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Wi-Fi Based Smart Home Automation Using Raspberry Pi

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Abstract- In recent years, the home environment has seen a rapid introduction of network enabled digital technology. This technology offers new and exciting opportunities to increase the connectivity of devices within the home for the purpose of home automation. This paper is mainly concerned with the automatic control of light or any other home appliances using internet. It is meant to save the electric power and human energy. Raspberry Pi provides a low cost platform for interconnecting electrical/electronic devices and various sensors in a home via the internet network. The design of smart home is monitored by the Raspberry Pi via the internet of things (IOT).

Keywords – Raspberry Pi, Relay Switches, PIR Sensor, Internet of things (IOT).

Introduction

The internet of things (IOT) is the network of physical objects–devices, vehicles, buildings and other items embedded with electronics, software, sensors and network connectivity that enable these objects to collect and exchange data. The Internet of Things allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. When IOT is augmented with sensors and actuators, the technology becomes an instance of the more general class of, cyber physical system which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing internet infrastructure. Experts estimate that the IOT will consist of almost 50 billion objects by 2020.

British entrepreneur Kevin Ashton first coined the term in 1999 while working at Auto-ID Labs (originally called Auto ID centers, referring to a global network of objects connected to radio frequency detection, or RFID). Typically, IOT is expected to offer advanced connectivity of devices, systems and services that goes beyond machine-to-machine (M2M) communications and covers a variety of protocols, domains, and applications. The interconnection of these embedded devices (including smart objects), is expected to usher in automation in nearly all fields, while also enabling advanced applications like a smart grid, and expanding to the areas such as smart cities.

INTERNET OF THINGS

"Things," in the IOT sense, can refer to a wide variety of devices such as health monitoring implants biochip transponders on farm animals, electric clams in coastal waters, automobiles with built-in sensors, DNA analysis devices for environmental/food/pathogen monitoring or field operation devices that assist firefighters in search and rescue operations. Legal scholars suggest to look at "Things" as an "inextricable mixture of hardware, software, data and service". These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices. Current market examples include smart thermostat systems and washer/dryers that use Wi-Fi for remote monitoring. As well as the expansion of Internet- connected automation into a plethora of new application areas, IOT is also expected to generate large amounts of data from diverse locations, with the consequent necessity for quick aggregation of the data, and an increase in the need to index, store, and process such data more effectively. IOT is one of the platforms of today's Smart City, and Smart Energy Management Systems.

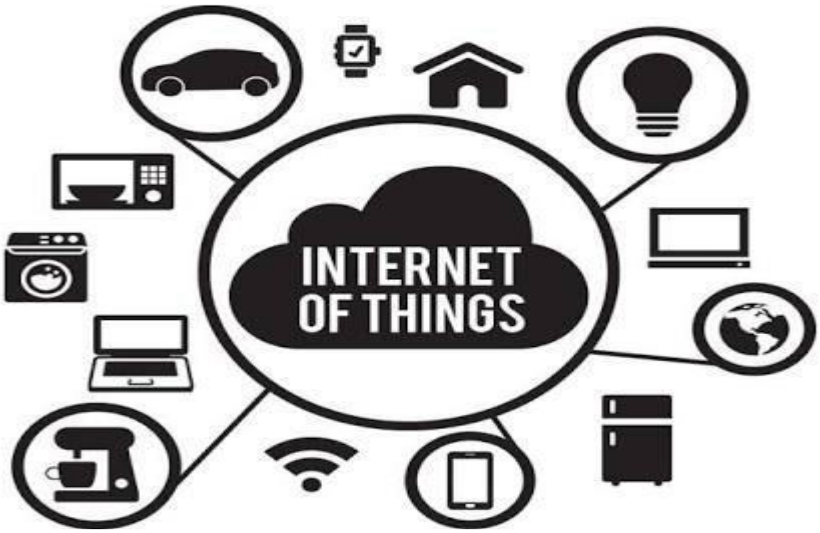

Figure 1: INTERNET OF THINGS

Integration with the internet implies that devices will use the IP address as a unique identifier. due to the limited address space of IPv4 (which allows for 4.3 billion unique addresses), objects in the IoT will have to use IPv6 to accommodate the extremely large address space required.

II. SYSTEM OVERVIEW

The purpose of hardware interface unit is all the electronic home appliances are connected to the raspberry pi board which is connected to the Wi-Fi by using Wi-Fi module. All the electronic appliances are operated and controlled through our smart phone or computer or tablet.

Raspberry PI 2 is interfaced with either PC or Mobile Phone by Using Web Protocol. Raspberry PI is connected to Electronic Switching System. By Using Electronic Switching System we control various electrical devices like Fan, Tube light etc.

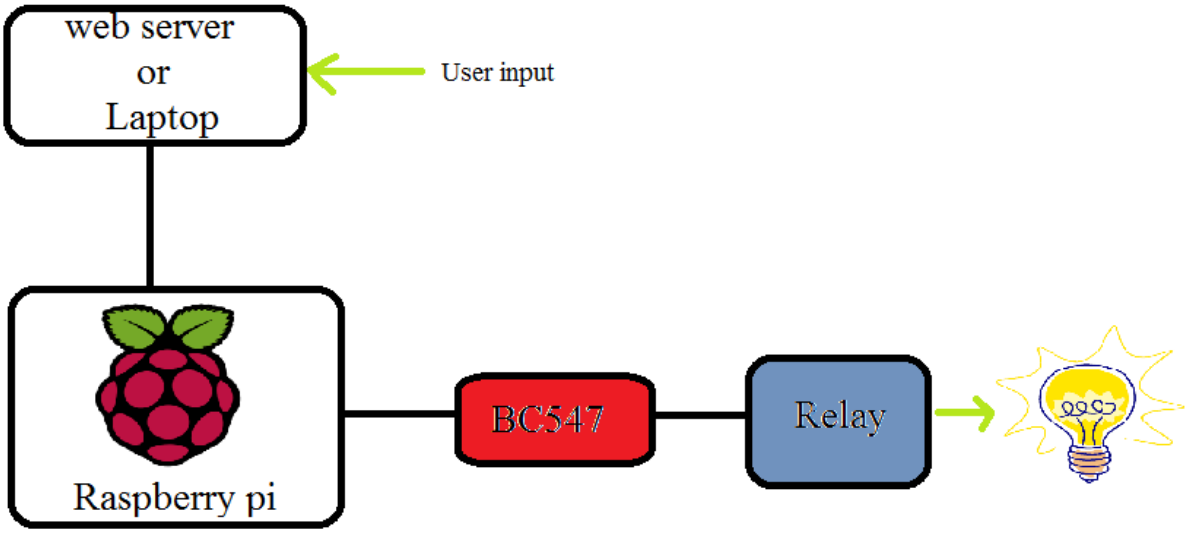

Figure 2: SYSTEM OVERALL BLOCK DIAGRAM

A.RASPBERRY PI:-

The Raspberry Pi is a small, cheap circuit board, called a microcontroller. It is basically a tiny computer on a single circuit board, and has been designed especially with hobbyists and students learning about electronics and programming in mind. It is very low powered compared to a regular computer, meaning that it

can be left on all of the time without racking up your electricity bills too much, and it can easily be connected to a range of peripherals and other circuit boards.

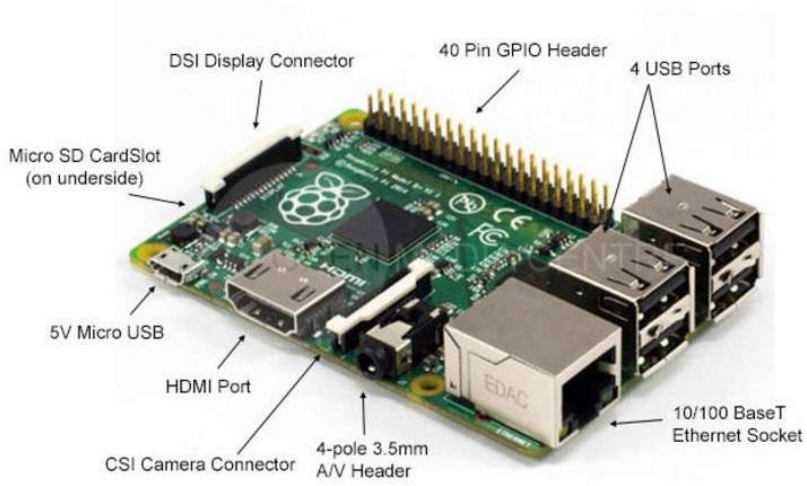

Figure 3: RASPBERRY PI

The sending command to the raspberry pi is server side script running on our laptop or on a web server takes input commands from the user and correspondingly sends it to the client (Raspberry Pi). Here, we will be using commands to tum a light ON/OFF. When we pass the command to tum ON a light through the server side script, the information is relayed to the Raspberry Pi and it's GPIO pin tums ON a relay. The system also sends status updates to the server on whether the light is ON/OFF.

The receiving command of the server side script running on our laptop or on a web server takes input commands from the user and correspondingly sends it to the client (Raspberry Pi). Here, we will be using commands to tum a light ON/OFF. When we pass the command to tum ON a light through the server side script, the information is relayed to the Raspberry Pi and it's GPIO pin tums ON a relay. The system also sends status updates to the server on whether the light is ON/OFF.

RELAY:

A Relay is electrically operated switches, which allow low power circuits to switch a relatively high voltage or current on/off. For a relay to operate a suitable pull in and holding current should be passed through its coil. Relay coils are designed to operate from a particular voltage often its 5V or 12V. The function of relay driver circuit is to provide the necessary current energize the relay coil, when a LOGIC 1 is written on the PORT PIN thus tuming on the relay. The relay is tuming off by writing LOGIC 0 on the port pin. In our system four relays are used for device control.
SPDT-Single Pole Double Throw A common terminal connects to either of two others. Including two for the coil, such a relay has five terminals in total.

Figure 4: SPDT RELAY

The two main configuration of relay are-

Normally open (NO) - contacts connect the circuit when the relay is activated; the circuit is disconnected when the relay is inactive. It is also called a "Form A" contact or "makes" contact. NO contacts may also be distinguished as "early-make" or "NOEM", which means that the contacts close before the button or switch is fully engaged.

Normally closed (NC) - contacts disconnect the circuit when the relay is activated; the circuit is connected when the relay is inactive. It is also called a "Form B" contact or "break" contact. NC contacts may also be distinguished as "late-break" or "NCLB", which means that the contacts stay closed until the button or switch is fully disengaged.

APPLICATIONS:

By the rapid developments of new technologies, monitoring, controlling services have been started to be served along with internet as an instrument providing interaction with machinery and devices. The system can be use in several places like banks, hospital, labs and other sophisticated automated system, which dramatically reduced the hazards of unauthorized entry.

1. Pi in the sky: This board is a GPS receiver, radio transmitter designed for tracking high altitude balloon flights.
2. Live bots: Live bots is scheme that allows users to control many robots based on Raspberry Pi over the internet.
3. Lap pi: The scheme features a laptop assembled from scratch which is based on the Raspberry pi board.

B. Web Protocol:–

They are different types of IOT (internet of things) protocols. In this web protocols we choose MQTT (Message Queue Telemetry Transport) protocol. For implementing MQTT protocol we use mosquito broker or Node.js.So in this project we used Node.js. Targets device data collection As its name states, its main purpose is telemetry, or remote monitoring. Its goal is to collect data from many devices and transport that data to the IT infrastructure. It targets large networks of small devices that need to be monitored or controlled from the cloud. MQTT makes little attempt to enable device-to-device transfer, nor to "fan out" the data to many recipients. Since it has a clear, compelling single application, MQTT is simple, offering few control options. It also doesn't need to be particularly fast. In this context, "real time" is typically measured in seconds. A hub-and-spoke architecture is natural for MQTT. All the devices connect to a data concentrator server, like IBM's new Message Sight appliance. You don't want to lose data, so the protocol works on top of TCP, which provides a simple, reliable stream. Since the IT infrastructure uses the data, the entire system is designed to easily transport data into enterprise technologies like Active MQ and enterprise service buses (ESBs).MQTT enables applications like monitoring a huge oil pipeline for leaks or vandalism. Those thousands of sensors must be concentrated into a single location for analysis. When the system finds a problem, it can take action to correct that problem. Other applications for MQTT include power usage monitoring, lighting control, and even intelligent gardening. They share a need for collecting data from many sources and making it available to the IT infrastructure.

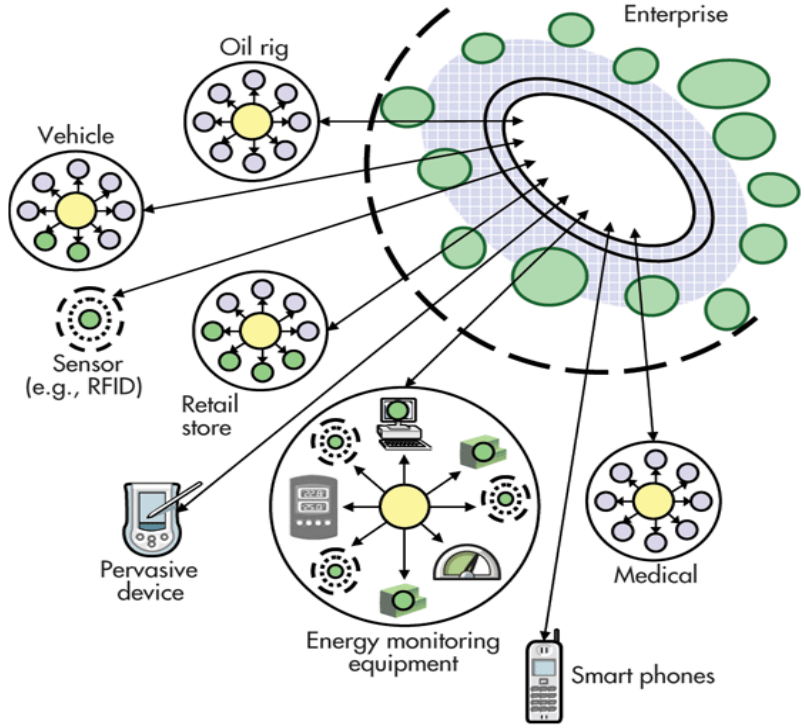

Figure 5: MQTT implements a hub-and-spoke system

C. Hardware Implementation:–

1. Raspberry Pi model B with memory card preloaded with an OS.
2. Bc547 Transistor.
3. 5V SPDT relay.
4. 1N4001 diode.
5. Solder dot prototyping board.
6. 9V battery
7. (Optional) WiFi dongle : Edimax EW 7811UN.
8. USB keyboard.
9. HDMI monitor.

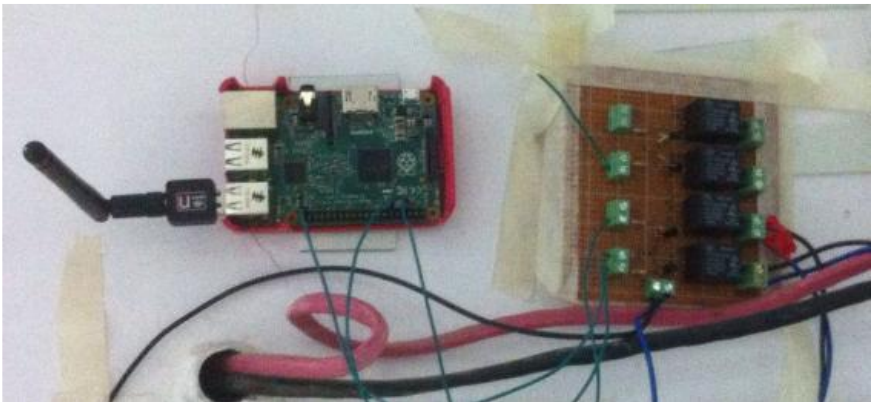

Figure: 6 PCB of the complete hardware interface unit.

D. Software Implementation:-

The Graphical User Interface is designed by using PHP.
Software (Programming languages and OS involved):
1. PHP.
2. HTML/CSS.
3. Python.
4. Linux/Rasbian

IV.CONCLUSION

Very soon in near future, the traditional grids of today will evolve into a robust, effective, environment friendly and energy efficient system known as the Smart Grid. Even our home will undergo its own transformation towards the smart homes that will be in constant interaction with the grid in an effort for better energy management and full home automation to ensure comfort, security and privacy. Present paper sought to design a smart home to be controlled by the Raspberry Pi via the IoT. This system is also equipped with automated lights and virtual switches for controlling lights and appliances in the home remotely using external or internal networking with the Raspberry Pi via an HTML page. Full functionality of prototype indicates that devices like Raspberry Pi can play very important role in designing smart home of the future at very low cost. An energy aware smart home can be developed using Raspberry Pi.

REFERENCES

1. Remote-Controlled Home Automation Systems with Different Network Technologies.
2. IOT based home automation using IBM BLUEMIX diyhacking.com.
3. Home automation system using raspberry pi 2 using huckster.iot
4. Google.com.
5. British Sachdeva and Shrutik Katchii,“ A Review Paper on Raspberry Pi” Vol.4, No.6,Dec 2014.
6. "Internet of Things Global standards Initiative”. ITU. Retrieved 26 June 2015.

