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IOT ENABLED SMART HOME SYSTEM USING OWN PRIVATE SERVER

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Abstract - *Over the last few years, life of an individual has become simpler, easier and smarter due to Internet of Things (IoT). IoT aims the idea of remotely connecting and monitoring real world objects(things) through the Internet. When it comes to our house, this concept can be appropriate to make it smarter, safer and automated. This IoT project mainly aims on building a basic wireless smart home which can send alert to the owner by using internet by sensing the outside humidity, temperature and also pressure. Then the owner can also control the lights and the fans accordingly. Smart home using IoT is a system that uses computers or smart phones to handle and control basic home functions and other features automatically through the internet.*

In this paper we have our own server that employs the integration of cloud networking, wireless communication, to provide the user with remote control of various lights, fans, other appliances within their home environment and storing the data in the cloud. The system will change on the basis of sensor data which are of low cost and easily available. It is designed to be expandable allowing a variety of devices to be controlled.

Key Words: **IoT, Smart Home, Cloud, Server, Senor, Wireless Communication.**

1. INTRODUCTION

To simplify the Internet of Things it is "A network of Internet connected objects able to collect and exchange data." It is generally abbreviated as IoT. This type of data can be accessible by other "things" too. A “thing”,in the internet of things can be a person with a heart monitor implant,Siri and Alexa as voice assistants, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low or any other natural or manmade object that can be assigned an Internet Protocol (IP) address and is able to transfer data over a network.

Increasingly, organizations in a variety of industries are using IoT to operate more efficiently and more flexibly, better understand customers to deliver enhanced customer service, improve decision-making and increase the value of the business.

An IoT ecosystem consists of a web-enabled smart devices that use embedded systems, such as processors, sensors and communication hardware, to collect, send and act on data they acquire from their environments. Basically IoT devices share the sensor data they collect, this is done by connecting to an IoT gateway or other edge device where data is either sent to the cloud to be analysed or analysed locally.

2. OVERVIEW

Most homes of these century are more and more self controlled and automated due to the comfort it provides, especially when employed in a private home. A Smart home system is a means that allow owners to control electric appliances of varying kind. Most of the existing, rich built homes are based on wired communication, they are all interconnected physically. This is not an issue until the system is planned well in advance and installed during the physical construction of the building. But for already existing buildings the implementation and installation cost goes very high.

In such cases wireless can be a good solution.With the advancement and evolution of wireless technologies such as Wi-Fi, Bluetooth, zigbee, cloud networks in the recent past, wireless system are

used every day and everywhere.

3. PROBLEM STATEMENT

Automated systems which are currently available now have a lot of constraints that limit or restrict the use of it diversely. Some of them may include the high cost, singleton control and lesser range of connectivity and network.

4. EXISTING SYSTEM

The Existing scenario in the normal houses are Security worries where there are chances of our data getting leaked and hacked from the hacker .Lack of control where there will be no control over the networks and the third party owner handles everything. Connectivity issues due to duplicity problem more bandwidth is consumed which results in connectivity problem. Less Accuracy which takes a lot of time consuming process where lot of time gets wasted which results in dissatisfying the users. These days most of the enterprises have multiple constituency of application, infrastructure, suppliers, customers, process, Policies and many more constraints to run a business So they are not under one but instead a huge server or a domain that is controlling them which works in distributed environment. Basically Existing System means that describes something that exists now especially when it might be changed or replaced.

5. PROPOSED SYSTEM

The proposed system tells how different our project is from the others and it is important to know how differently our project works.Here in our project we create a private server with an IoT application which will control or manage the IoT device activities locally. So by building our own cloud we can control things and there is no need to worry about privacy and security threats. The main benifits of building a own cloud are strong security ,more flexibility, cost savings and resource utilization can be improved. We push the data and get relevant output data and there will be no limitations for creation of objects which provides smooth and flexible running .There is no fear of 3rd party or of the data leakage as it

is secured. As technology is moving faster day by day Smart home is the latest trend where appliances of the home can be controlled by a person on a mobile phone or a PC.A Smart home is a home where the technology enables communication between the smart devices and control of the house. Some of the advantages of smart home are they are energy efficient, security is enhanced and customization can be done according to the user requirement. There is a Central Private Server to which other devices will be connected thus reduces the duplicity and thus reduces network bandwidth.

6. LITERATURE SURVEY

The concept of smart home automation system plays a major role in busy families and individuals. In the last few years smart home automation has played a vital role with the development of several middleware platforms. A home automation system based on Bluetooth was developed. Bluetooth technology that has emerged in late 1990s, is a perfect solution for this purpose. This paper describes about Bluetooth technology application in home automation and networking environment which contains a mobile host controller and other client modules. The client modules communicate with the host controller via Bluetooth devices. Appliances such as mobile phones, home security devices, air-conditioners, etc. are made to know how smart home completely works. Personal Area Network is choosen in home environment, where the home appliances can be monitored and interconnected using a controller. There is an attractive market for home automation system based on Bluetooth for busy families and individuals with limitation. A smart wireless home network that does not have additional costs of wiring would be advantageous at the same time.[1]

Smart City is one of the most trending applications of Internet of Things. In the last few years smart city has been playing a vital role in academic and industry fields, with the development of several middleware platforms. There are distinct approaches that creates a snippet scenario, in which other IoT ecosystems are incapable to communicate between themselves. This paper gives the semantic definition of the sensors which are present in the cloud and new services can be implemented by connecting Clouds and IoT. Things-like semantic will be considered to perform the assembly of heterogeneous resources which gives the definition of Clouds of Things (CoT) model. The survey for smart city was conducted by providing information on the main requirements and highlights which benefits the combining of different IoT ecosystems within the cloud under new CoT vision.The most dangerous events which involves many people in large buildings, protect workers need to intercede in timely and targeted manner in order to help most number of people and secure environment without

wasting resources. This work presents framework of Internet of Things which aims at monitoring environmental parameters in order to give alert notification to the rescuers when the alarm thresholds are exceeded. A software layer is added to the hardware infrastructure which gives adaptability and flexibility to the Complex Event Processing engine and rule engine-based reflective middleware where raw data is managed and analyzed in co excistence with knowledge based modelling application domain.[2]

The IoT enabled Smart Switch tells about how analog switches are mounted on the walls and to operate these switches user needs to turn ON or OFF switch. This helps in manually operating a switch that will be replaced by a smart technique which involves operating of the switches using the web browser present in laptops, mobile phones or other electronic gadgets. Smart switches in the market today are very expensive which requires additional devices like hubs for working. To control the operation of the switches the work makes use of web App and also cloud. A cloud server is created where the switches are mounted on the environment. The switches are interfaces with a electronic components such as a 555 timer, flip-flops, logic gates and processor. The user communicates with the processor through Web App.

The processor then controls the switches based on commands received from the user and also modernize users about the status of the switches after the control operation is performed to the cloud The smart house is a important point in the orange technology. The paper, gives a description of a proposed work applied to the Internet of things and sensing motion on smart house, given by Smart House Monitor & amp Manager (SHMM). This improves the safety which as special feature of power-saving for the house. Orange Technology is based on the Zigbee sensor that is connected to all sensors and actuators. SHMM is implemented with a smart house to display the availability of the power. [3].

7. COMPONENTS

A)Node MCU

ESP 32 is a successor to the ESP8266 microcontroller. It is a low cost, low power system on a chip microcontroller with integrated or built in Wi-Fi, dual mode Bluetooth capabilities and power saving features which made it more versatile. ESP32 is compatible with mobile devices and IoT applications.

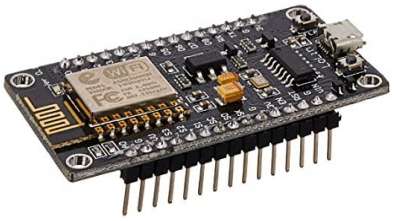


Fig.1. Node MCU

B)DHT 11Sensor

Temperature Monitoring is done by using DHT11sensor which uses a basic, ultralow-cost digital temperature and humidity sensor. It has a capacitive humidity sensor and a thermistor both to measure the surrounding air, and gives out a digital signal to the data pin.This sensor is used for various applications such as for measuring humidity and temperature valuesThe temperature range of DHT11 sensor is from 0 to 50 degree Celsius having 2-degree accuracy. The Humidity range of DHT11 sensor is from 20 to 80% having a5% accuracy.

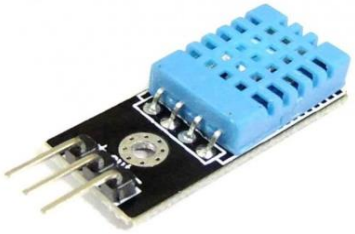


Fig.2. DHT 11Sensor

C)12V DC Fan

DC Fans are abbreviated as the Direct Current fansThe DC fans are powered with fixed value such as the voltage of a battery. such as 5V, 12V, 24V and 48V.

They consume very less power and easily configurable and can be easily handeled.

Fig.3. DC Fan

D)12V LED Light strip

LED strip light is also called as LED tape or as a ribbon light. It is a circuit board which is very flexible, populated by surface mounted light-emitting diodes It is easily plug and play and can be used anywhere.

Fig.4.LED Light Strip

E)2Channel Relay

2-Channel Relay Module is a relay interface board of 5V, it can be controlled directly and easily by a wide range of microcontrollers such as Arduino, AVR, PIC, ARM, etc. It uses a very low level triggered control signal (3.3-5VDC) to control the relay.a relay channel is a mode of the communication between a sender and a receiver aided by one/more relay nodes.

Fig.5. 2Channel Relay

8.SYSTEM DESIGN

A. HARDWARE IMPLEMENTATION:

The goal of this project is to have your domain name and hosting account that allows you to control your ESP32 or ESP8266 GPIOs from anywhere in the world.

1)We have a PHP script that contains a web page running with some toggle buttons in it, so this will allow the user in controlling the output buttons for ON and OFF.
2)When the button is pressed, it is going to update the state of the button and that will be saved in the database.
3)We also have a choice to add or delete any number of buttons from our dashboard.
4)We will be using ESP32 and ESP8266 or even many boards, to create an HTTP Get request for each X number of seconds on your server.
5)Finally, after all the HTTP GET request will give the result accordingly, and also the ESP will be updating the GPIO values also.

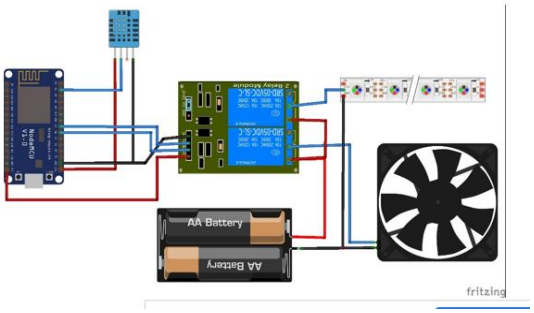


Fig.6. Final Hardware Setup

B.SOFTWARE IMPLEMENTATION:

REGISTER PAGE

- The register page is used to register an account for the users by providing their details
  First name
  Last name
  Email Address
  Phone number
  Password
- By doing this an account is registered
- The user has to provide valid first and last name so that he can login successfully.
- Then the user has to provide valid email address so that it can be used for the user's password recovery.
- A unique password should be created so that user can complete the registration process.

FORGOT PASSWORD

- The forgot password can be used when the user forgets his/her current password and the password can be recovered.
- By entering the valid email which was given at the time of creating an account is used for recovering the password of the user.

LOGIN PAGE

- The user can login to account after the registration process is successful.
- The user can login by providing the login credentials such as email and password and when this is submitted this page directs the user to the input board.
- The user can now ON/OFF according to the user's requirement.

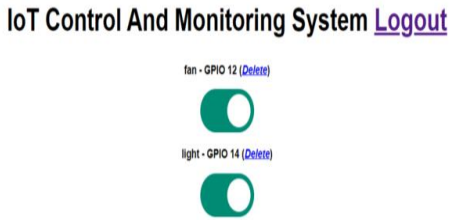
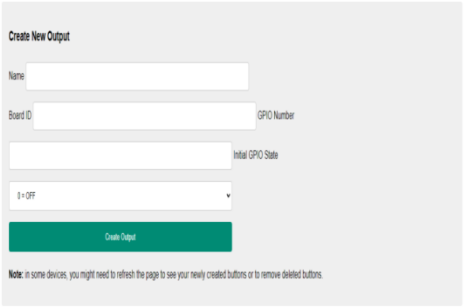


Fig.7. Input Window

- These are the General Purpose Input Output buttons where the user can control according to their requirements.
- The user can get any number of buttons as per the availability of the hardware components.

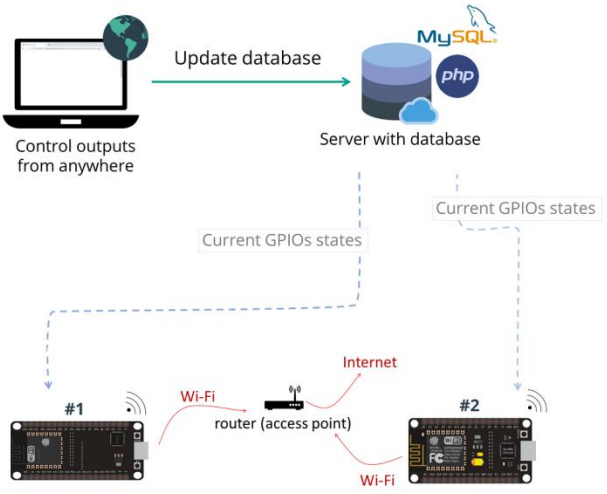


- To create a new GPIO button the user should enter the name of the button, board id and Initial GPIO state.
- Now a button will be created by providing the values.
- The output is shown in the form of graph which gives the temperature and the humidity of the surrounding and also the time is recorded and gives last forty values which was recorded.

C. METHODOLGY

- Tools used are:
  • System minimum I3 processor 4bg ram and 80gb hard disk
  •Xampp
  •HTML,CSS,PHP,mySQL
  •C++
  •ArduinoIDE
  •Nodemcu
  •Dht11sensor
  • Relay
- As it is shown in the diagram computer controls the output from anywhere and update that data to the database on my SQL here My SQL is a server with a database. The current GPIO's states pass the data to the controllers and that simulates the output that is sent to the server the output is displayed on the screen in the form of graphs.
- **Stage1** of an IoT architecture consists of your networked things, which are wireless sensors and actuators.
- **Stage2** has sensor data aggregation systems and analog-to-digital data conversion.
- **Stage3** edge IT systems perform pre processing of the data before it moves on to the data centre or cloud and in our architecture we will be using one common internet network(wifi) for all the devices. So that the data remains secure.
- So here in architecture data is pushed and retrieved, the sensing layer has microcontrollers and sensors. BME280 sensor is used as it will take the values of surrounding temp, humidity, and pressure and ESP32 or ESP8266 is used as controller's which has built-in WiFi.
- Four layers are used here i.e., base layer as sensing layer, cloud layer, and application layer. The devices in base layer will be connected to the WiFi or hotspot for internet connection. HTML, CSS for the front end, and for backend support my SQL is used, and few scripting files are also included and the data is pushed into the sensing part will be based on some time intervals like if the user has chosen the time as 30 sec the for every 30 sec the values are pushed that is temp, pressure, and humidity.

D. SYSTEM ARCHITECTURE



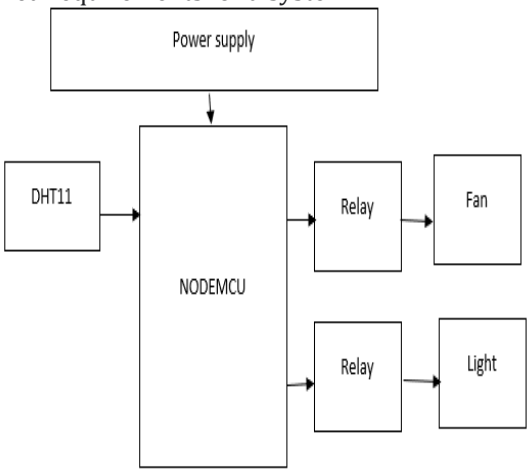
System architecture is the conceptual model which defines the structure, behaviorand views of a system. An architecture is a description and representation

of a system, organized in a way that supports reasoning about the structures and behaviour of the system. The overview of the system architecture is that the internet of things moved beyond the trends and became an autonomous technical and social relevance. As per the Gartner Research, the number of connected things will have reach 26.66 billion by 2019, and by 2025 this number will have increased up to 75 billion. IoT is one of the new technologies that will have the biggest influence on our global and urban design. Large part of home/Apartment automation systems includes lighting, temperature control, power management, security management can be controlled using a secure Local IOT server which provides scalability, Low-cost maintenance, and less downtime.

The private IOT server can be deployed on Raspberry Pie or on a laptop which acts as a local cloud for all control/monitoring of the devices. All these controls using the Local server without using the Internet. The control speed is very fast as everything is happening locally.

E. BLOCK DIAGRAM

The process which defines the components, modules, interfaces, and data to satisfy specified requirements for a system.

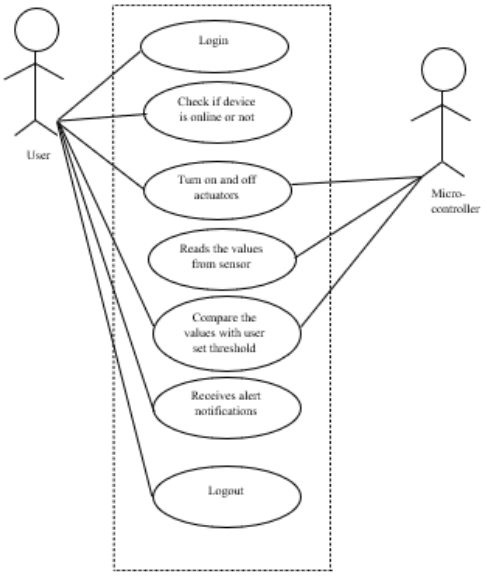


The system design consists of Power supply, DHT11, Node MCU, Relay, Fans and light

- Power supply is an electrical device that supplies electric power to an electrical load which convert the **power** from the source into the correct format and voltage So the fan and Light are connected here.
- DHT 11 it is commonly used temperature and humidity sensor that contains a calibrated digital signal output of temperature and humidity to which controllers are connected which is in turn connected to actuators.
- NodeMCU is the combination of the node and the microcontroller and a open source IoT platform is a self contained WiFi networking solution offering as a bridge from existing microcontroller to WiFi and is also capable of running self contained application.
- A local server is being used were all the appliances are connected to the same internet connection (WiFi)
- Relay is an electrically operated switch which consists of input terminal for single or a multiple control signals, these are trigger devices that will activate appliances to which all the output devices that is fans and light are connected.

F. USE CASE DIAGRAM

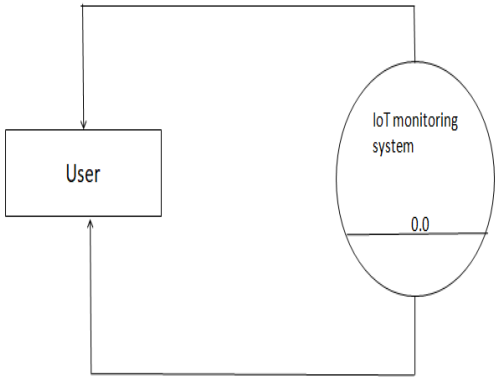
A simplest representation of user interaction where the system shows relationship between the user and different use cases where the user is involved.



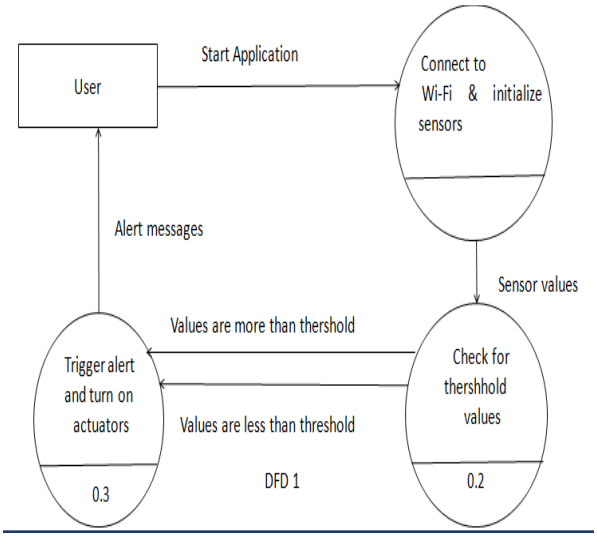
- The user should login first using the login credentials to start the system and check whether the device is online or not and then the controller will turn on/ off the actuators according to the requirement.
- The values are read from the sensors and compares the values with user set of threshold frequency.
- The user will receive the alert notifications and the output will be displayed after all the process the user will logout.

G. DATA FLOW DIAGRAM

It is also known as DFD that is used to represent the flow of data in a business information system.



DFD 0



- Data flow diagram tells about the process that are involved in a system to transfer data and how the data flows from one system to other.
- Initially the user log's in then if the credentials are successful then it checks authentication in database.
- If the credentials is unsuccessful then login fails and comes back to again login page.
- Then it connects to the wi-fi and initialize the sensor and then sensor reads the values.
- It then checks the threshold value if the value is more than threshold then trigger alerts and turn on actuator.

H. METHODOLGY

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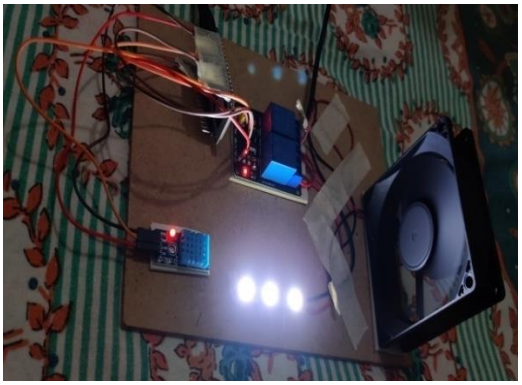
9. RESULTS



- All the output devices will be connected to the Relay.
- So the Fan and Light are connected here.
- Sensors are connected to controllers. Controllers are in turn connected to actuators.
- DHT11 is the sensor used to check humidity and temperature of the surrounding.
- NODEMCU is the combination of the node and the microcontroller.
- As we are using local server we have to connect all the appliances to the same internet connection (WiFi).
- The control speed is very fast as everything is happening locally.
- The output is displayed on the screen in the form of graphs.
- We can also change the type of graph based on user requirements.

10. CONCLUSIONS

In this project, we have included the studies and reviews of the presently available home automation systems. Many systems like these will include additional devices which are connected to the network like hubs which are

useful for their working, and in turn, it will increase the cost of it. When we are going to use NodeMCU with the IoT platform, that time these devices can be made cost-effective.

One more benefit is that this application is going to give a great user convenience because of this it will be helpful for us to control the surrounding devices from the remote location. When we are going to use a web page or a web application that time the system will be made platform-independent. By using IoT, home automation is proven to be worked with simple appliances when connected experimentally. When these appliances are grouped they can remotely be controlled across the internet. We can take up an example like switching on a fan when it gets hot, so this will be investigated by the designed system according to the process which is carried out by the users. We can use sensors to implement and store the data so that we can use this data in the future to analyze the system.

11. FUTURE WORKS

This application can be enhanced in many different ways like attaching few smoke sensors we can detect the gas leakage in the buildings and offices and also we can detect the motion sensors to detect the intruders at the time when the user is not in the surrounding.

In case of security purposes we can place a CCTV or an IP camera in a particular place and by using a face recognition mechanism we can provide visual streaming and this streaming can be used directly on the user's smartphone, and we can also get the notifications by detecting any unknown persons.

We can also implement commands like voice recognition of different languages for future implementations.

Automation of garage system.

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