Smart Home Automation Using Thinkspeak Cloud

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Abstract*— This paper explains the rationale behind the Internet of Things (IoT)-based home automation concept. The purpose of this project is to create an Internet of Things (IoT) system that allows the user to remotely operate electrical appliances using an Android mobile application. Additionally, the solution it is putting forth aims to reduce energy consumption by having automatic behavior follow its preprogrammed actions. An Android smartphone application can be used to track energy use. The system is user-friendly and, most importantly, simple to use. The appliances that will be tested and implemented for this model include door locks, fans, water sprinklers for the lawn, and lighting both inside and outside. .. The primary hardware elements that are utilized are A well-known development board called NodeMCU is built on the ESP8266 and makes use of ThingSpeak's services. The cloud, the DHT-11 digital temperature and humidity sensor, the MQ135 air quality sensor, The reports produced from the computed difference in energy consumption between devices attached to and disconnected from the system are used to analyze the results.

Index Terms*— NodeMCU (ESP8266), MQ135, DHT-11 , Thinkspeak Cloud

I. INTRODUCTION

The sophisticated addition to internet connectivity is called the Internet of Things (IoT). It uses the internet to link everyday physical devices with one another. This technology now serves as a link between a number of different industries, including internet connectivity, digital electronics, sensors, and actuators. Interacting and communicating with one another is possible between devices that are linked to the internet. These gadgets also offer simple monitoring and controlling. The world has been captivated by the rapid advancement of Internet of Things (IoT) technology in recent years, and it is being used in a variety of industries, including home automation, industry, farming, and education .The idea of home automation has gained popularity in the advancement of human comfort, especially for private homes where dependability and a comfortable living environment are essential. The market is filled with devices designed for home automation. Furthermore, using wireless technology to regulate a home can offer a high degree of viability. Through automatic appliance control, these systems can aid in reducing and managing the amount of electricity used. It is possible to monitor daily power use. IoT can be utilized for security and other stand-alone modules, including automated garden water sprinkling and outdoor lights, in addition to controlling electric appliances. Using a tablet or smartphone running Android, these modules can be observed. To create such systems, a great deal of study has been done. Sensors provide vast amounts of data, which are retrieved and analyzed to create and display future predictions. The purpose of this study is to expand on our understanding of the design and application of cloud-based smart home automation systems. It's an automated system that operates around the clock. An Android smartphone application is created that allows users to remotely operate household appliances and lock/unlock door locks from any location once they have successfully connected to the Internet via Wi-Fi or 3G/4G. Moreover, the application allows users to monitor their monthly power usage. Additionally, this system includes a stand-alone module that handles lawn water supply automation.

II. LITERATURE REVIEW

We will go over the overview of IoT home automation in this article. and will concentrate on things like gas and smoke detectors, smart appliances, smart lighting, and intrusion detection. Let's talk about them one by one. Building automation for a residential setting—also referred to as a "sensible home" or "smart house"—is known as home automation. Your lights, fans, TV, and other devices are all under your control inside the IoT home automation network. A home automation system can keep an eye on and/or control features like the lights, air conditioning, entertainment

systems, and appliances. Controlling the appliances in your house is really useful. Furthermore, it will integrate home security features like alarm systems and access control. Home appliances play a significant role in the Internet of Things when combined with the internet. Controlled gadgets are often connected to a central hub or gateway by means of a home automation system. The system control program can be accessed by wall-mounted terminals, desktop or tablet computers, smartphone applications, or an online interface that can even be accessed remotely via the Internet. The term "smart home automation" describes the use of technology to regulate and automate a number of household tasks, including lighting, air conditioning, heating, and security. A network connection can be used to remotely operate and monitor home automation systems in the context of IoT (Internet of Things) and M2M (Machine-to-Machine) communications. One more benefit of IoT-powered home automation is the ability to monitor and manage equipment from a distance, even when not at home. This can be helpful for maintaining home security and safety as well as for regulating energy use. Smart devices that can be controlled and monitored via a centralized hub or app, like lightbulbs, security cameras, and thermostats, are commonly used in IoT-enabled home automation systems. Utilizing wireless protocols like Zigbee, Z-Wave, and Bluetooth, these smart gadgets may connect with the central hub as well as with one another. All things considered, homeowners can gain a lot from IoT-enabled home automation, including enhanced security, convenience, and energy economy. But since these systems could be open to hacking and other online dangers, it's critical to maintain their security.

Numerous home automation options are offered by various publications and are readily available on the market. Giving household appliances controls is one strategy. Economical power use and home monitoring with ZigBee and Google Cloud Services. utilizing a mobile application and web application client to enable remote interactions and monitoring. visualization of the environmental atmosphere, including temperature and humidity .

Two Arduino-based prototypes, one for indoor use and the other for outdoor use, have been proposed by Mandula et al.[4] Bluetooth is used to control appliances indoors, and IP addresses against Ethernet. Home gadgets like LED TVs, fans, air conditioners, and lightbulbs may all be controlled by the system. The Android mobile application is used to give ON and OFF switching for appliances. It is impossible to assess or monitor energy use or any other automatic intelligent reaction for automation because the data is not being kept in any database.[1-2]

Intelligent systems have replaced simple automation systems in the modern era. It is possible to see a system that Zainab et al.[3] have proposed for use in smart cities. Artificial Intelligence (AI) and the Internet of Things were used in the construction of this system. The system that is being presented promises to assist in lessening traffic congestion on the highways. IoT-based healthcare has been emphasized by Safeeullah et al. [5], much like an intelligent traffic system. The project is extensive and consists of numerous minor systems that can be tracked, managed, and maintained, like medical refrigerators, patient surveillance, fall detection, and many more. Our research work is primarily concerned with presenting a method for home automation. Expanding the system to suit the needs of future research can be done. IoT Data Protocols: Low-power IoT devices are connected using IoT data protocols. They allow users to communicate with gear without requiring an internet connection. Through a wired or cellular network, IoT data protocols and standards are connected. Here are a few instances of IoT data protocols:

- Telemetry Message Queuing Transport, or MQTT

A simple Internet of Things data protocol is called MQTT (Message Queuing Telemetry Transport). It has a publisher-subscriber messaging mechanism that enables straightforward data transfer across various devices. The primary feature of MQTT is its architecture. Its genetic makeup is simple and light, which enables it to give devices low power consumption. Additionally, it operates using the TCP/IP protocol. The purpose of Internet of Things data protocols was to address unstable communication networks. As more small, inexpensive, and low-power gadgets have entered the network over the past few years, this has become necessary in the context of the Internet of Things. Even while MQTT has been widely adopted, most notably as an Internet of Things standard with industrial uses, - It is incompatible with

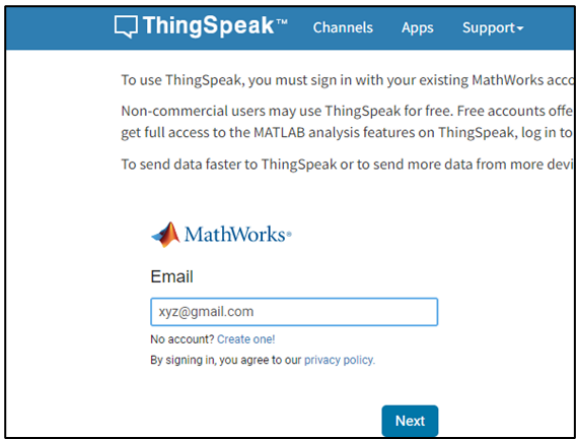
modes of device management structure and defined data representation. This means that the way data and device management features are implemented is totally platform- or vendor-specific.[6-7]

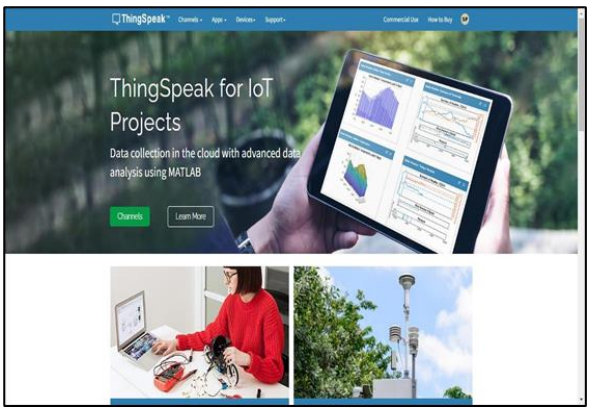
- Proposed Work :

Entire project is based over the "Thingspeak IOT Cloud platform". Below are some of the key features of this IOT platform :[15-16]

- Public/Private view
- Channel Settings
- API-keys
- MATLAB Analysis
- Add Visualizations

1) Open the browser and search for THINGSPEAK IOT CLOUD in the search bar and look for the website www.thingspeak.com
2) Create a MathWorks account to access all the features of ThingSpeak





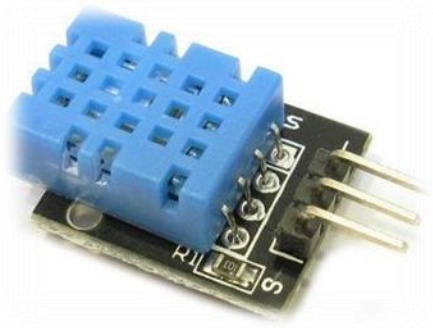
Components:
Esp8266 NODE MCU

A well-liked development board built on the ESP8266 platform is the NodeMCU. It has more functionality than just the ESP12 Module, which has the ESP8266 in it. To make it simpler for you to test and create projects with the ESP8266, it also has a USB connector and pins that are suitable for a breadboard. [7-8-9]

MQ-135 Sensor
One kind of MQ gas sensor used to identify, quantify, and track a variety of gases found in the air, such as ammonia, alcohol, benzene, smoke, carbon dioxide, etc., is the MQ135 air quality sensor. It uses 150mA of power and runs at a 5V supply. [10-11]

DHT-11 Sensor:

A straightforward, incredibly affordable digital temperature and humidity sensor is the DHT-11. It measures the ambient air using a thermistor and a capacitive humidity sensor before emitting a digital signal on the data pin (no analog input pins are required). [7,12]

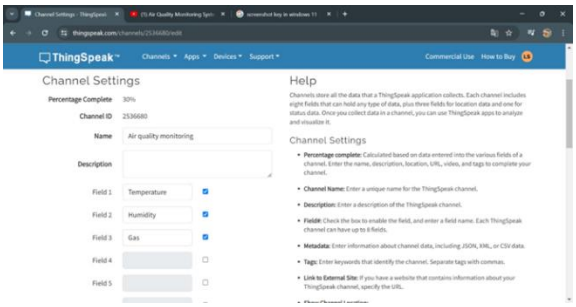


USB Data Cable (2.0)

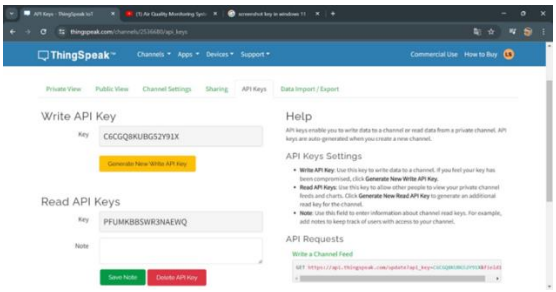
USB 2.0 is compatible with low-bandwidth devices like keyboards and mouse as well as high-bandwidth devices like high-resolution webcams, scanners, printers, and high-capacity storage systems. It offers three speed modes: 1.5, 12 and 480 megabits per second.

Step 1: Visit https://thingspeak.com/ and create your account by filling up the details.

Step 2: Create a New Channel by Clicking on "Channel & fill up the following details as shown in the image below.

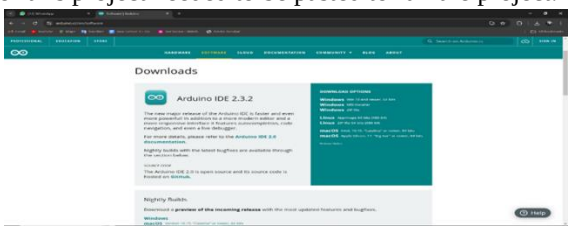


Step 3: Click on API Key, you will see the "Write API Key". Copy the API Key. This is very important, it will be required in Code Part.



Note: API – KEY is different for each console API-KEY: C6CGQ8KUBG52Y91X

Arduino IDE –The code editor in which all the codes of this project needed to be pasted to run the project.

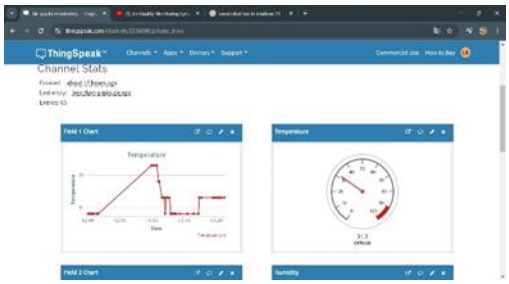


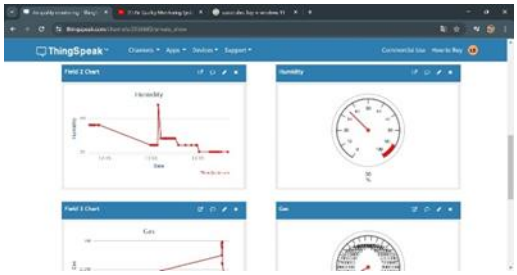
The IoT Smart & Automatic home system with ESP8266 has extremely basic source code. The NOdeMCU Board can be simply updated with the code. The library listed below

1. DHT.h
2. MQ135.h
3. ESP8266WiFi.h

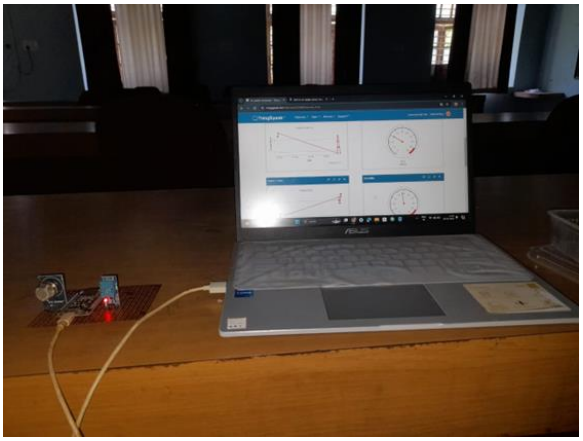
Modify the Thingspeak API Key, WiFi SSID, and password in the section of code below. The calibration of the home automation system values, such as the gas and air values, is the most crucial component of this code. See this page for instructions on calibrating and obtaining the accurate reading: Calibrating Sensor Value. Do not, please, skip this step.[15]

- Testing & Results





It displays data in real time. A warning is given as the gauge rises with an increase in gas level. This graphic below shows you how it operates in its entirety. Thingspeak Server allows you to monitor the data online from anywhere in the world. Navigate to the Thingspeak server's private view to accomplish that. Along with the relay status, you can check the temperature, humidity, and status.



III. LIMITATIONS

The anticipated system's functionality is somewhat limited. To begin with, the system requires a steady supply of electricity in order to maintain synchronization. If there is no electric supply, the system will not function. Attaching a battery power supply, which can supply backup electricity in the event that the main power source is unavailable, can overcome this restriction. Secondly, without Internet connectivity, signal transmission and cloud interaction are not possible. If we confirm that the system is connected to a legitimate, safe, and continuous internet connection offered by the internet service provider, this issue may also be fixed.

CONCLUSION AND FUTURE WORK

The goal of the suggested system's development was to use Internet of Things (IoT) technology to reduce energy consumption. The system has managed and minimized energy use with reasonable results. Budget constraints are taken into consideration when developing suggested architecture. If this technology is created and widely used for households, it can significantly reduce energy consumption. This research can also be extended to include the development and application of fuzzy algorithms for the management of electrical energy. The system's efficiency may suffer if a fuzzy algorithm is used. Since street lights use a significant amount of electric energy, managing traffic lights and street lights could be another approach to expand the scope of this study. This idea will save a significant quantity of energy if it is implemented widely for countrywide and urban street lighting. This research will set the stage for intelligent systems of the future, ones that can learn and adapt over time and make advantage of increasingly sophisticated machine learning and deep learning techniques.

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