Project Synopsis
on
Home Automation using IoT and Cloud

Submitted as a part of course curriculum for

Bachelor of Technology
in
Computer Science

Submitted by
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DECLARATION

We hereby declare that this submission is our work and that, to the best of our knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgement has been made in the text.

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CERTIFICATE

This is to certify that Project Report entitled "**Home Automation using IoT and Cloud**" which is submitted by **ARJUN SINGH, RACHIT SONI and SHREYA TIBREWAL** in partial fulfilment of the requirement for the award of degree B. Tech. in Department of Computer Science of Dr A.P.J. Abdul Kalam Technical University, Lucknow is a record of the candidates own work carried out by them under my supervision. The matter embodied in this report is original and has not been submitted for the award of any other degree.

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Last but not the least, we acknowledge our friends for their contribution to the completion of the project.

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ABSTRACT

An IoT network leverages a combination of mobile, cloud, and Big Data Technology along with data analytics and low-cost computing to enable the collection and exchange of data among physical objects connected within the network. And what's impressive is that all of this is accomplished with minimal human intervention. Home Automation using IoT and Cloud Computing provides many connectivity options, implying large network access. People use a wide range of devices to gain access to cloud computing resources: mobile devices, tablets, laptops. This is convenient for users but creates the problem of the need for network access points.

Developers can use Home Automation using IoT and Cloud computing on-demand. In other words, it is a web service accessed without special permission or any help. The only requirement is Internet access.

Based on the request, users can scale the service according to their needs. Fast and flexible means you can expand storage space, edit software settings, and work with the number of users. Due to this characteristic, it is possible to provide deep computing power and storage.

Cloud computing in combination with the Internet of Things will make fundamental changes to the life of mankind, particularly in how information is managed. The cloud is the only technology that can analyze, store, and access the IoT depending on the deployment model. Because of the nature of on-demand information, cloud computing with an Internet connection is available on any device at any time. As hybrid cloud adoption grows, many companies are realizing its benefits and the need to implement it. Cloud computing will continue to open up new opportunities for the IoT for a long time to come.

This project "Home Automation using IoT and Cloud" will help people to check the condition of weather which includes the temperature and humidity in the climate and it will store all the data in database. So that all the data can be used as a reference in the future about the weather condition. To predict the temperature and humidity of a climate we can use the data that is store in the database. We try to make this project user friendly so that it will be easier to use. The research paper will contain all the development phases and in detail study about the technology used. It will also contain the algorithm used and about the future scope of the project.

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INTRODUCTION

A Home Automation using IoT and Cloud is a massive network that supports IoT devices and applications. This includes the underlying infrastructure, servers and storage, needed for real-time operations and processing.

A Home Automation using IoT and Cloud also includes the services and standards necessary for connecting, managing, and securing different IoT devices and applications.

This project is a web Home Automation using IoT and Cloud based project which will promote the automation in daily life.

It will do so by automating the home appliances by measuring the temperature and give all the details on the website like the temperature, humidity and which appliances are active and at what time the appliances are on.

Time is a very valuable thing. Everybody wants to save time as much as they can. New technologies are being introduced to save our time.

To save people's time we are introducing Home Automation using IoT and Cloud system using NodeMCU.

The appliances can also be controlled by using the website. It will help the user to get access to all the thing by just sitting on one place.

PROBLEM STATEMENT

In today's changing world, technology plays a crucial and important role. Technology are developing daily and new things are always being introduced.

Everyone wants the luxury and automated lifestyle. This project **"Home Automation using IoT and Cloud"** will help promoting the technology. It increases the automation and everything will be done by just using phone and laptop.

As the IOT being used it will automate the home appliances according to the weather and room conditions.

This project helps the user to control all the electronic devices using his/her smartphone.

Time is a very valuable thing. Everybody wants to save time as much as they can. New technologies are being introduced to save our time.

OBJECTIVES

The main objective of this project is to develop a Home Automation using IoT and Cloud which can measure the temperature and humidity in weather.

Using NodeMCU we can measure the temperature and humidity of the room.

After measuring the temperature and humidity it will display the details on the screen.

With the data NodeMCU will send signal to the home appliance like AC or fan So that they will automatically turn on according to the value of temperature and humidity present in the room.

The whole application can be controlled using phone or laptop.

LITERATURE REVIEW

1. Cloud IoT: A Combination of Cloud Computing and Internet of Things

Cloud Providers like Amazon Web Services, Google Cloud Platform, IBM Watson, and Microsoft Azure have incorporating of Internet of Things in cloud Computing. Cloud Computing is a remote location technology that has transformed the way of Information Technology. Internet of Things (IoT) is radically changing the way of businesses operate and people interact with the physical world. The combination of Cloud Computing and Internet of Things build a robust, maintainable, end-to-end Internet of Things solution on cloud platform. It creates streams of insight by extending your infrastructure to the physical world.

Trendy, Internet of Things (IoT) and Cloud Computing are the most modern issues of Future Internet. The IoT is the most important concept of Upcoming Internet for providing a collective global IT Platform to combine seamless networks and networked things. Cloud Computing provides backend solution for processing huge data streams and computations while facing the challenges of everything will be connected with seamless networks in the future. However, there is a lack of common fabric for integrating IoT and Cloud. We believe that the IMS communication platform is the most suitable fabric for integrating IoT and Cloud. In this study, we will provide the review about various cloud computing dominating fields in IoT and all discussion of open challenges and possible solutions for Future Internet under cloud computing.

2. Making sense of IOT data

IoT devices typically have limited data storage capabilities, may run on batteries, and may be deployed in publicly accessible areas. So the bulk of the data acquired by IoT devices is communicated using communication protocols such as MQTT or CoAP, and then ingested by IoT services for further processing and storage. More data is being stored and accessed by IoT apps and services than ever before. Data analytics techniques are an integral part of most of the IoT systems. The collected IoT data is usually transformed into dashboards, reports, visualizations, and alerts. They are myriad use-cases where such setup is useful like monitoring the status of connected devices, presenting device readings in a human-friendly way, identifying patterns, detecting anomalies, trigger actions based on rules, predict outcomes, and even make business decisions based on them.

Data is usually transformed on the device or preferably at device gateways (if they exist) to perform normalization. Events may need to be re-ordered if they have been received out of order, and if data is time sensitive, stale data might be dropped.
Provenance information about the sensor that captured the data, as well as location and timestamp for the data, is often attached at this point too. It is useful to store raw data for debugging and historical analytics purposes, but storing the pre-processed data will avoid having to repeat expensive transformations if the data should need to be analyzed more than once.

3. Cloud database

A cloud database is a collection of informational content, either structured or unstructured, that resides on a private, public or hybrid cloud computing infrastructure platform. From a structural and design perspective, a cloud database is no different than one that operates on a business's own on-premises servers. The critical difference lies in where the database resides. Where an on-premises database is connected to local users through a corporation's internal local area network (LAN), a cloud database resides on servers and storage furnished by a cloud or database as a service (DBaaS) provider and it is accessed solely through the internet. To a software application, for example, a SQL database residing on-premises or in the cloud should appear identical.

The behavior of the database should be the same whether accessed through direct queries, such as SQL statements, or through API calls. However, it may be possible to discern small differences in response time. An on-premises database, accessed with a LAN, is likely to provide a slightly faster response than a cloud-based database, which requires a round trip on the internet for each interaction with the database. In a traditional cloud model, a database runs on an IT department's infrastructure with a virtual machine. Tasks of database oversight and management fall upon IT staffers of the organization.

4. Storing IoT data in database and integrating real time analytics

IoT data is one of the important parts, it can help IoT analytics application in understanding the data, put analytics with an eye toward reducing maintenance, costs

avoiding equipment failures and last but not least integrating machine learning to predict the future behavior. The Internet of Things (IoT) is making our modern world very fascinating, by giving power to control the lights of our home from two towns away, or leave it to refrigerator to make sure they know when milk and other staples need to be replenished?

But there's more to the IoT than fascinating lifestyle. It also includes enabling organizations to collect and analyze data from sensors on manufacturing equipment, pipelines, weather station etc.

We will see how to store temperature and humidity data from IoT devices into database, integrating real time analytics. For achieving this we will cover following tutorial:

1. **Setting up NodeJs server on local system.**
2. **Setting up Node-red to get the temperature and humidity data from IoT device**
3. **Creating Flow for database node in Node-red to store data into database**
4. **Integrating real time analytics using Node-red Dashboard.**

5. NodeMCU V3 For Fast IoT Application Development

The best way to develop quickly an IoT application with less Integrated circuits to add is to choose this circuit "NodeMCU". Today,we will give a detailed Introduction on NodeMCU V3. It is an open-source firmware and development kit that plays a vital role in designing a proper IoT product using a few script lines.

The module is mainly based on ESP8266 that is a low-cost Wi-Fi microchip incorporating both a full TCP/IP stack and microcontroller capability. It is introduced by manufacturer Espressif Systems. The ESP8266 NodeMcu is a complex device, which combines some features of the ordinary Arduino board with the possibility of connecting to the internet.

Arduino Modules and Microcontrollers have always been a great choice to incorporate automation into the relevant project. But these modules come with a little drawback as they don't feature a built-in WiFi capability, subsequently, we need to add external WiFi protocol into these devices to make them compatible with the internet channel.

This is the famous NodeMCU which is based on ESP8266 WiFi SoC. This is version 3 and it is based on ESP-12E (An ESP8266 based WiFi module).

NodeMCU is also an open-source firmware and development kit that helps you to prototype your IOT product within a few LUA script lines, and of course you can always program it with Arduino IDE.

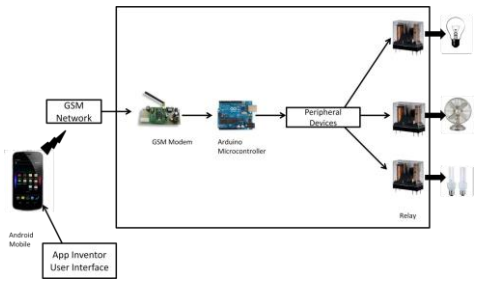
In this article, We will try present useful details related to this WiFi Development Kit, its main features, pinout and everything we need to know about this module and the application domain.

6.Phone Based Home Automation

Phone Based Home Automation Some systems are described as an enabling system that can be used to provide a common framework for home Automation. It provides a system for a smart h o me that includes facilities such as a system controller, house wide wiring and a common interface. This will enable using the existing system for home automation. A hardware based remote controller for power point control has been described. The function of this remote controller is to control the power supplied to devices at a remote location. The system uses the telephone line for transmitting the commands. The controller is a logic system built entirely of hardware. It eliminates the cost incurred with microcontrollers. It uses a DTMF transceiver which is interfaced with a solid state relay to control the power supply. It could also be implemented experimentally with infrared signals and AC power line carrier technology.

6. Wireless Control Systems

System using wireless communication can be made by linking up stand alone appliances that are present at home or in office and integrating to form a co operating network. A combination of various technologies like Wi-Fi and Bluetooth are used to integrate the system. Such a system is laid out as illustrated in figure 5 & 6. The universal Plug and play capability is used to provide a transparent network of devices to the user. The system makes use of the Open Service Gateway Interface (OSGi). The appliances are connected via different networking technologies. The user application layer makes use of web browsers, pocket PC application and a central console. Speech based commands can also be used for controlling the appliances. Advanced features are provided such as device discovery and device connection. The entire system is implemented in a Linux platform. The system also has the ability to add intelligent control modules. These control modules are capable of knowledge capturing and pattern recognition. The universal plug and play system uses many standard protocols for interoperability. The main advantage of the system is its interoperability. Another advantage is the dynamic discovery of the service. It also has the ability for sharing of service.



A voice control system is proposed that will enable the elderly and disabled to control appliances remotely. The primary communication means is through GSM. An Android mobile phone is used to get the voice commands and converts them into text. This is sent via SMS to another phone through the GSM network. This other phone uses Bluetooth and sends the text commands to the Bluetooth module. This module is connected to a microchip controller of the PIC16F877A family. This controller interprets the commands and performs the appropriate actions. The control of electrical circuits is done with a separated system, to isolate the load from the control circuitry. The system also sends back feedback to alert the user about the result of the command. This system's voice command feature makes it universally accessible. However the usage of SMS makes it unreliable. Also the necessity of two phones, one with the user and another in proximity to the controller can lead to additional expenses. A system uses the GSM network along with an AVR microcontroller. This is also an SMS based system. The user enters the commands .These are sent via SMS. However, this system uses a standardized AVR code that can be easily interpreted by the microcontroller. There is a GSM module that is attached to the AVR. This will receive the commands that are sent via SMS. AT commands are used to communicate with the modem. The AVR in turn instructs a driver circuit to control the appliances as necessary. This system has remote access capabilities from all over the world. However it cannot function in real time.

METHODOLOGY

To develop this project, we will have to go through these phases:

- We have to have knowledge of api, JSON, database and webpages.
- We have to start by creating the id pass on the platform.
- Then we will have to create a php api, create a new table to insert weather and temperature and humidity sensor data, create a new table for LED to control Led of ESP12E or NodeMCU from webpage
- Create php rest api for insertion, deletion, read and update data in database
- Then we will program ESP12E to insert data through rest api
- Then reading the data from mysql database using rest api on a webpage using HTML, javascript, Jquery.
- After all this we will work on how to control the LED by use of rest api.
- We will do this by creating a program to read LED status as on or off and then we will create a webpage with buttons to change status of led which is connected using the rest api.

Components used

1.NodeMCU

NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits

Both the firmware and prototyping board designs are open source.

The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson] and SPIFFS. Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented.

The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna.

Technically speaking NodeMCU is a firmware for ESP8266 developed using C Programming Language, Espressif NON-OS SDK and Lua scripting language.

Traditionally, we write code for our Microcontrollers like Arduino, STM32, 8051 etc., either in C or C++ and compile it with a set of tools and generate a binary file. This binary file is then uploaded into the flash memory of the microcontroller and it gets executed.

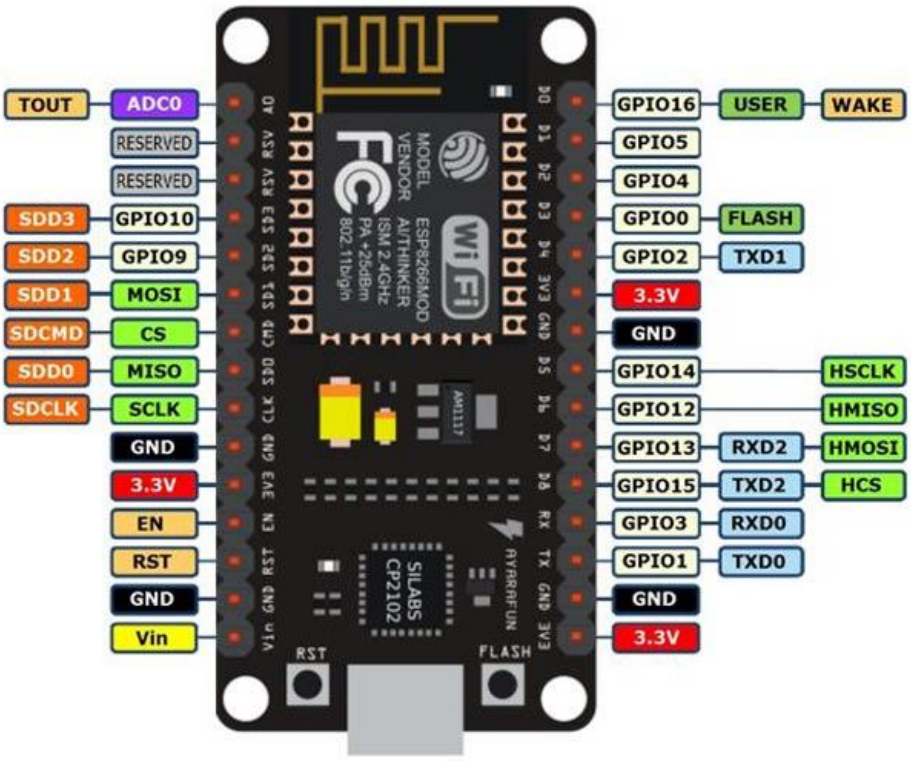
Things are quite different with NodeMCU. You can consider the NodeMCU firmware as an interpreter for Lua Scripts. So, if your ESP8266 is loaded with NodeMCU Firmware, you can simply write your application in Lua and send it to the ESP8266.

NodeMCU Firmware will interpret the bytecode and executes the commands. There is no compilation, no binary file etc. Just write a script and run it.

The team which developed NodeMCU Firmware also developed a breakout board for ESP-12E module called the NodeMCU Devkit. So, many of us are actually using the board called NodeMCU and programming it with Arduino IDE and not the Lua Scripts.

NodeMCU ESP8266 Specifications:

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1
- UARTs: 1
- SPIs: 1
- I2Cs: 1
- Flash Memory: 4 MB
- SRAM: 64 KB
- Clock Speed: 80 MHz
- USB-TTL based on CP2102 is included onboard, Enabling Plug n Play
- PCB Antenna
- Small Sized module to fit smartly inside your IoT projects



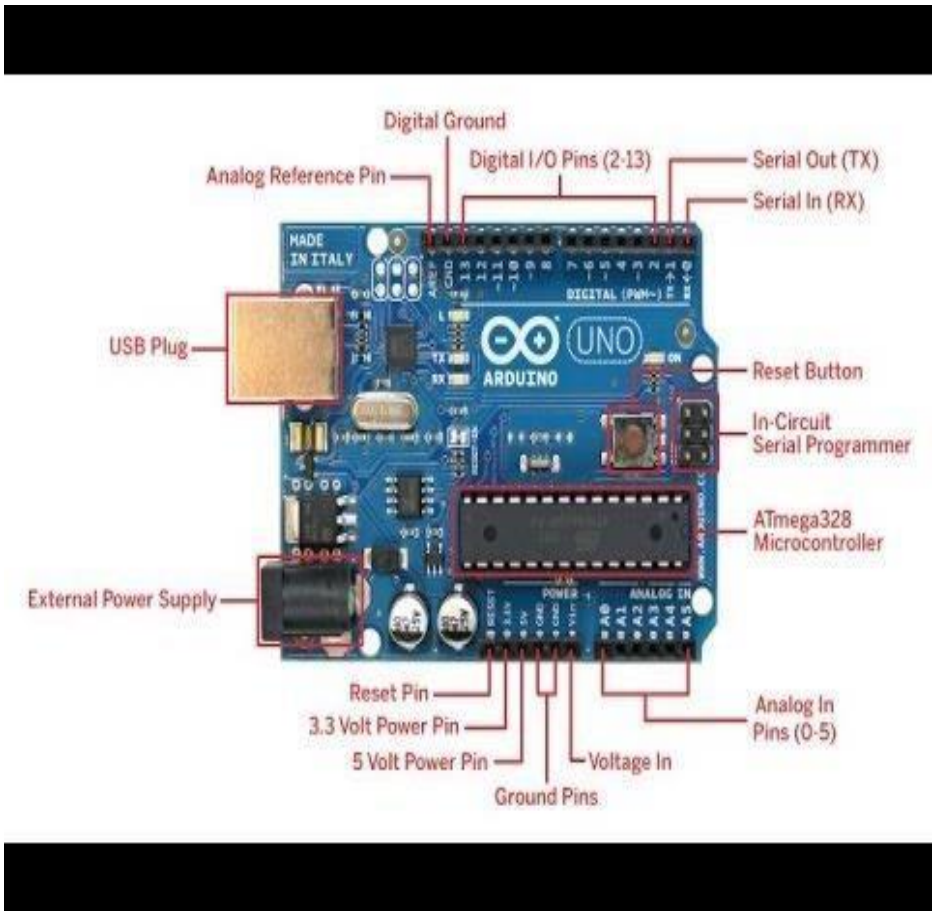
ARDUINO UNO:

Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and

microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself (DIY) kits. Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or Breadboards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project. The Arduino project started in 2003 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy, aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors. 11 The name Arduino comes from a bar in Ivrea, Italy, where some of the founders of the project used to meet. The bar was named after Arduin of Ivrea, who was the margrave of the March of Ivrea and King of Italy from 1002 to 1014.

Features of the Arduino UNO:

- Microcontroller: ATmega328
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V
- Input Voltage (limits): 6-20V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 40 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB (ATmega328)
- EEPROM: 1 KB (ATmega328)
- Clock Speed: 16 MHz



ARDUINO HARDWARE PART: -

Arduino is open-source hardware. The hardware reference designs are distributed under a Creative Commons Attribution Share-Alike 2.5 license and are available on the Arduino website. Layout and production files for some versions of the hardware are also available. Although the hardware and software designs are freely available under copyleft licenses, the developers have requested the name Arduinoto be exclusive to the official product and not be used for derived works without permission. The official policy document on use of the Arduino name emphasizes that the project is open to incorporating work by others into the official product. Several Arduino-compatible products commercially released have avoided the project name by using various names ending in -duino. Most Arduino boards consist of an Atmel 8-bit AVR microcontroller (ATmega8, ATmega168, ATmega328, ATmega1280, ATmega2560) with varying amounts of flash memory, pins, and features. The 32-bit Arduino Due, based on the Atmel SAM3X8E was introduced in 2012. The boards use single or double-row pins or female headers that facilitate connections for programming and incorporation into other circuits. These may connect with add-on modules termed shields. Multiple and possibly stacked shields may be individually addressable via an I²C serial bus. Most boards include a 5 V linear regulator

and a 16 MHz crystal oscillator or ceramic resonator. Some designs, such as the Lilypad, run at 8 MHz and dispense with the onboard voltage regulator due to specific form-factor restrictions. Arduino microcontrollers are pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory. The default bootloader of the Arduino UNO is the optiboot bootloader. Boards are loaded with program code via a serial connection to another computer. Some serial Arduino boards contain a level shifter circuit to convert between RS232 logic levels and transistor–transistor logic(TTL) level signals. Current Arduino boards are programmed via Universal Serial Bus (USB), implemented using USB-to-serial adapter chips such as the FTDI FT232. Some boards, such as later-model Uno boards, substitute the FTDI chip with a separate AVR chip containing USB-to-serial firmware, which is reprogrammable via its own ICSP header. Other variants, such as the Arduino Mini and the unofficial Boarduino, use a detachable USB-to-serial adapter board or cable, NodeMCU or other methods. When used with 14 traditional microcontroller tools, instead of the Arduino IDE, standard AVR in-system programming (ISP) programming is used. The Arduino board exposes most of the microcontroller's I/O pins for use by other circuits. The Diecimila, Duemilanove, and current Uno provide 14 digital I/O pins, six of which can produce pulse-width modulated signals, and six analog inputs, which can also be used as six digital I/O pins. These pins are on the top of the board, via female 0.1-inch (2.54 mm) headers. Several plug-in application shields are also commercially available. The Arduino Nano, and Arduino-compatible Bare Bones Board and Boarduino boards may provide male header pins on the underside of the board that can plug into solderless breadboards. Many Arduino-compatible and Arduino-derived boards exist. Some are functionally equivalent to an

ARDUINO SOFTWARE PART: - IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The source code for the IDE is released under the GNU General Public License, version 2.

The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

Sketch:

A program written with the Arduino IDE is called a sketch. [58] Sketches are saved on the development computer as text files with the file extension .ino. Arduino Software (IDE) pre-1.0 saved sketches with the extension .pde. 16 A minimal Arduino C/C++ program consist of only two functions: setup(): This function is called once when a sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch. loop(): After setup() has been called, function loop() is executed repeatedly in the main program. It controls the board until the board is powered off or is reset.

RELAY:

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations. A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor.

Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays". Magnetic latching relays require one pulse of coil power to move their contacts in one direction, and another, redirected pulse to move them back. Repeated pulses from the same input have no effect. Magnetic latching relays are useful in applications where interrupted power should not be able to transition the contacts.

Magnetic latching relays can have either single or dual coils. On a single coil device, the relay will operate in one direction when power is applied with one polarity, and will reset when the polarity is reversed. On a dual coil device, when polarized voltage is applied to the reset coil the contacts will transition. AC controlled magnetic latch relays have single coils that employ steering diodes to differentiate between operate and reset commands. 18 A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays". The Arduino Relay module allows a wide range of microcontroller such as Arduino, AVR, PIC, ARM with digital outputs to control larger loads and devices like AC or DC Motors,

electromagnets, solenoids, and incandescent light bulbs. This module is designed to be integrated with 2 relays that it is capable of control 2 relays. The relay shield use one QIANJI JQC-3F high-quality relay with rated load 7A/240VAC,10A/125VAC,10A/28VDC.The relay output state is individually indicated by a light-emitting diode.

APPLICATIONS OF RELAY:-

Relays are used wherever it is necessary to control a high power or high voltage circuit with a low power circuit, especially when galvanic isolation is desirable. The first application of relays was in long telegraph lines, where the weak signal received at an intermediate station could control a contact, regenerating the signal for further transmission. High-voltage or high-current devices can be controlled with small, low voltage wiring and pilots switches.

Operators can be isolated from the high voltage circuit. Low power devices such as microprocessors can drive relays to control electrical loads beyond their direct drive capability. In an automobile, a starter relay allows the high current of the cranking motor to be controlled with small wiring and contacts in the ignition key. Electromechanical switching systems including Strowger and Crossbar telephone exchanges made extensive use of relays in ancillary control circuits.

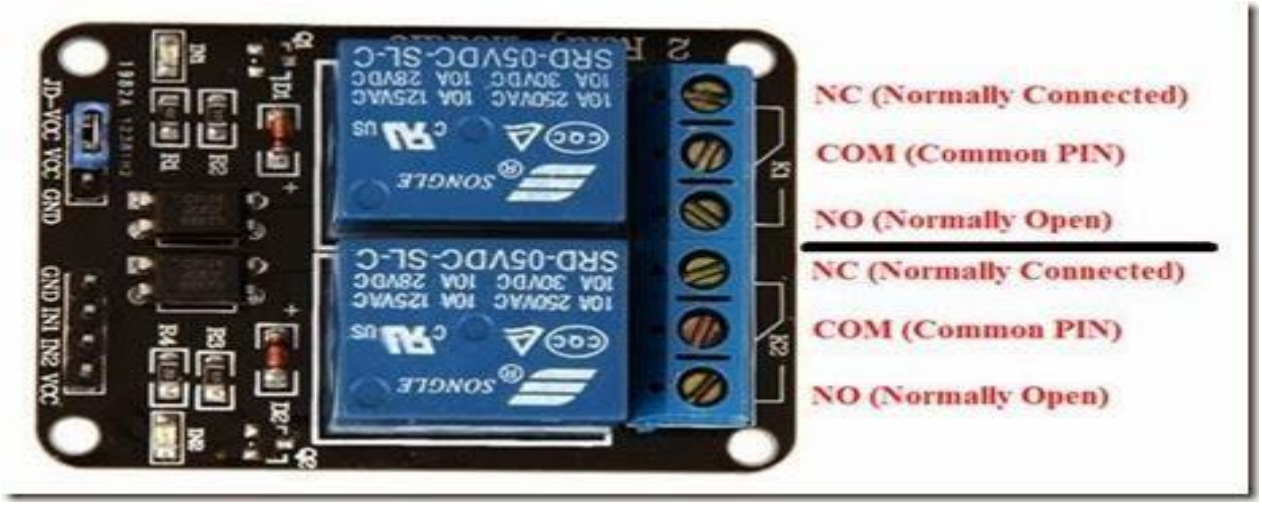
The Relay Automatic Telephone Company also manufactured telephone exchanges based solely on relay switching techniques designed by Gotthilf Ansgarius Betulander. The first public relay based telephone exchange in the UK was installed in Fleetwood on 15 July 1922 and remained in service until 1959.

The use of relays for the logical control of complex switching systems like telephone exchanges was studied by Claude Shannon, who formalized the application of Boolean algebra to relay circuit design in A Symbolic Analysis of Relay and Switching Circuits. Relays can perform the basic operations of Boolean combinatorial logic.

For example, the boolean AND function is realised by connecting normally open relay contacts in series, the OR function by connecting 30 normally open contacts in parallel. Inversion of a logical input can be done with a normally closed contact. Relays were used for control of automated systems for machine tools and production lines. The Ladder programming language is often used for designing relay logic networks. Early electro-mechanical computers such as the ARRA, Harvard Mark II, Zuse Z2, and Zuse Z3 used relays for logic and working registers. However, electronic devices proved faster and easier to use. Because relays are much more resistant than semiconductors to nuclear radiation, they are widely used in safety-critical logic, such as the control panels of radioactive waste-handling machinery.

Electromechanical protective relays are used to detect overload and other faults on electrical lines by opening and closing circuit breakers.

RELAY MODULE:



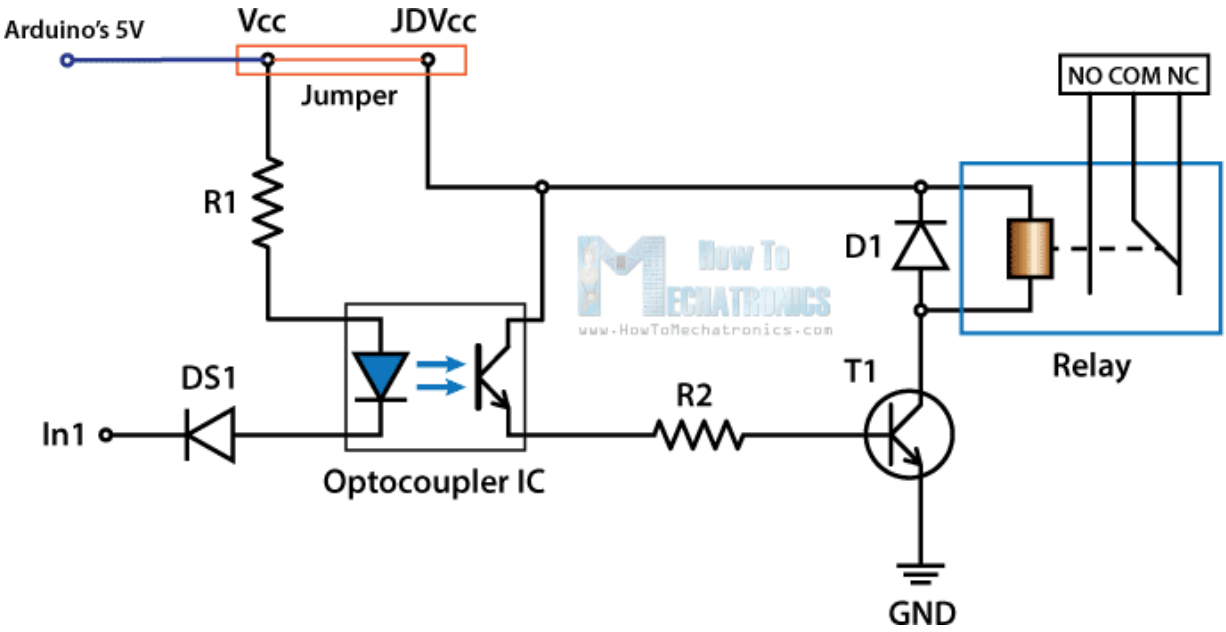
Overview:

We can control high voltage electronic devices using relays. A Relay is actually a switch which is electrically operated by an electromagnet. The electromagnet is activated with a low voltage, for example 5 volts from a microcontroller and it pulls a contact to make or break a high voltage circuit

As an example for this Arduino Relay Tutorial we will use the HL-52S 2 channel relay module, which has 2 relays with rating of 10A @ 250 and 125 V AC and 10A @ 30 and 28 V DC. The high voltage output connector has 3 pins, the middle one is the common pin and as we can see from the markings one of the two other pins is for normally open connection and the other one for normally closed connection.

On the other side of the module we have these 2 sets of pins. The first one has 4 pins, a Ground and a VCC pin for powering the module and 2 input pins In1 and In2. The second set of pins has 3 pins with a jumper between the JDVcc and the Vcc pin. With a configuration like this the electromagnet of the relay is directly powered from the Arduino Board and if something goes wrong with the relay the microcontroller could get damaged.

Circuit Schematic:



For better understanding let's see the circuit schematics of the relay module in this configuration. So we can see that the 5 volts from our microcontroller connected to the Vcc pin for activating the relay through the Optocoupler IC are also connected to the JDVcc pin which powers the electromagnet of the relay. So in this case we got no isolation between the relay and the microcontroller.

In order to isolate the microcontroller from the relay, we need to remove the jumper and connect separate power supply for the electromagnet to the JDVcc and the Ground pin. Now with this configuration the microcontroller doesn't have any physical connection with the relay, it just uses the LED light of the Optocoupler IC to activate the relay.

First let's take a look at the circuit diagram. As previously described we will use a 5V Adapter as a separate power supply for the electromagnet connected to the JDVcc and the Ground pin. The Arduino's 5V pin will be

connected to the Vcc pin of the module and the pin number 7 to the In1 input pin for controlling the relay. Now for the HIGH Voltage part we need a power plug, a socket and a cable with two wires. One of the two wires will be cut and connected to the common and the normally open pin of the module output connector. So with this configuration when we will activate the relay we will get the high voltage circuit closed and working. Here's how made the cable. So I bought a plug, a socket and a cable. Then I carefully cut the cable and cut one of the wires as shown in the picture below and connect them to the normally open connection pins of the relay module. Also connected the ends of the cable to the plug and the socket.

DIAGRAMS

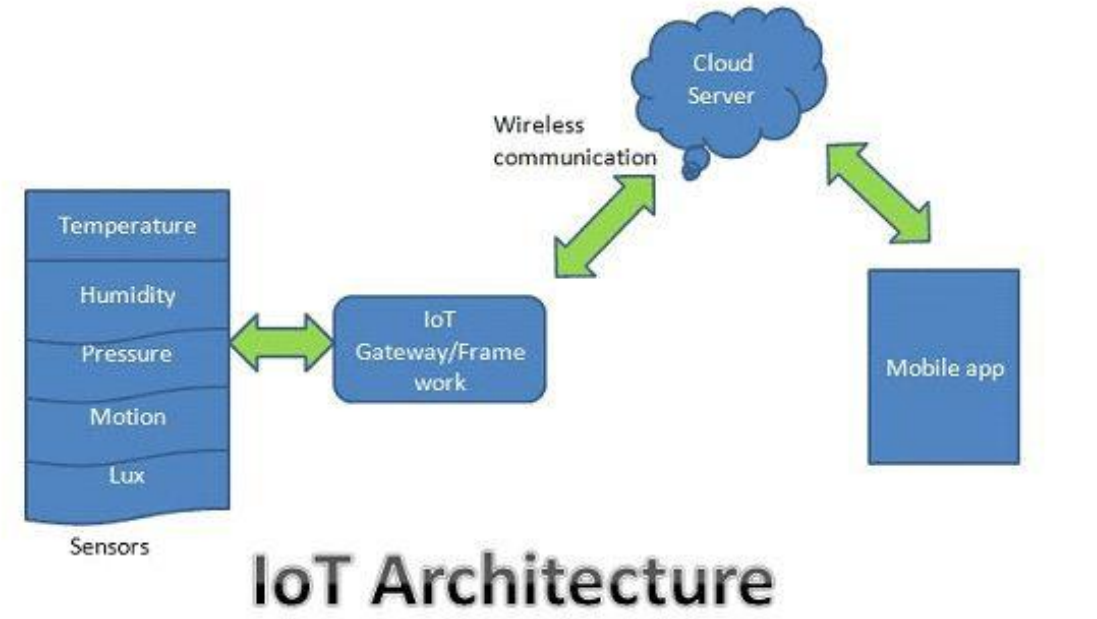


Figure 1: Basic explanation of IOT working

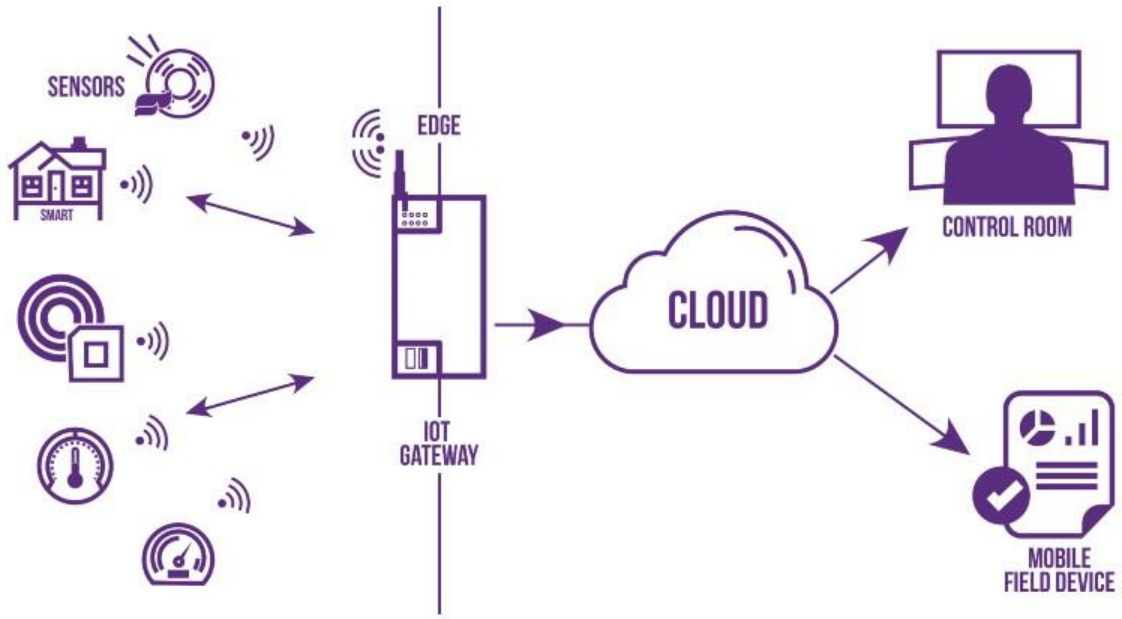


Figure 2: showing how the thing work in reality by flow chart diagram

OUTCOME

Research Paper

We will be publishing the research paper on the topic **"Home Automation using IoT and Cloud"** with some new features and enhancement.

The research paper will contain all the development phases and in detail study about the technology used.

It will also contain the algorithm used and about the future scope of the project

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