

Home Automation with Node MCU & Firebase using Internet of Thing (IoT)

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Abstract—The Internet of Things is made up of objects with unique identities that are linked to one another online. The idea is to simply connect and keep an eye on numerous sensors and equipment via the Internet, which is widely used in this new era. This paper primarily explains the general overview and knowledge of IOT-based sensing systems and monitoring systems, which leverage databases and software to construct smart, automated household appliances. board, and an Android OS smartphone is used to remotely control the internet. This system's core part and brain, the Node MCU, can serve as an interface between a wide range of hardware parts and the real-time database. The system provides many cutting-edge switching features that turn on and off lights, fans, and other connected household equipment. It is widely used for switching lights, fan on/off by sensing and analyzing data. The cloud-based system is another notification element of this system architecture. The main feature of this system is that it can also be controlled from remote areas which can prove to contribute towards energy saving.

Index Terms— Node MCU, Flutter, Sensors, Voice Control ,Firebase.

I. INTRODUCTION

In IOT(Internet of Things), devices communicate with each other . IoT devices can share contents based on function control in a predefined manner. This project focuses on the use of cloud to operate the home appliances over the internet from even remote areas.



Fig. 1 Illustration of IoT

This article explains how the home appliances can be controlled in a secure way even from remote areas. A single device can be linked to several devices.

Wireless fidelity technology is used to connect the network. The frequency range that has been formally agreed upon [3] is 2.4GHZ. The node MCU used in this system must be connected to this WiFi to which the other appliances are connected. The above Fig.1 represents the flowchart of the system. This project consists of a flutter app which is platform independent and allows the user to change the states introduced in a real time database provided by firebase. A connection is established between the Node MCU and Firebase Database where the changes made in the Database are reflected.

II. RELATED WORK

Emerging technologies in the present and future are playing a significant role in automating human existence. In our fast-paced society, people are enamored with the internet and automated technology, and they are mostly reliant on them. As a result, automated houses or smart homes have become a buzzword, and their adoption is fast expanding. Smart homes should have secure connection as well as communication with physical devices over the internet. We learned a lot from excellent study on papers on Smart Home Automation and various designs used in leisure. Some of the existing designs that were utilized are detailed here. Kumar Mandala implemented home automation in two methods in his work, employing Bluetooth and Ethernet. Arduino is used here to programme and control numerous gadgets. Bluetooth is a short-range communication technology. As a result, with smart home automations that use Bluetooth, one can only activate the gadgets from home within a distance of 10-20m. This constraint has been solved in the forthcoming Ethernet-based architecture. This study just described how to operate various electrical gadgets in the home using mobile applications and did not contain any security aspects.

III. PROPOSED SYSTEM

As the cost of items in our daily lives rises owing to technological advancements, a little notion known as the smart home project is launched to minimize costs and inconvenience while also providing energy-saving solutions. A smart house is capable of controlling the home even when the owner is not present [6]. The IoT system may be constructed by combining an MCU with additional components such as a DC motor, L293D, USB cables, and software such as Firebase, which are used to operate various household appliances namely as fans, lights, and lamps. It provides status updates on the mobile app [7]. Data is uploaded to the cloud via Firebase, where it may be stored and accessed as required. The suggested system and its operation may be explained in detail in Fig.2.

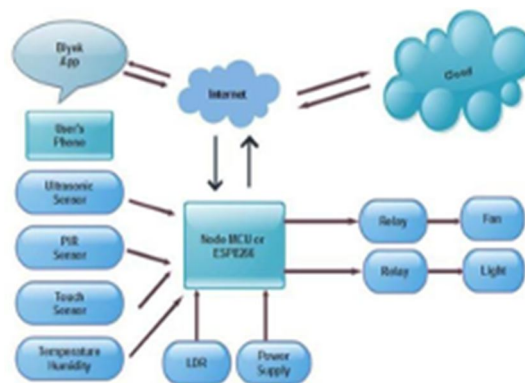


Fig. 2 Schematic of Home automation using node MCU

Various components like DC motor, L293D, etc. are connected to Node MCU microcontroller, these components help in acquiring data from surroundings, which include the state of appliances and send this collected data from microcontroller to the database. Users can access as well as update this data anytime, from anywhere using Android app developed using Flutter which uses Dart Programming language. Using this application the states of appliances in the database can be updated. The Microcontroller (Node MCU) fetches the data from the database and reflects the updated state on the Arduino program. This program then executes or operates the various appliances based on the updated conditions in the database. The state of the appliances can be updated using buttons or the voice control commands through the application.

IV. IMPLEMENTATION SETUP

Components Required Hardware Requirements:-

- 1) NODE MCU ESP8266
- 2) DC Motor
- 3) L293D
- 4) Male to female jumper wire
- 5) Connecting Wires
- 6) Breadboard
- 7) LED
- 8) Fan
- 9) Mobile phone
- 10) Power Supply Software requirements:
- 11) Android Flutter App

A. NODE MCU ESP8266

Node MCU The ESP8266 is an open source Internet of Things (IoT) platform that comprises both software and hardware (WHAT IS A NODEMCU?). The application is powered by Espressif's ESP8266 Wi-Fi SoC, which is a System-on-Chip. The ESP-12 module contains the hardware. The ESP8266 is a System-on-Chip (SoC) that combines a 32-bit CPU, an antenna, switches, filters, a power amplifier, power management modules, and standard digital peripheral interfaces in a small and simple package [8]. The ESP8266 is a low-cost microprocessor that works with a Tensilica Xtensa LX106 core and is used in a variety of IoT applications. This microcontroller is connected to the WiFi continuously which helps in fetching the states of the appliances from the database. Different appliances are connected to this controller.

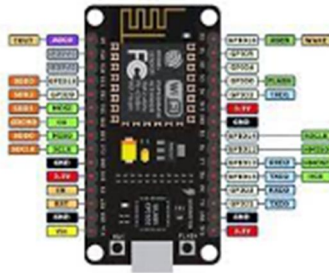


Fig.3 ESP8266 Module

B. DC Motor

The DC motor is a sort of electrical equipment that transforms electrical energy into mechanical energy. DC motors use direct current to convert electrical power into mechanical rotation. It is a type of rotary electric motor that transforms direct current (DC) electrical energy into mechanical energy. The most prevalent forms are based on magnetic field forces. We have used a DC motor to create a prototype of the rotating fan. The motor was controlled using a L293D Motor Driver to which when a high input is given the motor rotates at a certain default speed in a particular direction. The direction of rotation can be reversed by inverting the high voltage inputs and low voltage inputs.

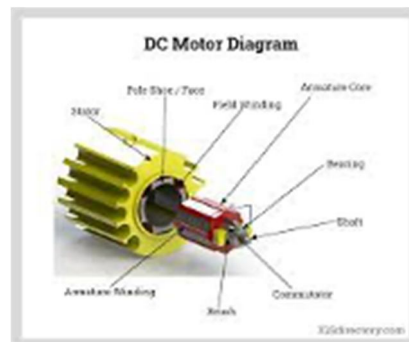


Fig.4 DC Motor

C. L293D

L293D is a standard motor driver or motor driver IC that allows a DC motor to be driven in either direction. L293D is a 16-pin integrated circuit that can operate two DC motors in any direction at the same time. It means that a single L293D IC may operate two DC motors. The L293D can also power tiny and silent large motors. It is based on the H-bridge idea. The H-bridge circuit enables voltage to flow in either direction. Because voltage must change direction in order to rotate the motor in either a clockwise or anticlockwise direction, H-bridge ICs are perfect for controlling a DC motor. Fig 5 shows L293D motor driver. We have used a L293D motor driver to control a DC motor to which we have attached a fan. This can be used to prototype the switching on/off states of a fan.



Fig .5 – L293D Motor Driver

D. Breadboard

For building a prototype and to mount our components at one place for connection purposes and creating a proper circuit, we have used a breadboard. Many electrical components in electronic circuits can be coupled by placing their leads or terminals into the holes and then connecting them with wires as needed. The breadboard contains metal strips below it that link the holes on the top of the board.



Fig. 6- Breadboard

E. LED

The light-emitting diode (LED) is a common standard light source in electrical electronics. It can be used in various applications such as in mobile phone or large advertising billboards. They are mostly used in devices that include works related to time and displaying various types of data. Aviation, illumination, fairy lights, car headlights, marketing, general lighting, traffic lights, camera flashes, lit wallpaper, horticulture grow lights, and medical supplies are just a few of the uses for LEDs.



Fig .7- LEDs

F. Android Flutter App

We can design our own application through a development platform which is provided by the Android Flutter Application. This application is connected to the Firebase Server using which we can establish a connection for transmission and reception between the microcontroller and the user which is shown in Fig.11. This Android Flutter Application can be developed by the user. The user must sign into this application to access the states of all the home appliances and switch ON/OFF their respective states through this app.

This Android Flutter App is in charge of generating an interface for user interaction by giving a dashboard from which the user may operate. This app is connected to hardware, and connection between them is facilitated via the Firebase server. These hardware components can communicate with the server with the help of commands defined in Firebase libraries.



Fig. 8 Representation of project using Android Mobile App

G. Firebase

Google Firebase is an application development software provided by Google that enables developers to develop iOS, Android & web apps. Firebase offers capabilities for measuring statistics, reporting and troubleshooting app problems, and generating marketing and product experiments.

By giving safe access to the database directly from client-side code, Firebase Real-time database enables you to develop complex, collaborative apps. Data is saved locally, and real-time events continue to fire even when the user is offline, providing the finest responsive experience ever.



Fig. 9– Firebase

V. RESULTS AND DISCUSSIONS

The main objective of developing the Home Automation system was to operate the home appliances from remote locations using a secure smartphone application which was developed using dart language and flutter IDE, which also allows cross platform usage. A fine working flutter application was successfully developed which was not only limited to control the appliances using buttons but also allowed the user to control the same by taking voice commands as the input. All the members in that family can share this Android flutter App so that, when one person from the family switches a device either fan or light or any other appliance. From this project we can confidently say that we can make a home automation system with readily and cheaply available components and can be used to operate multiple appliances such as lamps, televisions, and also the whole house lightning system. It is evident that we can make this easily as the components required are so small that they can be packed into a container. The Home Automation framework is utilized to be something which is extremely important & useful in this emerging digital world. In any case, as innovation progresses so rapidly, the normal people have prepared access to calculations that can do some really astonishing things. By interconnecting user's gadgets with user's Internet, user's WIFI, or other advanced gadgets, the user's home turns out to be progressively effective at warming, cooling, lighting, and, well, running.

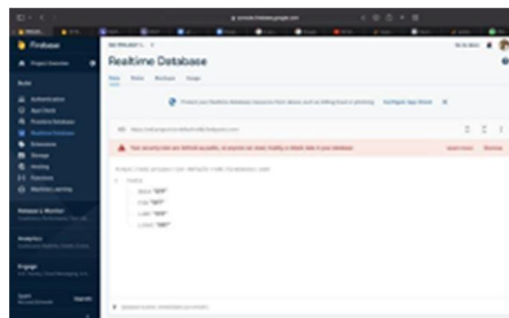


Fig .10– Real-time Database created by Google firebase

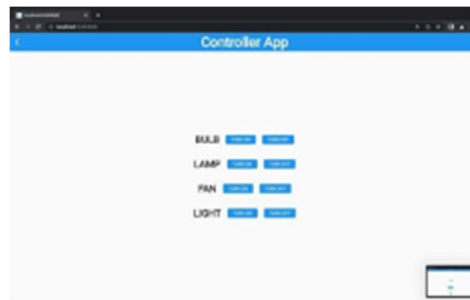


Fig. 11 – On/Off Buttons in Android Flutter App for turning on/off lamp, fan, light

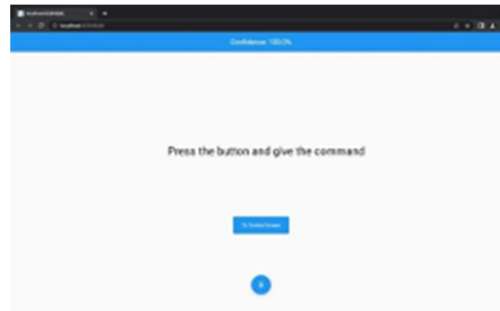


Fig. 12– Button for Voice Command for turning Home appliance on/off

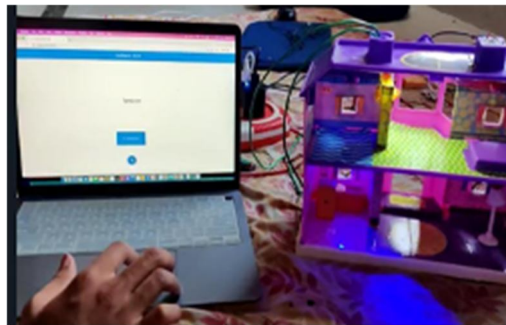


Fig .13 – Smart Home Automation Setup with Overall Functioning

VI. CONCLUSION

With the help of IOT technology, we get to know or have basic idea on how we can control home appliances. As long as the user is connected to internet, this prototype of ours will help the user to control his home appliances irrespective of his location . The GUI System which we have created allows the user to easily control the appliances using a smartphone which is connected to internet ,so as any change occurs,the user will be notified immediately and he/she can control the appliances using the provided GUI interface.The microcontroller which we have used is Node MCU which acts like an interface between the components and the user. This Node MCU is connected to several appliances like light,fan,lamps,etc. To establish an application layer for connection between the user who is remotely located ,we have used a micro web server. This system communication between the user and the appliances was possible through internet. Notifications are delivered to users via the Android flutter app, which is installed on their smartphone. Users may operate remotely or automate household appliances by utilising components such as NodeMCU, DC Motor, L293D, Firebase, and so on. All these components together help in building a remotely controllable smart home automation system through which we can switch the lights , fan ON/OFF.

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