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Smart home controller using internet of things

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***Abstract*---**This project revolves around creating a home controller system prototype for controlling home appliances. The central device is the micro controller, in which node mcu is used to connect the internet and receives the command from the user through a mobile application. Firebase is used as a server which cause interaction between the user and the micro-controller. Users and devices are stored in the database server. Mobile applications are used for controlling the IOT devices which are connected to the controller. This project presents the work of the mobile application as a user interface that provides convenience for the user(s) to be able to control the home appliance for remotely by the graphical user interface. The graphical user interface is developed by MIT App Inventor. Using this project, ordinary people can develop the IOT system for their home by extending the basic communication equipment they have with the effective cost of implementation.

***Keywords*---**smart home controller, internet, database server.

Introduction

IoT devices are hardware which are available to control online, such as sensors, actuators, gadgets, appliances, or machines, that are programmed for certain applications and these can transmit data over the internet or other networks.

They can be embedded into other mobile devices, industrial equipment, environmental sensors, medical devices, and more to make them smart. There are several top devices in the market. Smart phones, refrigerators, smart watches, smart fire alarms, smart door locks, smart bicycles, medical sensors, fitness trackers, smart security system, etc., are few examples of IoT products. IOT systems depend on the collection of data. The collected data is then used for monitoring and to control devices via the internet with the help of mobile application. This is called smart home powered by IoT. In this project we aim to create a smart home system that helps to monitor and control home from anywhere and anytime through our mobile phones. Sensors such as temperature and humidity sensors, water level sensors are used in the project for checking the air conditions and other lot of monitoring purposes which can be monitor using our mobile phones. With the data that is provided, user can easily monitor their house condition and electrical appliances from anywhere with just a smartphone. this project is to assist people to control their home electrical devices and in getting Live Data (Temperature, Humidity, Soil Moisture, Soil Temperature) for environmental monitoring for gardening and also to check any gas leakages. This smart home system using IoT is controlled by NodeMCU and consists of a relay switch (digital switch) and sensors. When the smart home system starts, it checks the soil moisture status, temperature, humidity, electrical device status, and rain detection. It then sends this data to the firebase cloud for live monitoring.

Related Works

Home Automation using IOT [2018]. This project presents a step-by-step procedure of a home automation system using IOT. In this project they have used mobile application as a user interface, an online server to store user information, cloud service to interact with the server and a database to store user details, Wi-Fi router to provide 24/7 internet connection for the IOT device. This project focus on home automation using both smart phone as well as the computer. The IOT devices are controlled and monitored by the mobile application and computer for the electronic device used in various types of buildings. The devices connected to the cloud server are controlled by a single admin which acts as an admin user. This model extends with the admin user can access and control all the IOT devices connected to each user but a single user can control only their own IOT device in which the user itself is connected. This project focus on controlling various electrical and electronic appliances using control systems remotely.

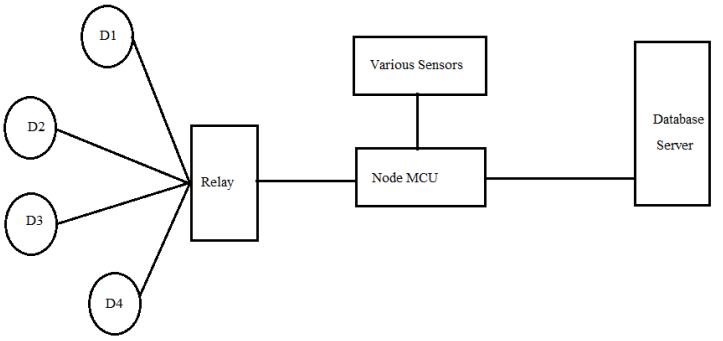
This method of controlling such applications is referred as IOT which has become an integral part of everyday life of a human being. The working model designed in this project has its focal point on home automation providing about 100% efficiency. This model has its roots on an IOT platform that allows devices to work along with the IOT platform. This project uses the IOT technology platform to create a network between the main server with the other electrical and electronic appliances thus making a smart home network. Implementation of Cost-Effective Smart Home Controller with Android Application using Node MCU and Internet of Things [2018] This project is also similar to the above projects but they have introduced a new way for storing data from the IOT device. They have used node mcu as a micro-controller, relay switch as a digital switch and a server. Here, the server is used built as a home server. This will provide privacy for the customers

that they can maintain their own data. The main drawback or disadvantage is that people must have proper knowledge on maintaining server at home.

The user can control their devices using the Android Application with the help of their Smart Phone. Client server architecture is used for server and Internet of Things (IOT) for communication. Arduino microcontroller (Node MCU) acts as a micro-controller at the user end and is connected to the internet by 24/7 through Wi-Fi module. In this system, every device is connected to the internet through the IOT and controlling is done through the Android mobile application. The API (Application Programming Interface) connects the server and mobile application and allows it to interact and exchange data between the server and the mobile application. Using this method, controlling home appliances using Internet of things is discussed in this project. This project presents a cost effective with secure prototype of Smart Home Controller using internet of things which can control the home appliances through the android mobile application. As an extension in this project, the web server can be replaced by dedicated local server. This project has tried to implement the fast-building IOT whose applications can further be explored in building smart home controllers.

System Architecture and Design

The communication between the mobile application and IOT device is served via the database server. We have user firebase as a database server for this project. The micro controller unit which is the node mcu is connected to the internet by 24/7. Node mcu esp8266 has an inbuild Wi-Fi module. With this we can able to made the node mcu online. The server interacts with the mobile applications with the set of API requests.



Block Diagram

Working

- Step 1: Connect the node mcu with the internet.
- Step 2: Open Mobile Application and login in to your account.
- Step 3: You can connect up to 4 devices. So, you can see 4 buttons to ON/OFF the device.

- Step 4: Turn ON/OFF the devices using the button in which the electrical devices are digitally turned ON and OFF by the relay switch.

Modules

Node MCU

We have used node mcu ESP 8266 as a micro controller unit. The node mcu is a CPU like functioning devices which can be functioned according to the coding given to it. This contains an inbuilt Wi-Fi module which can easily makes this device online. The primary function of this module is to control the electrical and electronic devices and to send and receive the data provided by the sensors to the web server.

Relay Switch

we have to control electrical devices. For this we need to use digital switch. This can be achieved by using relay modules. The relay module is a digital switch which is operated by the commands sent by the micro controller unit.

Temperature and Humidity Sensor

Here we aiming to viewing graphical data of the Temperature and Humidity over a certain time period with the help of Temperature and Humidity sensor and getting its data from Arduino Serial Monitor. As we know that DHT22 Temperature and Humidity Sensor has four pins, pin number1 is the Vdd power supply and can be connected with 5v. pin number2 is the data pin, pin number4 is connected with the ground connection. This is the basic connection of the DHT22 temperature and humidity sensor, so as you know that the DHT22 sensor has 4 pins, and out of 4 pins only the 3 pins are used. The pin number 3 is not connected. Pin number1 is connected with node mcu.

Ultra Sonic Sensor

We have used ultra-sonic sensor to monitor the height of the water level. Ultra-sonic sensor is used to measure the distance of the targeted object by emitting or producing ultra-sonic waves and these waves get reflected by the targeted object which is converted into electrical signal. Using this, we are going to place this sensor under the top of the tank, which can monitor the water level of the tank.

Soil Moisture Sensor

We have used soil moisture sensor for monitoring and maintaining gardens in home. Using this sensor, we can able to monitor the moisture level of the garden so that we can able to pour water to the plants. It is worked by placing the sensing probe in the garden. When there is more water level in the soil conductivity between the probes increases as well as if the moisture level is low the conductivity decreases. Using this sensing technique, we can able to monitor the gardens through our smart phones.

Gas Sensor

A gas sensor is a device that senses the atmosphere's presence or concentration of gases. The sensor calculates potential difference depending on the concentration of the gas by adjusting the resistance in the sensor, which can be determined as the output voltage. The concentration of the gas is calculated based on this voltage value. The automated pin goes up when the concentration reaches threshold.

Result and Discussion

The hardware demonstrates the smart home controller through android application using IOT. This is an economic, robust and secure method of controlling the devices remotely. IOT providing the necessary communication infrastructure promising the implementation of this controller in large scale. The challenge that we faced is in terms of the speed of controlling. The proposed system allows the user to monitor the electrical devices. The proposed system uses the mobile application for remote monitoring which is very easy to use and adapt. In addition, this method advocates for the use of the Internet of Things. Internet of Things has enabled the home monitoring easy and efficient and lesser cost of establishment. Sensors of different types are used to collect the information of air conditions, soil conditions for gardening, temperature conditions and water level monitoring and this information is transmitted through network to the customer's smart phone.

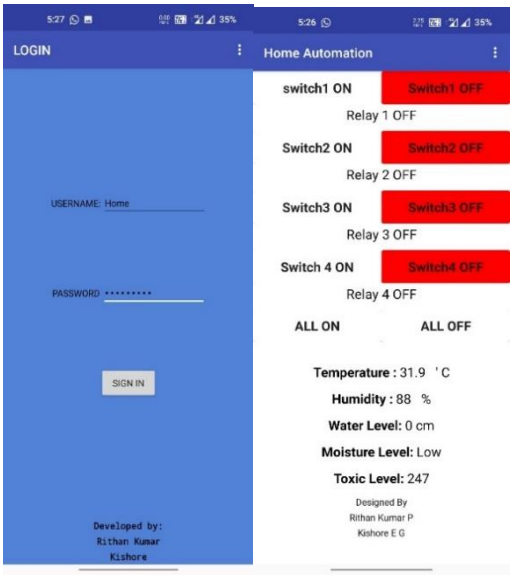


Image of Mobile Application (Login Page) and (Controlling and Monitoring Page)

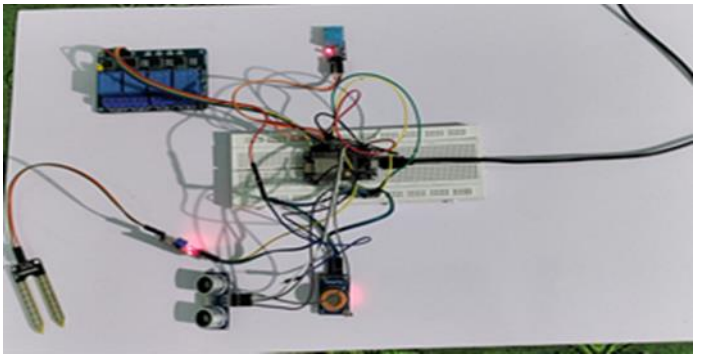


Image of Hardware Connection (Node MCU, Relay Switch, Various Sensors)

Conclusion

There are different modules for monitoring the temperature, humidity, and other data collected by various modules this provides the user with various data inside one database server which reduces user stress and provides with various options. The communication between different nodes is controlled by a gateway (Node MCU) which reduces the components and the energy that needs to drive them. The proposed system allows the user to monitor the electrical devices. We have used the mobile application for remote monitoring which is very easy to use and adapt. In addition, this method advocates for the use of the Internet of Things. Internet of Things has enabled the home monitoring easy and efficient and lesser cost of establishment. We have used different types of sensors to collect the information of air conditions for home monitoring, soil conditions for garden monitoring, temperature conditions and water level monitoring and this information is transmitted through network to the customer's smart phone.

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