NodeNet – A Complete Home Automation System

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***Abstract*—Home automation system achieved great popularity in the last decades and it increases the comfort and quality of life. In this paper an overview of current and emerging home automation systems is discussed. Nowadays most home automation systems consist of a smartphone and microcontroller. This project proposes an efficient implementation of the Internet of Things (IoT) used to monitor and control home appliances on the World Wide Web. Home automation systems use portable devices as the user interface. You can communicate with your home automation network through an internet gateway using low power communication protocols such as WiFi. This project aims to control home appliances via a smartphone using WiFi as the communication protocol and Raspberry Pi as the server system. Here, users interact directly with the system via a web-based interface over the Internet, and appliances such as lights, fans, and door locks are remotely controlled via a simple web-application. The server is connected to a relay hardware circuit that controls the devices running in the home. Communication with the server allows the user to select the appropriate device. Communication with the server allows the user to select an acceptable device. The server communicates with the appropriate relay. If the internet connection is lost or the server goes down, the embedded system board will continue to manage and operate the appliance domestically. We provide an upgradeable and inexpensive home automation system.**

Keywords— IOT, Micro- processor, IC, ESP, NodeNet, Wifi, Bluetooth, Blynk.

I. INTRODUCTION

NodeNet is an IOT-based project specially designed to control ordinary home appliances over the Internet. You can use NodeNet to turn a non-smart device into a smart device. With NodeNet, you can control your home appliances from anywhere in the world. To send and receive commands over the Internet, you need to connect NodeNet to your WiFi network. If you are not connected to the internet, you can issue commands via Bluetooth. The Internet of Things has evolved into one of the world's leading technologies. It has gained a lot of popularity in a short period of time. One of the coolest technologies. Provides easy access and control to the device. Basically, AI and ML programs are combined with IOT devices to achieve proper automation. With the Internet of Things (IoT), you can make your home smarter. It is a system in which computing devices are connected over a network using unique identifiers (UIDs) and exchange data between individuals or without the need for individuals. Communication with people.

Computer interactions can be sent. These IoT devices can also be used to automate our home. The first home automation technology was developed in 1975 using a network technology called X10, a communication protocol. was at that time, it was used in home automation devices. I used power transmission wiring Signal transduction and control of various electronic devices. Signals used radio frequencies as digital data to control all digital electronic devices installed in the home. Technology has changed now. With the help of sophisticated hardware and free and open source software (FOSS), home automation can turn your dream home into a reality.

A. ESP32

ESP32 micro controller is selected for this project due to its compact size, performance and compatibility. It has dual core processor with a clock frequency of 240 MHz with wireless connectivity of Wi-Fi and Bluetooth. Esp32 can be programmed easily with Arduino IDE, LUA, Micro Python or Espressif IDE. Having Bluetooth allows the operator to operate the device without internet within a range up to 10 meter. With a internet connection through Wi-Fi, it is possible to operate from anywhere until the operator has a internet connection on mobile.

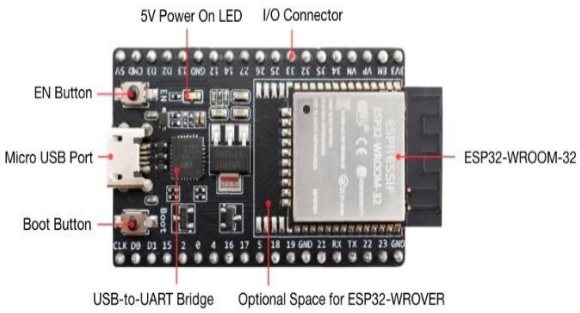

Fig. 1. Aurduino Board

Esp32 can be powered through USB port or regulated 5v can be supplied through 5v pin. There are total 39 GPIO (General purpose input output) pins. 0v (low) and 3.3 (high), but pins 34 to 39 can be used as input only.16 independent channel is available for PWM (pulse width modulation), any

GPIO can be made to work as PWM through the software.Esp32 supports 3 UART interface, 2 I2C interface, 2 I2s interface, 3SPI interface and also supports CAN protocol.

B. Relay

Relay in an electromagnetic switch which is utilized to segregate two circuits electrically. It is used when we want a low voltage circuit to turn ON/OFF device which requires high voltage for its operation. Relays are available in different ranging voltages. Relay have 3 contractors: Normally closed, normally open and common. With proper combinations, the electrical appliances may turn ON/OFF.

Fig. 2. Relay

In NODEnet, relays receive signal from the microcontroller i.e. High (3.3v) or Low (0v) through which the appliances are turned ON/OFF.

C. Infrared (IR) Sensor

An IR sensor is a radiation-sensitive optoelectronic component with a spectral sensitivity in the IR wavelength range from 780nm to 50µm. Nodenet uses this sensor to provide gesturebased control of home appliances in a defined range i.e. using hand gesture like waving hand from left to right or right to left in front of the IR sensor to turn ON/OFF the appliances. The sensor elements detect the heat radiation (IR radiation) changes over time and space due to movement of people/object.

Fig. 3. IR Sensor

D. Reed Switch

Nodenet uses reed switch for notification on unauthorized door access. The reed switch sends an input i.e. either 1 or 0 through which doors open/closed status can be known.

Fig. 4. Reed Switch

As shown in the above image, reed switch is made of ferromagnetic material sealed inside a glass envelope filled with nonreactive gas. There are two types of reed switch i.e. Normally Open (NO) and Normally Closed (NC). We used NO read switch in which the magnetic reeds are separated by a small gap, the gap closes and the circuit is close i.e. allowing the current to flow when comes in contact with a magnetic field.

Reed switch and the magnet is placed in a hard plastic cover as shown in the figure below and clamped in the door and door frame. When the door is closed, input is High andis switched to Low when the door is open.

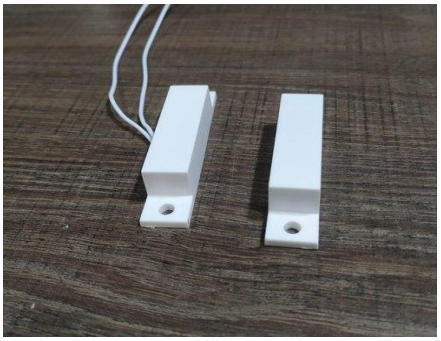

Fig. 5. Magnet

E. Arduino IDE

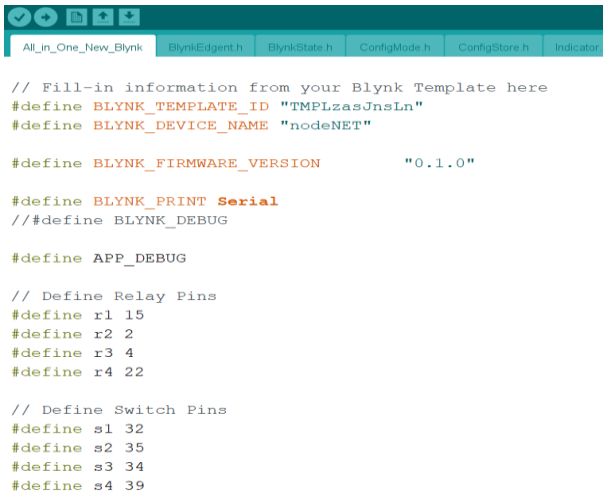

Fig. 6. Arduino IDE Interface

Nodenet is programmed with the help of Arduino IDE. Programs written using Arduino IDE are called sketches, written in the text editor and saved with the file extension .ino. We had to import blynk libraries and add the BLYNK_TEMPLATE_ID along with BLYNK_DEVICE_NAME that is available when setting up Blynk Web Dashboard. We can flash the compiled code into the microcontroller by connecting with the computer using a micro usb to usb type A cable and selecting the correct board and port from the arduino IDE.

F. Blynk

Blynk is a cloud platform that allows you to quickly build interfaces for operating and monitoring hardware projects from iOS and Android devices.

Through blynk libraries in arduino IDE, we can program our microcontroller to connect to blynk cloud. To operate Nodenet through iOS/Android device, we need to setup data streams as shown in figure depending on code. These data streams help in communicating with the Esp32/Esp8266 to send/receive signals. We also need Blynk Web Dashboard for arranging buttons, sliders, graphs, notification and other widget onto the screen.

Fig. 7. Blynk Library

Working

In this device the ESP32 module is used as core component in which dual core system on chip acts as parallel processing mechanism which takes command from Bluetooth or Wi-Fi module embedded in Esp32, then processes it gives the command to the respective relay which in turn makes the appliances respond to the device. A Bluetooth module and a Wi-Fi module are embedded in Esp32 so Esp32 can connect to any device via a Bluetooth network or a Wireless fidelity network to communicate to any device and use Bluetooth or Wi-Fi as a channel of communication. Esp32 is programmed in such a way that it`s 24 General purpose input output pins can be used as 12 input pins take command from the switches or fan regulators and rest 12 pins can be used as a output pins to give commands to the relays.

The Power Supply will provide energy to the system through the relay and ESP32 module, so that all equipment can work and function properly. ESP32 microcontroller will also read commands that have been sent by the Blynk Server in TCP / IP format which will then be changed by giving the logic "HIGH" or "LOW" on certain pins by relay to regulate the on / off of the home lights.

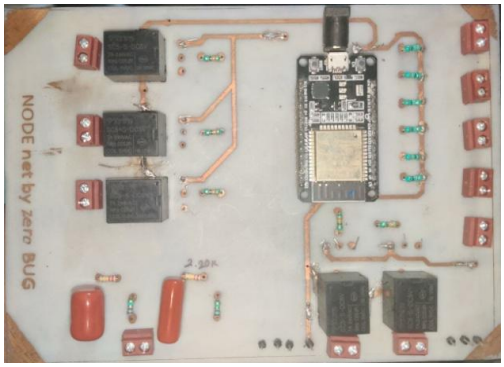

Fig. 8. *ESP32 module*

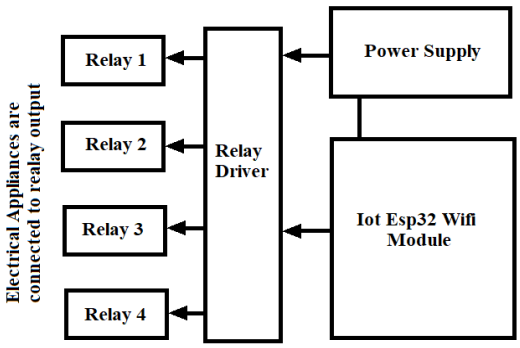

Fig. 9. Relay Output

Work Flow

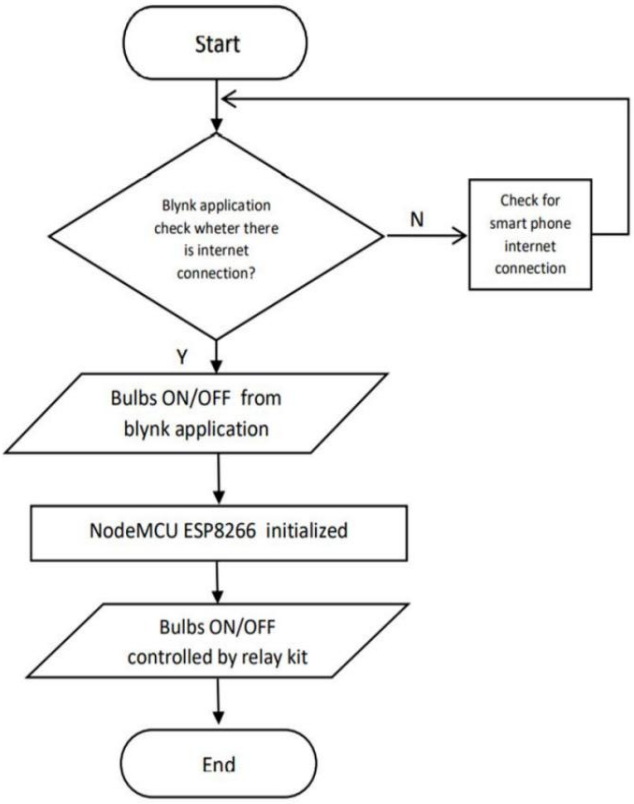

Fig. 10. Work Flow

Data Flow

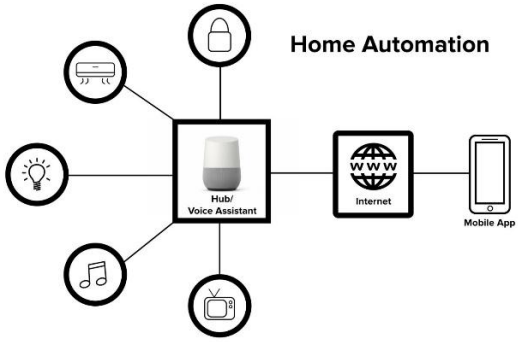

Fig. 11. Home Automation System

Circuit Diagram

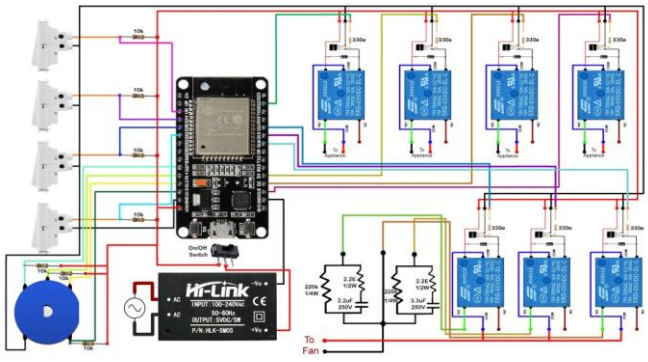

Fig. 12. Circuit Diagram

PCB Design

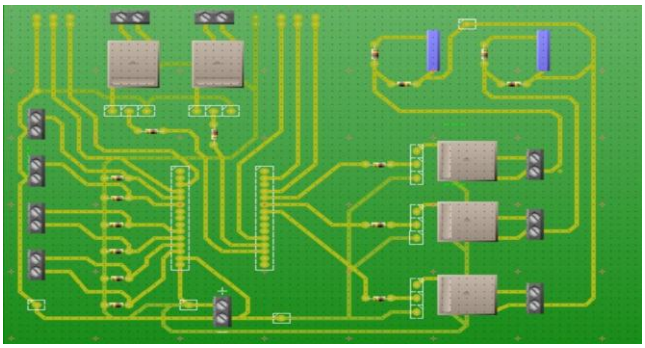

Fig. 13. PCB Design

II. Implementation and Survey

Implementation

To better understand the working of Nodenet. Nodenet was implemented in certain areas including AICTE IDEA lab of Shri Shankaracharya Institute of Professional Management and Technology Raipur, Gram Panchayat of Palaud village etc. In the span of last six months only a single issue was reported by both the places that is its system shuts down when it is overloaded. After researching this issue for a month and changing some components, overload shutdown bug was fixed and there have been no complaints of any issue arising after that. Nodenet works fine anywhere and consumes very low energy that is negligible as compared to the electricity bill of a standard house.

Fig. 14. Real Time Implementation

III. Survey

A quick short and simple survey was done with the help of NSS cell Raipur to understand the requirement and use of "Home Automation System" in such small villages like Palaud. The villagers seemed quite excited and curious to know that a "Home Automation System" is possible at their

door step. Almost 95% people agreed that they would definitely implement a "Home Automation System" at their home if available at affordable price. Nodenet is made in such a way that is cost lies between 1500₹ to 2500₹ based on the functionalities provided to the user. And as the availability of Wi-Fi connection is very rare and uncommon in small villages like Palaud, so instead of using both Wi-Fi & Bluetooth module in a device we can only use Bluetooth module in Nodenet for small villages and cut cost to even lower that will make it more affordable for small villagers.

IV. CONCLUSION

Nodenet is working fine and can be implemented anywhere as an automation assistance. Using Wi-Fi module it can be operated from anywhere in the world as long as you have proper internet connection. On the other hand using Bluetooth module you can control it without internet connection. The only limitation that arises is it`s range is reduced to 10 meters. In conclusion to all these you can control Nodenet using both of them as per your need and wish.

Some trends that we foresee for this phase of the industry are Big companies like philips, Siemens & scheider will eventually bring out fairly mass market automation products with appealing user interface but at a lower price point today, and more people will be able to afford the products. Some foreign players will have niche in high and automation and focus fun the premium market.

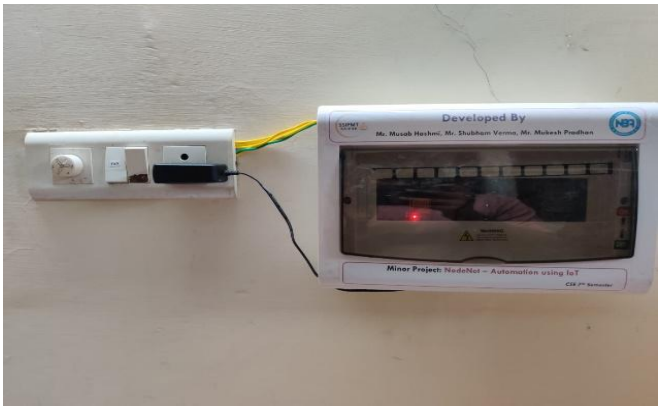

Fig. 15. Output

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