SMART HOME AUTOMATION SYSTEM

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ABSTRACT

In the current era, establishing communication between electrical control panels and electrical appliances for home automation utilizes expensive technology and methodologies. Many established firms make use of zigbee modules and heavy processors which in turn adds up to the cost. Installation of this system is also complicated and requires changing the complete cabling and panels. As a result, this technology is far away from mass implementation and is available to a few percent of population worldwide i.e. 7.7%. The approximate cost of installing one automated switch is 3000 Indian Rupee. In this paper we aim to substantially reduce the cost of home automation without compromising the product quality by deploying our module by using Wi-Fi with our circuit and adapting our module to current cabling system present in respective homes. The module will possess an advantage of detecting the switching status of mechanical switches present along with it. Using Wi-Fi module will have numerous advantages over other protocols as Wi-Fi is compatible with smart phones, routers and PCs. It will not require any additional components for internet connectivity. Internet connectivity will mean that the user will be able to control the appliances worldwide. Our module will use MQTT (Message Queuing Telemetry Transport) for robust pub-sub architecture. The user will be able to control appliances with application installed on user's smart phone or PC. We'll be able to monitor all the switching of appliances without any load on our module. All the major processing is shifted on the server side which will in turn keep our module fast.

Keyword : - *Zigbee, Wi-Fi module, MQTT.*

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1. Introduction

Today with the rising technology of IOT, the demand for innovative product is also rising, but, the main concern is comparing the product's quality with its price. In today's market numerous products are launched which use IOT technology to control home appliances. For example, when IOT enabled switch panel is used the customer needs to replace its old switch panel and this increases the cost, because the new panel's technology is not compatible with the old switches, so there is no room for reuse of switches.

Another problem in current technology is that the communication protocol is Zigbee , one of the major drawbacks of this is the range and expense of installation. So, instead of using such troublesome technology, we have developed a device which uses a fairly compatible technology i.e. it works over Wireless Fidelity (Wi-Fi).The main advantage of Wi-Fi is its range and also, we can add a large number of devices to control the appliances. Moreover, our product provides flexibility to the user to control its appliances either automatically or completely manual.

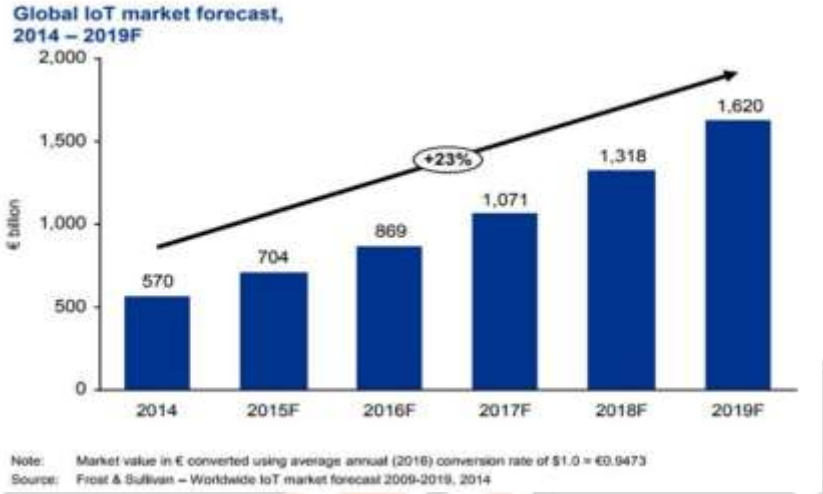
As our product works over a separate power supply (12 V, 36000mah),the working of the circuit never gets affected due to cut of phase power supply. This product is compatible for most of the appliances and it can

be controlled from any corner of the world. It comes with an added feature, availing the user, the status of the appliance and power consumption statistics over the internet.

Literature Survey:

This paper provides a simple introduction to the IoT, its application and potential benefits to the society.

Home Automation System uses the technology of Internet of Things for monitoring and controlling of the electrical and electronic appliances at home from any remote location by simply using a Smartphone. Till today all IOT based system are using WiFi.



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3. SYSTEM DESIGN :

3.1 Node-Mcu

NodeMCU is an open source IoT platform.[4][5] It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.[6][7] The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It 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[8] and SPIFFS.[9]

Fig -2: Node-MCU

3.2 Relay and Relay Driver Circuit:

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.

- Each one needs 15-20mA Driver Current.; Equiped with high-current relay : DC30V 10A AC250V 10A.
- Each relay has normally open and normally closed contact.
- The 8 channels are optically isolated, safe, reliable, anti-interference.; Can be selected by jumper relay and TTL or ground.
- With power indicator,8-way road has a status indicator.; With a relay coil to absorb the diode protection.
- The circuit board size 140mm X 55mm; Mounting hole size 133mm X 40mm (Size is approximate)
- The board works on 12V but the input signal can come directly from microcontroller output working at 3V or 5V to control relays. Each relay can switch varierty of AC or DC high voltage, high current loads working at 110V or 220V AC mains like lights, fans, motors and such. The status of relay is indicated by individual LEDs.

3.3 4-to-16 line decoder/demultiplexer

The 74HC154; 74HCT154 is a 4-to-16 line decoder/demultiplexer. It decodes four binary weighted address inputs (A0 to A3) to sixteen mutually exclusive outputs (Y0 to Y15). The device features two input enable (E0 and E1) inputs. A HIGH on either of the input enables forces the outputs HIGH. The device can be used as a 1-to-16 demultiplexer by using one of the enable inputs as the multiplexed data input. When the other enable input is LOW the addressed output will follow the state of the applied data. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of VCC.

3.4 Quad SR latch

The ’279 offers 4 basic S\-R\ flip-flop latches in one 16-pin, 300-mil package. Under conventional operation, the S\-R\ inputs are normally held high. When the S\ input is pulsed low, the Q output will be set high. When R\ is pulsed low, the Q output will be reset low. Normally, the S\-R\ inputs should not be taken low simultaneously. The Q output will be unpredictable in this condition.

3.5 Quad 2-Input Exclusive-NOR Gate

The **XNOR gate** (sometimes **ENOR**, **EXNOR** or **NXOR** and pronounced as **Exclusive NOR**) is a digital logic gate whose function is the logical complement of the exclusive OR (XOR) gate[1]. The two-input version implements logical equality, behaving according to the truth table to the right, and hence the gate is sometimes called an "equivalence gate". A high output (1) results if both of the inputs to the gate are the same. If one but not both inputs are high (1), a low output (0) results.

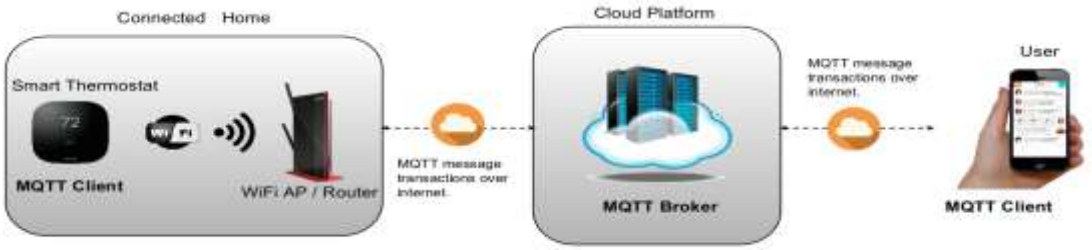
3.6 Parallel In Serial Out Shift Register

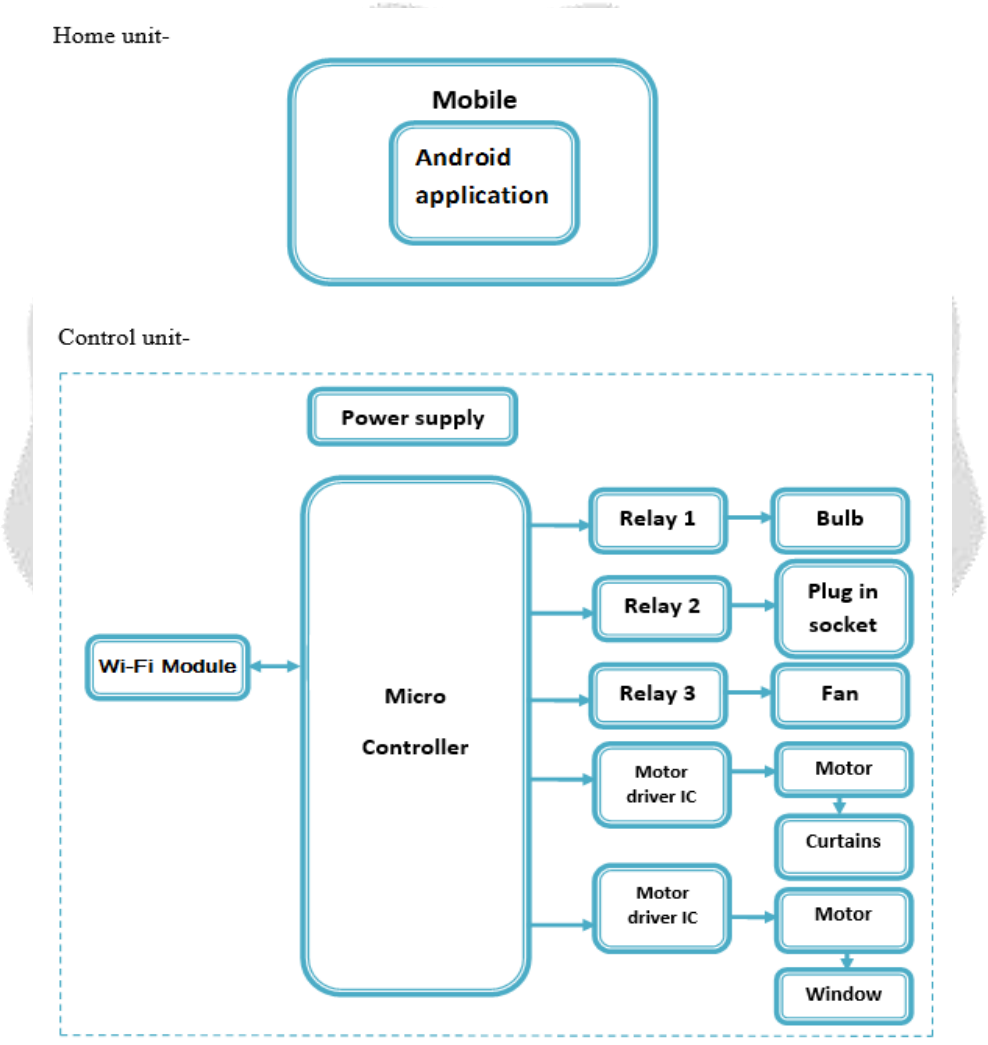
The SN74HC595N is a simple 8-bit shift register IC. Simply put, this shift register is a device that allows additional inputs or outputs to be added to a microcontroller by converting data between parallel and serial formats. Your chosen microprocessor is able to communicate with the The SN74HC595N using serial information then gathers or outputs information in a parallel (multi-pin) format. Essentially it takes 8 bits from the serial input and then outputs them to 8 pins.

This small DIP packaged IC contains an 8-bit, serial-in parallel-out shift register that feeds an 8-bit D-type storage register with parallel 3-state outputs.

4. IMPLEMENTATION:

4.1 System Architecture:





1. Android application in mobile sends the signal to the Wi-Fi module which is connected to same network. Android application has all the GUI buttons for each appliances.

2. Wi-Fi module receives the signal from the mobile application and give this signal to the NodeMCU board for processing.

3.NodeMCU is being used to control the further devices. A decoder is used to decode the signal received from NodeMCU board and activates the required output .

4. The corresponding relay is activated and the electrical appliances get turned On.

4.2 Hardware Implementation

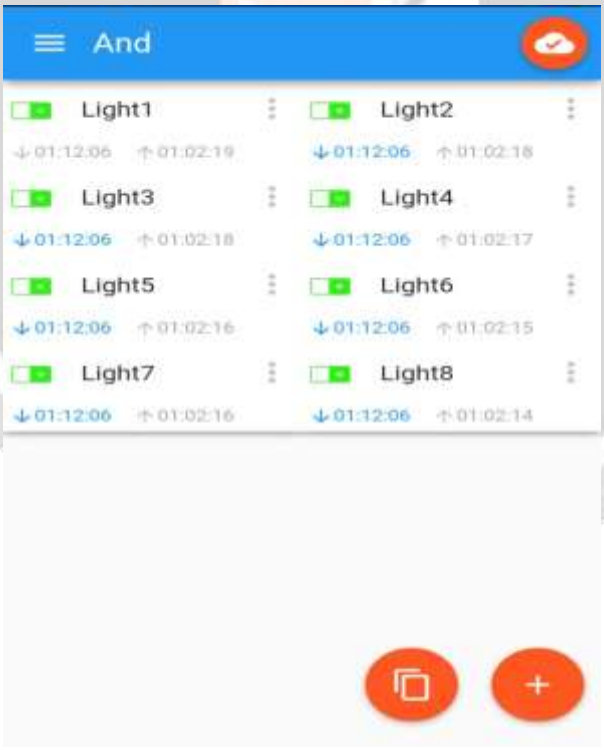
- When a mobile application turns on the the device , this message will pass on to the NodeMCU via internet. We will use NodeMCU's 5 control pins which will control 8 electrical appliances by providing this pins output to demultiplexer.
- The output of Demultiplexer is fed to SR latch, it is mainly used to save the previous output sequence of Demultiplexer so that the next output of demux should not affect the previous one.
- The output of SR latch and another input from the electrical switches is given to XNOR gate.
- XNOR gate is used to add the feature of controlling appliances with manual as well as autonomous.
- The output of XNOR gate is given to the relay circuit board which will turn On/Off the devices respectively.
- The Status of 8 relays are taken as 8 bit input sequence and it is fed to PISO register, the register is used as a feedback parameter for the circuit, this 8 bit string will act as status and is given to NodeMCU.
- NodeMCU will send this string to the remote server so that the mobile application should update the current status of the electrical appliances.

4.3 Software Implementation

An Android app is built and the features of this app are as follows:

- The app will continuously update itself from the server.
- The information at the server is sent from NodeMCU.
- It will use the MQTT protocol for the communication .

With the help of app user can decide to control any device from any remote location with the help of internet.



5. Future Scope

In our system we are providing restricted access to user that is limited to only our network. So in future we are providing access to system remotely via cloud and IoT technology. This technology can be used to provide security feature for Home as well as Industrial applications.

6. CONCLUSIONS

Smart Home Automation System provide interface between various types of home and electrical appliances like fans, lights, etc. It provide control and ease of use of appliances as per users need. After analysing other existing systems, we propose the novel technique for better human interaction and for providing better utilization of android and NodeMCU. By using Home automation system we can manage cost, flexible and energy efficient smart homes. Providing every switch an IOT access will give room for automation and interfacing of sensors and the tracked data can be used for energy management pursposes.

7. ACKNOWLEDGEMENT

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8. REFERENCES

[1]"Wi-Fi Based Smart Home Automation Using Raspberry Pi", *International Journal of Recent Trends in Engineering and Research*, pp. 89-93, 2018. Available: 10.23883/ijrter.conf.20171225.012.yxlsq.
[2]M. Kashyap, V. Sharma and N. Gupta, "Taking MQTT and NodeMcu to IOT: Communication in Internet of Things", *Procedia Computer Science*, vol. 132, pp. 1611-1618, 2018. Available: 10.1016/j.procs.2018.05.126.
[3]J. Lee, G. Park, J. Shin and S. Yoo, "An Extensible Smart Home IoT System Based on Open Hardware Platforms", *IEMEK Journal of Embedded Systems and Applications*, vol. 11, no. 6, pp. 369-377, 2016. Available: 10.14372/iemek.2016.11.6.369.
[4]U. Sharma and S. R. N. Reddy, "Design of Home/Office Automation Using Wireless Senosr Network," International Journal of Computer Applications, vol. 43, pp. 53-60, 2012.
[5]Mansour H. Assaf, Ronald Mootoo, Sunil R. Das, Emil M. Petriu, Voicu Groza, and Satyendra Biswas "Sensor Based Home Automation and Security System." 978-1- 4577-1722-7/12/$26.00 ©2012 IEEE
[6]K. P. Dutta, P. Rai, and V. Shekher, "Microcontroller Based Voice Activated Wireless Automation System," VSRD Internation Journal of Electrocal, Electronics & Communication Engineering, vol. 2, pp. 642-649, 2012.
[7]A. Z. Alkar and U. Buhur, "An internet based wireless home automation system for multifunctional devices," IEEE Trans. Consum. Electron., vol. 51, no. 4, pp. 1169–1174, Nov. 2005.
[8]Sharon Panth, Mahesh Jivani "Home Automation System (HAS) using Android for Mobile Phone" International Journal of Electronics and Computer Science Engineering ISSN 2277-1959/V3N1-01-11
[9] R. Piyare and M. Tazil, "Bluetooth based home automation system using cell phone," in IEEE 15th International Symposium on Consumer Electronics, Singapore, 2011, pp. 192 - 195.
[10] https://www.esp8266.com/
[11] https://openhomeautomation.net/
[12] http://instructables.com