An Elegant Perspective Way of Automating Home To Conserve Power

Kayalvizhi .P[1], Subbulakshmi .S[2], Rakshana .N[3], Guna Sekar .M[4]
[1]Assistant Professor, Dept of Electronics and Communication Engineering
[2, 3, 4]Dept of Electronics and Communication Engineering
[1, 2, 3, 4] Sri Subramanya College of Engg & Tech, Palani

Abstract- *In The main attraction of any automated system is reducing human labour, effort, time and errors due to human negligence. With the development of modern technology, devices have become a necessity for every person on this planet. This project will presents Internet of Thinks (IoT) based home automation system using devices. Such a system will enable users to have control over every appliance in his/her home with their devices. All that the user needs is a devices, which is present in almost everybody's hand nowadays, and a control circuit.The control circuit consists of microcontroller, which processes the user commands and controls the switching of devices. The connection between the microcontroller and the devices is established via Wi-Fi, a widespread wireless technology used for sharing data.*

Keywords- Home Automation, Mobile Dashboard, IoT aided Blynk app, Wifi.

I. INTRODUCTION

Home Automation or Smart Home assembles automation for the home. It includes and deals with the automation of lighting, warming, ventilation, cooling, and security. When the home devices are checked and controlled by utilizing the Internet. The Internet is a critical component of the Internet of Things. This chapter explains the present scenario of smart home automation and the function of the Internet of Things in smart home automation. The presentation of different IoT models, its preferences and cutoff points are likewise clarified.

Home automation encompasses the utilization of at least one PC to control fundamental home capacities, even remotely. An automated home is called a smart home. Home automation can incorporate the booking and programmed operations of water sprinkling, warming and cooling, window covers, security frameworks, lighting, and nourishment arrangement machines. Home automation may likewise enable key home capacities to be controlled remotely from anyplace on the planet utilizing a PC associated with the Internet. Other than the capacities as of now said, the remote control can be stretched out to phones and voice-mail, fax machines, novice radios, and different correspondences hardware, and home robot, for example, programmed vacuum cleaners.

The fundamental components of a well-designed home automation system include a computer (or computers) with the appropriate programming, the various devices, and systems to be controlled, interconnecting cables or wireless links, a high-speed Internet connection, and an emergency backup power source for the computer, its peripherals, and the essential home systems.

Home automation frame works are made of equipment, correspondence with an electronic interface that work to coordinate electrical devices by each other. Household activities would then be able to be directed and controlled easily and effortlessly. Clients can alter the controls on home excitement system, control the measure of daylight given to houseplants, or change the temperatures in specific rooms. Smart home programming is regularly associated through PC with the goal that clients can modify settings on their own devices [1].

There are many home automation systems offering a variety of services and function. A few of the common features existing in these platforms consist of

- Fire and carbon monoxide monitoring
- Remote lighting control
- Thermostat control
- Device control
- Live video observation
- Securing surveillance
- Alarm systems
- Text message and email alert

Customers can save on energy bills by reducing the length of time that lights stay on or lowering temperatures when they have left a room.

The name Internet of Things (IoT) was first used by British technology pioneer Kevin Ashton in 1999 to illustrate a system in which protests in the physical world could be connected with the Internet by sensors. Ashton authored the name to summarize the energy for interfacing Radio-Frequency Identification (RFID) labels utilized as a part of corporate supply chains in the direction of the Internet so as to check and track merchandise without the necessity for human intercession. Currently IOT has turned into a well-known term in which Internet accessibility and computing ability reach out to an assortment of devices, sensors, articles, with ordinary things [2].

From a broad perspective, the confluence of various technologies and market trends is making it possible to interconnect more and smaller devices cheaply and easily:

Ubiquitous Connection- Low–cost, high–speed, pervasive network connectivity, mainly during licensed and unlicensed wireless services and technology, make almost the whole thing “connectable’’.

Widespread adoption of IP–based network- IP has become the leading global platform for networking. It provides that a well– defined and widely implementable platform of software and tools that can be included into a broad series of devices easily and inexpensively.

Computing Economics - Driven by industry deal in research, and development, Moore’s law continues to send greater computing power at lesser price points with lower power consumption.

Efficiency - Manufacturing advancements allow cutting-edge computing with communications technology to be included even in very small objects. Coupled with better computing economics, this has fueled the progress of small and low-cost sensor devices, which make many IoT applications.

Advances in Data Analytics - Novel algorithms and quick advancements in computing power, data storage, and cloud services allow the aggregation, connection, and analysis of huge quantities of data; these large and dynamic datasets offer new opportunities to extract the information and knowledge.
The rise of Cloud Computing - Cloud computing, which leverages remote, networked computing resources to process, manage, and store data, allows small and distributed devices to interact with powerful back-end analytic and control capabilities.

There is an expansive scope of potential applications as far as "settings" where IoT is relied upon to make an incentive of industry and clients.

Device-to-Device - The device-to-device model shown in Figure 1.2 speaks to at least two devices that specifically associates and imparts between each other, as opposed to through a middle person application server. These devices operate over numerous kinds of systems, including IP systems or the Internet. These devices also utilize conventions like Wifi, 40 Z-Wave, 41 or ZigBee42 to build up guide device to-device interchanges, as shown in Figure 1.1

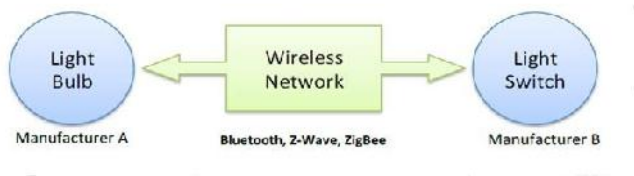

Figure 1.1 Devices to device communication model

These communication networks permit that cling to a specific correspondence protocol to convey and trade messages to accomplish their capacity. This correspondence is regularly utilized as a part of uses like home mechanization frameworks, which commonly utilize little information bundles of data to convey between devices with moderately low information rate prerequisites. Private IOT devices like light switches, indoor regulators, lights and entryway bolts typically send little measures of data to each other in a home automation scenario.

These devices often include an immediate relationship, and they normally have worked in security and trust. Still, they additionally utilize device information models that require repetitive improvement endeavors. This implies that the device makers need to put resources into advancement endeavors to execute device specific information designs instead of open methodologies that empower the utilization of standard information positions.

Device-to-Cloud - In this model, the IOT device associates specifically to an Internet cloud service similar to an application service provider to trade information and control messages. This model uses existing interchanges systems like customary wired Ethernet or Wi-Fi associations for setting up an association between the device and the IP organize, which at last interfaces with the cloud environment. This is shown in Figure 1.2

Figure 1.2 Devices to cloud communication mode

This model is employed by some popular consumer IoT devices like the Indoor regulator, Nest Labs Learning, and the Samsung Smart TV. For the situation of the Nest Learning Thermostat, the device sends the information to a cloud database where the information can be used to break down home vitality utilization. Further, this connection in cloud empowers the client to obtain remote access to the indoor regulator by means of an advanced mobile phone or Web interface, and it additionally underpins programming updates to the indoor regulator. Additionally, with the Samsung Smart TV innovation, the TV utilizes an Internet association with transmitting client seeing data to analysis and to empower the intuitive voice acknowledgment highlights of the TV. In the situation, the device to-cloud display increases the value of the end client by expanding the capacities of the device past its local highlights [3].

However, interoperability difficulties can emerge when endeavoring to coordinate devices made by various producers. As often as possible, the device and cloud provides are from the same vendor. If exclusive information protocol is utilized among the device and the cloud service, the device administrator or client may be attached to a specific cloud administration, constraining or keeping the utilization of elective specialist co-ops. This is usually alluded to as "seller secure", a term that incorporates special aspects of the association with the provider, for example, responsibility for access to the information. In the meantime, clients can by and large have certainty that devices intended for the specific stage, can be incorporated.

Device-to-Gateway - In this model, the IoT device interfaces through an application layer gateway structure as a conductor to achieve a cloud service. In a simpler word, this implies there is application programming working on a nearby gateway device, which goes about as a delegate between the device and the cloud service and gives security and other benefits, for example, information or convention interpretation. The model shown in figure 1.3

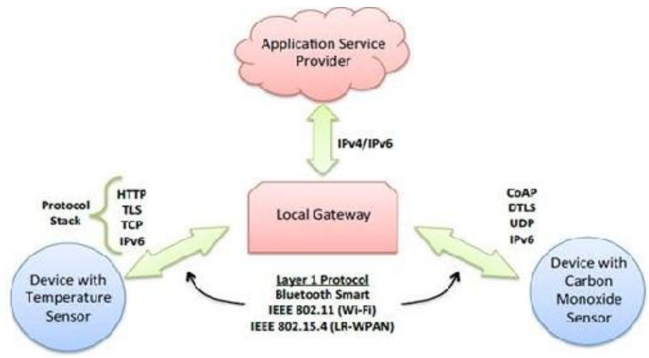

Figure 1.3 Devices to the gateway communication model

Several forms of this model are found in consumer devices. In several cases, the local gateway device is a Smartphone running an application to communicate with a device and relay data to a cloud service. This is a frequently used model that is employed with popular consumer items like personal fitness trackers. These devices do not contain the native ability to fix directly to a cloud service, thus they are frequently relying on smartphone app software to serve as an intermediary gateway to connect the fitness device to the cloud.

The other form of this model is the emergence of “hub” devices in home automation applications. These are devices that fill in as a neighborhood door between individual IoT [4]. Devices and a cloud service, but they can likewise connect the interoperability hole among devices themselves. For instance, the Smart Things center is a stay on a solitary gateway device that has Z-Wave and Zigbee handsets introduced to converse with the group of two devices. It interfaces with the Smart Things cloud, enabling the client to access the devices utilizing a PDA application and an Internet connection.

II. EXISTING SYSTEM

Figure 2.1 shows a simplified network architecture of a consumer HAS linked to a cloud computing service. The HAS architecture includes[5]: end-devices (IoT devices) at the customer premises; an IoT gateway (IGW), which essentially is an aggregator for IoT devices and provides application management and control capabilities; a home gateway/modem (HGW) for access to the Internet, and data centres hosting cloud services. In operation, the IGW and IoT devices form a local network referred to as an IoT Device Network (IDN). In a “typical” consumer HAS installation, the IGW connects to the HGW either via Ethernet or Wi-Fi access. A recent popular addition to the consumer home automation eco-system is the voice-activated Smart Hub.

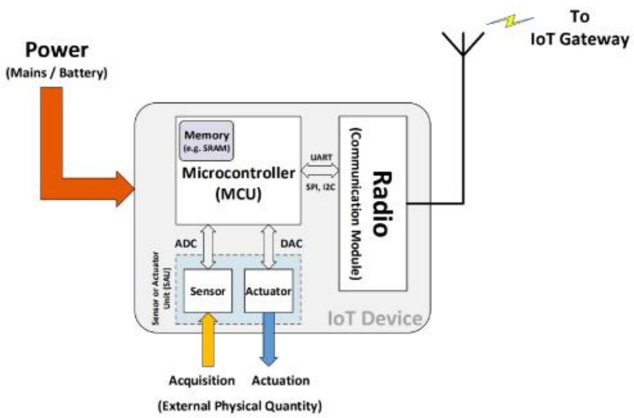

Figure 2.1 simplified network architecture

A. Defining IoT Devices:

The range of IoT devices in a HAS can be broadly categorised as "sensors" or "actuators", the latter including controlled devices. In either case, the devices include a number of functional elements. These elements include a sensor or an actuator unit (SAU), a microcontroller unit (MCU), and a radio interface module. Although shown as discrete elements, it is more common today for these functions (apart from the SAU transducers) to be integrated as a Systemon-a-Chip. A brief description of the workflow processes of sensor/actuator devices is given below[6].

Sensor Device: In a sensor device, some physical parameter is initially measured by an appropriate transducer, and the result passed to the MCU. The latter performs analogdigital conversion, may undertake some simple processing, and prepares the measurement data for transmission by the radio module to the IoT Gateway. To IoT Gateway Acquisition Power (Mains / Battery) Actuation (External Physical Quantity) Radio (Communication Module) Sensor or Actuator IoT Device Unit (SAU) ADC DAC Microcontroller (MCU) UART SPI, I2C Sensor Actuator Memory (e.g. SRAM).

Actuator Device: Conversely, an actuator device initially receives a signal via its radio interface. This is interpreted by the MCU, which in turn issues a command to the physical actuator element.

Each of these processes of sensing, processing, and communication consumes some energy, often operating many times per day. Some devices operate autonomously, so that, for example, the sense-process-communicate sequence repeats periodically. These are referred to as time-based devices. Others, labelled event-driven, operate when triggered by an external event (e.g. a button press, door opening). In the intervals between operations, the device continues to consume a (smaller) idle power. Further, the HAS may employ protocols that impose additional requirements (e.g. connectivity monitoring, "keep alive") which in turn add to energy consumption [7].

The IDN refers to a network of IoT devices within a consumer HAS with a common gateway (i.e. the IGW). The smart hub is an extension of the IGW for voice commands. In its most common form, communication between the IoT devices and IGW is via a wireless link. A range of short range wireless network protocols is used in HAS, including Wifi (Classic and Smart/Low-Energy), ZigBee, Wi-Fi and RF 433 MHz. While many of these protocols are designed for point-to-point communication, employing a star topology, a few can operate in a mesh topology (e.g. BLE, ZigBee) forming a daisy chain of links towards the gateway. A basic point-to-point single-hop, star-topology connection between the IoT devices and the IGW is modelled here.

B. ENERGY MEASUREMENT OF IOT DEVICES

We have conducted measurements on a range of IoT devices and report examples here. These will be used in Section IV to create more generic power consumption models for the HAS. A. Measurement Method and Setup For a number of IoT devices proposed for home use, we have studied their characteristics, including the device's bit rate, transmit sequence, protocol stack, energy consumption states (e.g. active, idle, standby) and trigger mechanisms. Power consumption measurements have been made in each phase of the device operation cycle and averaged over at least 10 iterations. We used custom-built USB 3V, 5V and 9V DC power meters, each with sampling rate of 5 ms (reprogrammed to 1 ms for some tests) and accuracy of 10 or 100 µW. For AC mains power measurements, an AC power meter was employed, which provides a 10 mW accuracy but is limited to 1 second sampling rate. A representative offthe-shelf consumer HAS is used as our testbed (referred to as Test-HAS). The Test-HAS consists of wireless sensors, actuators and cameras (i.e. IoT devices), a gateway unit (i.e. IoT gateway) and a cloud service hosted at a data centre, through which control and management of all connected IoT devices and their data are achieved.

Wireless communication between end-devices and the TestHAS gateway is via the ISM band 433 MHz connectionless RF protocol [8].

Sensor Devices power consumption traces for 433 MHz time-based and event-driven sensor devices. a Type I temperature and humidity sensor (T&H) collecting samples at regular intervals (≈7−8 s) followed by 3 transmit bursts (extra

2 for redundancy) of a 5-Byte data packet within a 60 s cycle. The average power and duration of each phase. A similar T&H device trace (Type II) in Fig. 3b shows non-distinct data sampling spikes but with one continuous transmit burst, also within a 60 s cycle. The repetitive behaviour of time-based sensors makes for a simple energy consumption estimate. From the energy consumption of Type I is ≈15 mJ per cycle or ≈22 J per day [9].

Traces for two event-driven sensor devices, a Passive Infrared (PIR) and a Door/Window (DW) sensor device, are given in Fig. 3c and Fig. 3d, respectively, with their measured values reported in Table II. Both devices transmit multiple bursts of a predefined 4-Byte data block when triggered. The PIR prevents excessive re-triggering for the same event by employing a selectable lockout timer. The power trace for a 5 s lockout time. With the sensor of the PIR being passive, negligible power dissipation was observed during the sensing phase. We can then calculate the energy consumption of the PIR and DW as 130 mJ and 63 mJ per event or 12 J and 13 J for 100 events per day, respectively. Similar mains powered sensor devices were reported in to consume about 0.6 W on average [10].

Actuator Devices Four 230V controlled mains-power sockets were used as examples of an actuator device. The controlled socket contains a 433 MHz RF wireless receiver that receives commands from the gateway to open or close the power circuit. We recorded its no-load average power consumption as 0.70 W in its “Socket OFF” state and 0.67 W in the “Socket ON” state. On average, similar mains-powered actuator devices have been reported to consume about 1 W.

IP Camera In the Test-HAS, an example IP camera (IPcam) was used as an IoT device for video surveillance, configured to provide a high definition image of 1280x720 pixels at 25 frames/s. The IPcam connects via Wi-Fi to the HGW. It consumed 3.75 W when streaming captured frames with a bit rate of 1.9 Mb/s.

C. Conclusion of Existing System

This paper has presented detailed measurements of devices in consumer home automation systems and developed novel system-level energy models. The models account for key functional components of the devices and their operational characteristics over time. Using this bottom-up approach, a first-order estimate of the potential energy impact of consumer HAS on the average household has been developed and extended, using ICT industry projections, to estimate energy consumption on a global scale. Our estimate indicates a household energy consumption increment of more than one-third of the current household annual consumption for a simple off-the-shelf HAS deployment. This could be much higher if augmented by fullscale video surveillance applications with higher throughput demand. Smart light bulbs were the least energy efficient of the range of IoT devices considered and contribute the most to that additional consumption. Smarter design of these products should be the prime focus for product development. At a more general level, the balance between the potential benefits and energy savings through “smartness”, as against the energy cost of their “smartness”, should be considered. On a global scale, the potential energy impact of HAS deployment is non-trivial and could reach about 157 TWh by 2025, nearly 14% of the global ICT industry energy consumption forecast for that year (estimated at 1140 TWh). It indicates that there is a significant price to pay if the more optimistic market growth projections eventuate, while energy efficiency improvements do not match that growth.

III. PROPOSED SYSTEM

This project will presents Internet of Thinks (IoT) based home automation system using smartphones. Such a system will enable users to have control over every appliance in his/her home with their mobile phone. The control circuit consists of microcontroller, which processes the user commands and controls the switching of devices. The connection between the microcontroller and the smartphone is established via Wi-Fi, a widespread wireless technology used for sharing data. The black diagram of proposed system are followed figure 3.1

`A.The Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

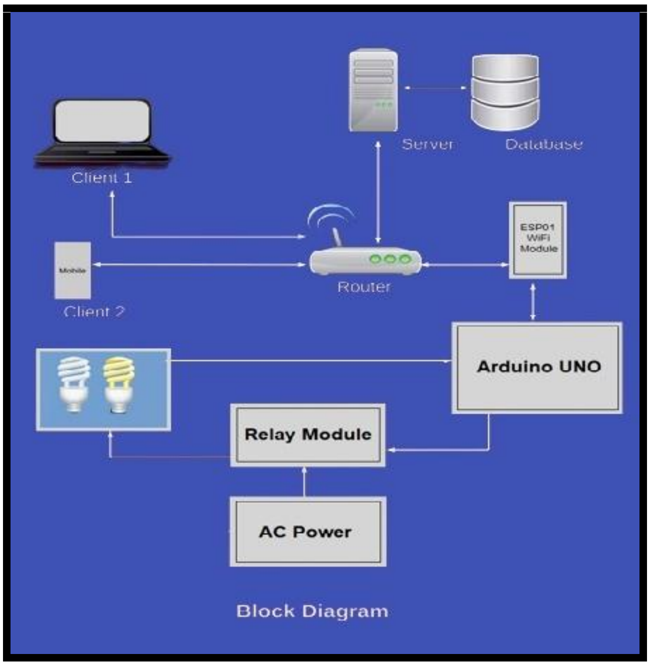

Figure 3.1 Proposed System

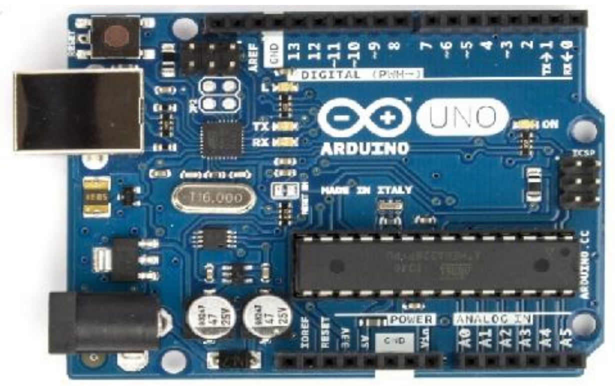

Figure 3.2. The Arduino Uno

The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards.

TECHNICAL SPECIFICATIONS

- Microcontroller ATmega 328P
- Operating Voltage 5V
- Input Voltage (recommended) 7-12V
- Input Voltage (limit) 6-20V
- Digital I/O Pins 14 (of which 6 provide PWM output)
- PWM Digital I/O Pins 6
- Analog Input Pins 6
- DC Current per I/O Pin 20 mA
- DC Current for 3.3V Pin 50 mA
- Flash Memory 32 KB (ATmega328P) of which 0.5 KB
- SRAM 2 KB (ATmega328P)
- EEPROM 1 KB (ATmega328P)
- Clock Speed 16 MHz
- Length 68.6 mm
- Width 53.4 mm
- Weight 25 g.

B. ESP 8266

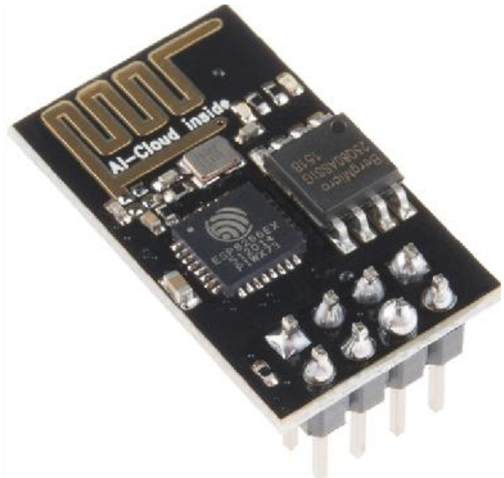

Figure 3.3. Schematic of ESP 8266

Description: The ESP8266 WiFi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers (and that’s just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existance interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts. There is an almost limitless fountain of information available for the ESP8266, all of which has been provided by amazing community support. In the Documents section below you will find many resources to aid you in using the ESP8266, even instructions on how to transforming this module into an IoT (Internet of Things) solution!

Features

- 802.11 b/g/n
- Wi-Fi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching
- network
- Integrated PLLs, regulators, DCXO and power management units
- +19.5dBm output power in 802.11b mode
- Power down leakage current of <10uA
- 1MB Flash Memory
- Integrated low power 32-bit CPU could be used as application processor
- SDIO 1.1 / 2.0, SPI, UART
- STBC, 1×1 MIMO, 2×1 MIMO
- A-MPDU & A-MSDU aggregation & 0.4ms guard interval
- Wake up and transmit packets in < 2ms
- Standby power consumption of < 1.0mW (DTIM3)

Specification of ESP 8266

- Wi-Fi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLLs, regulators, DCXO and power management units
- 19.5dBm output power in 802.11b mode
- Power down leakage current of <10uA
- 1MB Flash Memory
- Integrated low power 32-bit CPU could be used as application processor
- Standby power consumption of < 1.0mW (DTIM3)

RELAY BOARD

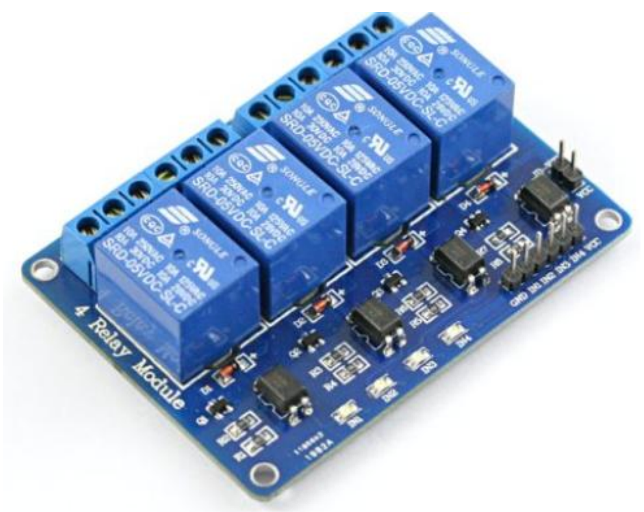

Figure 3.4 Relay board

A relay is an electrical device which is generally used to control high voltages using very low voltage as an Input. This consists of a coil wrapped around a pole and a two small metal flaps (nodes) that are used to close the circuit. One of the node is fixed and other is movable. Whenever an electricity is passed through the coil, it creates a magnetic field and attracts the moving node towards the static node and the circuit gets completed. So, just by applying small voltage to power up the coil we can actually complete the circuit for the high voltage to travel. Also, as the static node is not physically connected to the coil there is very less chance that the Microcontroller powering the coil gets damaged if something goes wrong.

This is Four Channel relay board controlled by computer USB port. The usb relay board is with 4 SPDT relays rated up to 10A each. You may control devices 220V / 120V (up to 4) directly with one such relay unit. It is fully powered by the computer USB port. Suitable for home automation applications, hobby projects, industrial automation. The free software allows to control relays manually, create timers (weekly and calendar) and multivibrators, use date and time for alarms or control from command line. We provide software examples in Labview, .NET, Java, Borland C++, Python

FEATURES

- Datasheet - here
- Power led: Yes
- Relay leds: YesHigh quality
- 4 SPDT Relay channels - selectable by user:

- JQC-3FC/T73 DC5V (7A / 250VAC, 10A / 125VAC, 12A / 120VAC, 10A /
- 28VDC)
- RAS-05-15 (10A / 250VAC, 15A / 120VAC, 15A / 24VDC)

PCB parameters: FR4 / 1.5mm / two layers / metalized holes / HAL / white stamp / solder mask / extra PCB openings for better voltage isolation /doubled high voltage tracks

- Power supply: from USB port
- Current consumption: 400 mA
- Chip: FT245RL
- Size: 77mm x 56mm x 17mm
- Supported by DRM software (Windows and Linux): Yes
- Supported by Denkovi Command line tool (Windows, Linux): Yes
- Android software available (low cost but very useful): Yes – New

IV. HARDWARE AND RESULT

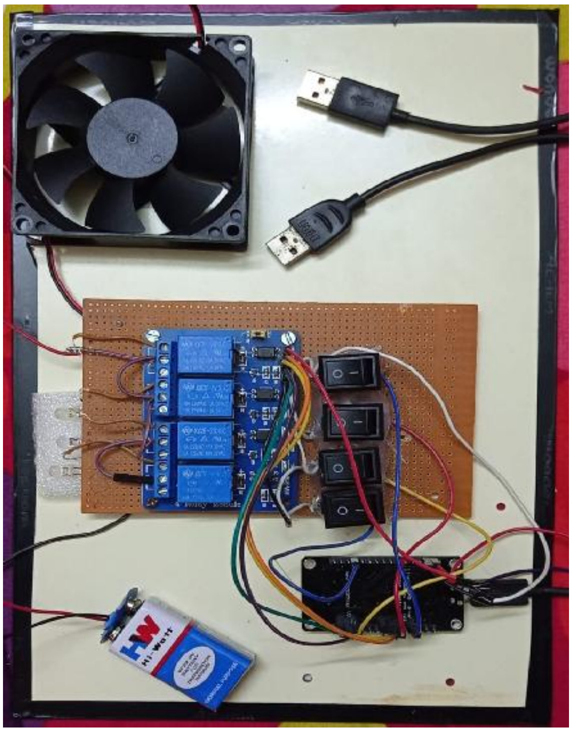

Figure 4.1 Hardware Design

In this Home Automation System, we will control 4 home appliances as Tv, Fan, Bulb, Motor, Refrigerator connected to Relay using Blynk Application. The Wifi Module NodeMCU ESP8266 will receive commands from the smartphone wirelessly through the internet. To encode the ON/OFF signal and send it to Server and to ESP8266 Board we need the best IoT Platform. So we chose Blynk as no other application can be better than this one. This project requires internet connectivity & can't work without Internet connection.

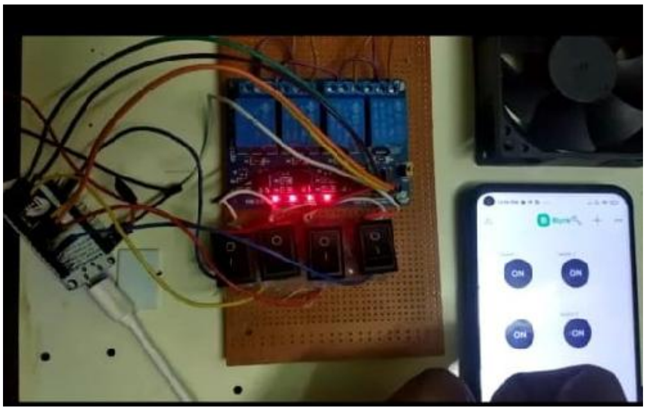

Figure 4.2 Result of Home Automation Kit

V. CONCLUSION

The process of controlling electrical appliances remotely and to perform automation process concludes the use of microcontrollers like Arduino, Raspberry pi, etc. The advanced technology enables the Wi-Fi which is a wireless network to be easily controlled using any other Wi-Fi network i.e. connecting from any network to the home network. The electricity cost can be reduced using smart automation as it turns off everything when there is no one in home. The wireless connection doesn't require any switches and is automated. Power consumption inside the building when the loads were in off conditions can be monitored, controlled and easily managed using smart applications that are designed for saving energy.

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