, power amplifier, low-noise amplifiers, filters, and power management module. The entire solution takes up the least amount of printed circuit board area. This board is used with 2.4 GHz dual-mode Wi-Fi and Bluetooth chips by TSMC 40nm low power technology, power and RF properties best, which is safe, reliable, and scale-able to a variety of applications.

- ZMPT101B:-

ZMPT101B AC Voltage Sensor is the best for the purpose of the DIY project, where we need to measure the accurate AC voltage with a voltage transformer. This is an ideal choice to measure the AC voltage using Arduino/ESP32/Raspberry Pi like an opensource platform. In many electrical projects, engineer directly deals with measurements with few basic requirements like High galvanic isolation, Wide Range, High accuracy, Good Consistency.

- ACS712:-



The 20A Range Current Sensor Module ACS712 consists of a precise, low-offset, linear Hall circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field in which the Hall IC converts into a proportional voltage.

- Relay Module:-

This is a 5V, 10A 2-Channel Relay interface board. It can be used to control various appliances, and other equipments with large current. It can be controlled directly with 3.3V or 5V logic signals from a microcontroller (Arduino, 8051, AVR, PIC, DSP, ARM, ARM, MSP430, TTL logic).

CHAPTER-3

SOFTWARE

We will be using the Arduino IDE for programming the microcontroller in order to manage and control the other all sensors. **Arduino IDE** is an open-source software, designed by Arduino.cc and mainly used for writing, compiling & uploading code to almost all Arduino Modules.

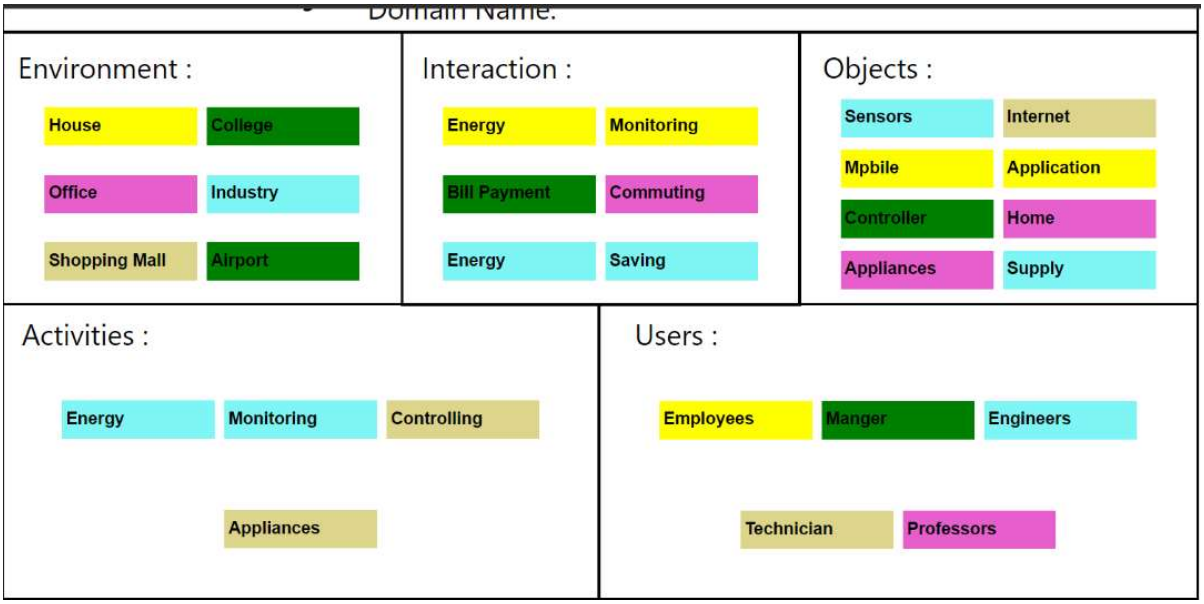
- It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process.
- It is available for all operating systems i.e. MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role in debugging, editing and compiling the code.
- A range of Arduino modules available including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro and many more.
- Each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code.

We have used Thingspeak's platform to show data on app and store as well. The Internet of Things (IoT) in education includes data storage, processing, and data visualization. ThingSpeak™ has a simple interface that makes it easy to learn cloud analytics and teach IoT. Then use ThingSpeak communities to provide support for your cloud education curriculum. ThingSpeak also supports and integrates with Arduino®, RPI, and other hardware.

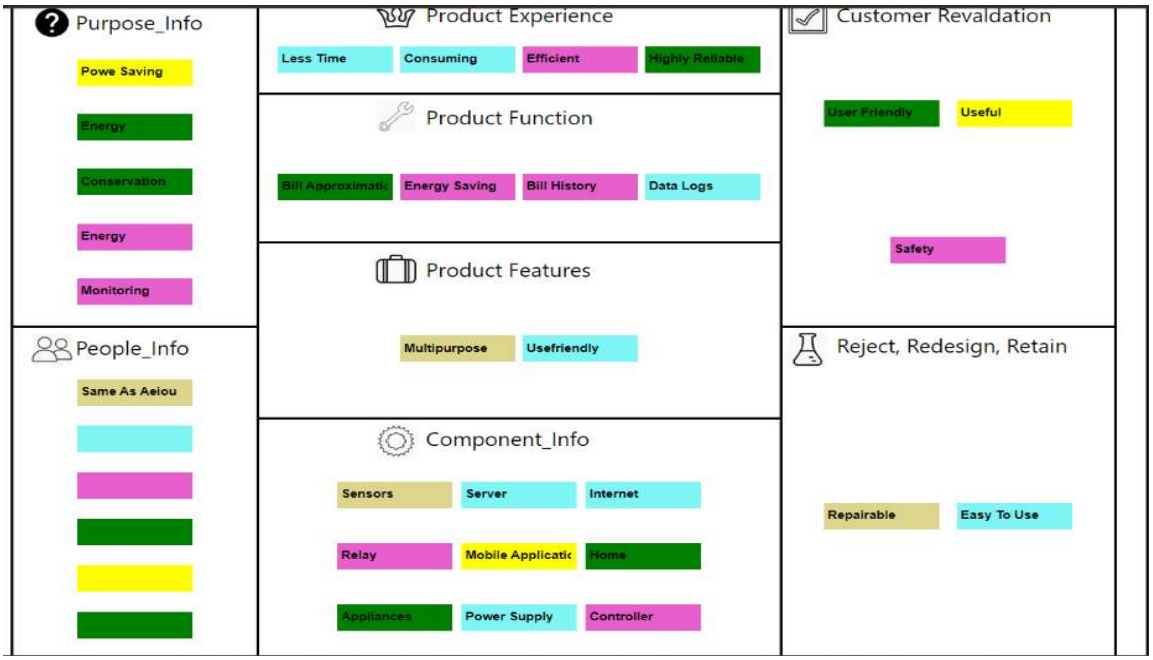
- See instant visualizations of data posted by your devices or equipment
- Execute MATLAB® code in ThingSpeak, perform online analysis and data processing with live data, and see automatic visualizations
- Build IoT systems without setting up servers or developing web software

CANVAS

AEIOU CANVAS:-



PRODUCT DEVELOPMENT CANVAS:-



EMPATHY CANVAS:-

Design for : **Design By :**

Date: **Version :**

USER

EMPLOYEES | TECHNICIANS | HOUSEHOLDS

MANAGERS | ENGINEERS | SUPERVISORS

STACKHOLDER

PRIVATE ORG. | HOUSE OWNER | SUPERVISORS

ACTIVITIES

ENERGY | MONITORING | APPLIANCES | CONTROLLING

STORY BOARDING

HAPPY

after installing the system the the energy consumption was continuously monitored any appliances taking more than required current was observed the faulty appliances was repaired and it started consuming normal power

HAPPY

as the bill approximation was also given in the system by making changes in usage the bill money was reduced significantly than that of without the monitoring system.

SAD

Once some of the appliances in the house wasn't in perfect condition and therefore was taking more than rated current, this consumption caused the electricity bill to rise tremendously and gave heart attack to the owner(the father) and he died

SAD

once lights and fans were left turned ON while going out which increased the bill and no one was even using it this increased electricity bill gave heart attack to the son this time and he also died so therefore All men must die.

IDEATION CANVAS:-

The ideanaut : *Ideation Canvas* Project : Team :

People

MANAGERS | PROFESSORS | ENGINEERS | SUPERVISORS | TECHNICIANS

Activity

ENERGY EFFICIENC' | ENERGY MONITOR | CONTROLLING | APPLIANCES

Situation/Context/Location

HOSPITAL | OFFICES | HOUSE | SHOPPING MALL | INDUSTRY | COLLEGE

Props/Possible Solution

RELAYS | SENSORS | INTERNET | SERVER | CONTROLLER

REFERENCE

https://www.youtube.com/watch?v=FVGvR9qlEc8&t=47s
https://www.circuito.io/app?components=512,11021
https://thingspeak.com/
https://www.youtube.com/watch?v=jYjuxWUefhg