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IOT Based Smart Home System Technologies

V.Jyothi[1], M. Gopi Krishna[2], B. Raveendranadh[3], Debashree Rupalin[4]
[1,2,3,4]*Assistant Professor, Department of ECE, Vardhaman College of Engg, Hyderabad TS, India.*

ABSTRACT:- The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems. It results improved efficiency, accuracy and economic benefit in addition to reduced human intervention. On the other hand, IoT systems could also be responsible for performing actions, not just sensing the things. Intelligent Shopping systems, for example could monitor specific users purchasing habits in a store by tracking their specific mobile phones. Other applications that the Internet of Things can provide enabling extended home security features and home automation. This paper relates smart home or home automation which induce technology for home atmosphere which is usage to provide ease and protection to its occupants.
Keywords:- Internet of Things, automation, sensors.

I. INTRODUCTION

A. Overview of Internet of Things

The internet of things (IoT) becoming a rapidly increasingly growth topic of conversation both in workplace and outside of it. It's a concept that not only has the potential to impact how we live but also how we work. This is the concept of basically connecting any device with an on and off switch to the Internet. This includes everything from cell phones, coffee makers, washing machines, headphones, lamps, wearable devices and sensors and actuators to the internet where the devices are intelligently linked together to enable new forms of communication amongst people and themselves almost anything else you . The survey Gartner says that by 2020 there will be over 26 billion to 64 billion connected device. The IoT is a giant network of connected of "things", which is related with people-people, people-things, and things-things. Significant advancement of IoT over the last couple of years has created a new dimension to the world of information and Communication technologies. The increasing technology is leading to anyone, anytime, anywhere connectivity of things with expectation which will extend and create an entirely advanced dynamic network of IoT. The IoT technology can be used for new innovation concepts that can be wide used for development space for smart homes system in order to provide intelligence, comfort, safety and improved quality of life.

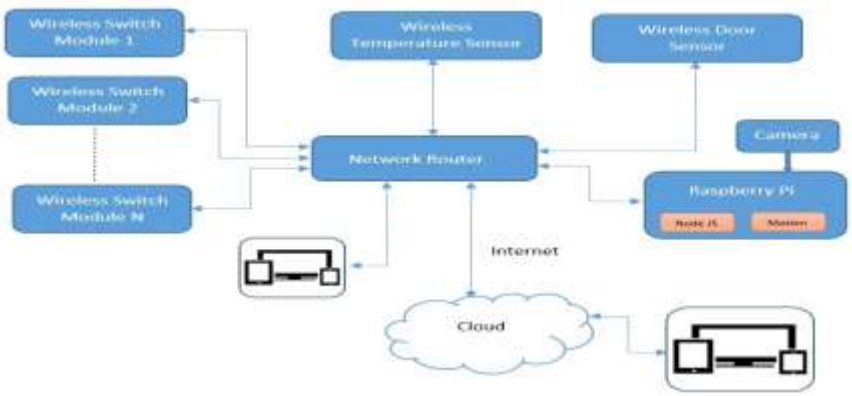


Fig.1: Internet of Things

B. Home automation Techniques

Smart home automation is very popular due to its numerous benefits in promising area, these techniques will controls all the electronic devices which will reduce the human involvement to get minimize. It will provide various benefits such as greater safety, comfort, and security, a more rational use of energy and other resources thus contributing to a significant savings. This research application domain is very important and it will implement in future as it offers very powerful means for supporting and helping special needs of the elderly and people with disabilities for monitoring and control of home appliances. There are a number of factors that needs to be considered when designing a smart home system [7]. The system is very friendly with the dramatic increase in smart phone users, smart phones have gradually turned into all-purpose portable devices

where the people can provide for their daily use. In this paper, a low cost wireless controlled smart home system for controlling and monitoring the home environment is presented. Embedded micro-web server with real IP connectivity is used for accessing and controlling of appliances and other devices remotely from an Android based app, which can be used from any Android supported device. The Raspberry pi is used for the micro web-server thus eliminating the use of PC and the system requires user authentication in order to access home automation system in smart home. Voice activation for switching applications may also incorporate to aid users especially for the elderly and the disabled persons.

Smart homes require sophistication control in its different gadgets which are basically electronic appliances. This has revolutionized the area of home automation with respect to a rapid increased level of affordability and simplicity through the integration of home appliances with smart phone and tablet connectivity [3]. Smart phones are already feature-perfect and can be made to communicate or interact with the other devices in an ad hoc network which has the connectivity options like Bluetooth and wifi. With the advent of mobile phones, Mobile applications development has seen a major outbreak. To Utilizing this opportunity for a smart home, we select the mobile phone commonly because it is found in normal household can be joined in a temporary network inside a home with the electronic equipment's. Android, by Google Inc. provides the platform for the development of the mobile applications for the Android devices. According to the International Data Corporation (IDC) Worldwide Quarterly Mobile Phone Tracker, Android maintained its position in global market share. Bluetooth is a short-range wireless communication technology that comes in handy as the solution while communicating over an adhoc network environment like connecting the home appliances with home environment with mobile phones [7].

The job of a sensor is to convert a physical quantity into numerical data. A single sensor or a number of different types of sensor can be integrated into one single device to collect data from the same spot which can be referred as a sensor node. When many sensor nodes are organized into a distributed network to collect the data from a large indoor environment we call this a sensor network. A data communication link through wire can be established for each of these nodes to transmit collected data to a central data collection sink node. The use of wire has become primitive and proved to be cumbersome for the sensor nodes residing far from the user.

C. Objectives of HAS (Home Automation Systems)

1) **Controlling Home Appliances via Application:** To develop an application that includes the features of switches mode application. Switch Mode can be used to control the switches of home appliances.
2) **Real Time Video Streaming from Web Camera:** To receives the quality video for the camera to the android application. Internal block diagram of Wireless Temperature sensor.
3) **Secure Connection Channels between Application and Raspberry pi*: Use*** of secure protocols over Wi-Fi so that other devices cannot control the home appliances. There are some Options for securing the connection in SSL over TCP, SSH.
4) **Controlled by any device capable of Wi-Fi (Android, IOS, PC):** To make the home appliances flexible in control, any device can be capable of using Wi-Fi based connectivity which will control the home appliances from remote location.
5) **Extensible platform for future enhancement:** The application is to be highly extensible, with possibility of adding features in the future as needed.

II. IMPLEMENTATION OF SHS ON IoT

A. Hardware selection

Whole system was based on a number of open source hardware and software so that the cost of building the system could be kept low. One of the goals while designing the system was to replace traditional personal computer in the system integration. There were quite a few options to choose from including the popular ESP8266 units. We chose the latter because it's economical and has tremendous support in the online community. Each of our sensor nodes was a combination of Arduino and DS18B20 was used as a sample data acquisition sensor.

B. The ESP8266 Wi-Fi Module

ESP8266 is an impressive, low cost WiFi module which is suitable for adding WiFi functionality to an existing controller project via a UART serial connection. These module even used be reprogramming for acting as a standalone WiFi connected device–just add power. The ESP8266 is a Wi-Fi module that costs less than 5 USD. This makes putting your sensors on the net actually feasible. There are lots of excitements about sensor on the Internet and currently the people have done an amazing job deciphering the obscure command structure of this device. There seems to be three ways of using this module, in order of increasing complexity:

- transmitting an AT commands from a computer via an USB to serial adapter. This is mostly useful for testing and setup.

- Interfacing with an Arduino or any other microcontroller and using this board as a peripheral.
- Programming the module directly and use its GPIO pins to talk to your sensors, eliminating the need for a second controller.
-

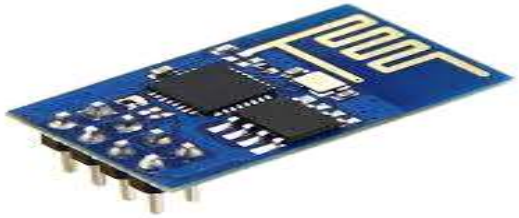


Fig.2: Wi- Fi Module

C. Ds18b20 Temperature Sensor

DS18B20 digital thermometer provides 9-bit, 10-bit, 11-bit and 12-bit Celsius temperature, which equates the temperature resolution of 0.5°C, 0.25°C, 0.125°C, or 0.0625°C. It can also be used for measuring the alarm function with nonvolatile user-programmable upper and lower trigger points. The temperature information can be retrieved over the 1-Wire interface by issuing a Read Scratchpad command once the conversion has been performed. The data is transferred over the 1-Wire bus, LSB first. The MSB of the temperature register contains the "sign" (S) bit, denoting whether the temperature is positive or negative. DS18B20 can operated temperatures range from -55C (-67F) to +125C (257F), which is perfect for general usage at home. Each DS18B20 has a unique 64-bit serial code, which will allow multiple DS18B20s to function on the same 1-Wire bus [6]. Thus, it is very simple to use one microprocessor to control many DS18B20s distributed over wide area. Some of the Applications may benefit from this feature that include HVAC environmental controls, temperature monitoring systems inside buildings, equipment, or machinery, and process monitoring and control systems.

Fig.3: DS18B20 temperature sensor

D. Lm1117 Voltage Regulator

The LM1117 is a series of low dropout voltage regulators with a dropout of 1.2V at 800mA of load current. The LM1117 is available in an adjustable version, which can set the output voltage from 1.25V to 13.8V with only two external resistors. In addition, it is also available in five fixed voltages, 1.8V, 2.5V, 2.85V, 3.3V, and 5V. The LM1117 offers current limiting and thermal shutdown. Its circuit includes a Zener trimmed band gap reference to assure output voltage accuracy to within ±1%. The LM1117 offers current limiting and thermal shutdown. Its circuit includes a Zener trimmed band gap reference to assure output voltage accuracy to within ±1%.the LM1117 Operating Temperature Range will be LM117 -55 °C ≤ Tj ≤ +150 °C .A minimum of 10-µF tantalum capacitor is required at the output to improve the transient response and stability.

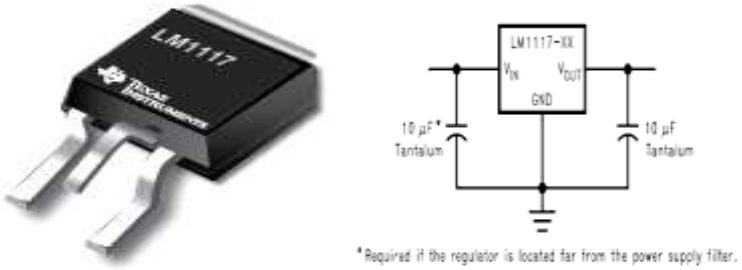


Fig.4: LM117 voltage regulator

E. MOC3063 Optocoupler

Opto-isolators or Opto-couplers, are made up of a light emitting device, and a light sensitive device, all wrapped up in one package, but with no electrical connection between the two, just a beam of light. The light emitter is nearly always an LED. The light sensitive device may be a photodiode, phototransistor, or more esoteric devices such as thyristors, TRIACs etc.

A lot of electronic equipment nowadays is using opt coupler in the circuit. An opt coupler or sometimes refer to as opt isolator allows two circuits to exchange signals yet remain electrically isolated. This is usually accomplished by using light to relay the signal. The standard opt coupler circuits design uses a LED shining on a phototransistor-usually it is a npn transistor and not pnp. The signal is applied to the LED, which then shines on the transistor in the IC.

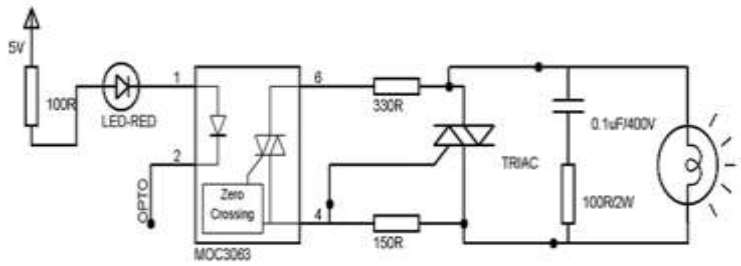


Fig.5: Optocoupler

F. Raspberry pi

The Raspberry Pi is small series of Credit card size single board computer or a Programmable PC which is Developed in U.K. by Raspberry - Pi foundation in 2009 .with the Concept initialized by Eben Upton works at Broadcom Supported by University of Cambridge Computer Laboratory & Broadcom" and also to promote the teaching of basics in schools and some developing countries. To improve the study of basic computer science in schools & to develop interest among higher studies the revolution in the market with over 3 million units sold . The Raspberry Pi 2 designed for several board configurations.

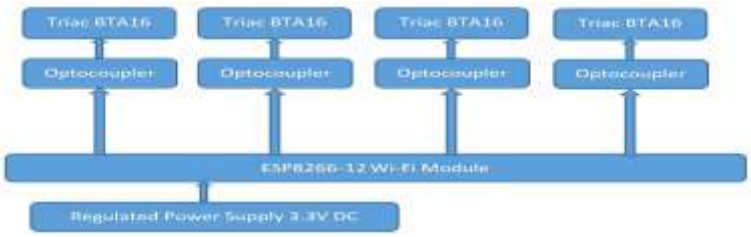
Fig.6: Raspberry Pi

III. SYSTEM ARCHITECTURE

Overview

The android OS provides the flexibility of using the open source. The inbuilt sensors can be accessed easily. We have built an application with following features. Android Phone acts as a client and data are sent via sockets programming.

- Switch Mode
- Video Mode



Switch mode uses the radio buttons that are used to control the home appliances. The radio button sends the status of the switch. Video Mode shows the video stream of the room. The captured video is streamed at the android application. All the devices are connected to a common network [9]. Smartphone, raspberry pi and Web Camera are connected to the common network Router is used to create a common network.

Wi-Fi Adapter is used to connect raspberry pi to the network. Raspberry pi is used to maintain the server. The pi collects the data analyses it and further activates GPIO pins as necessary. The GPIO pins of raspberry pi are connected to the relay. Relay switch are used to connect the home appliances.

Sensor Interfacing

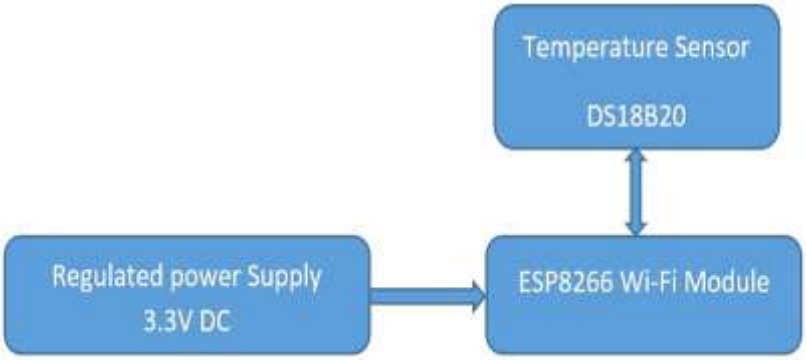


Fig.7: Internal block diagram of Wireless Temperature sensor

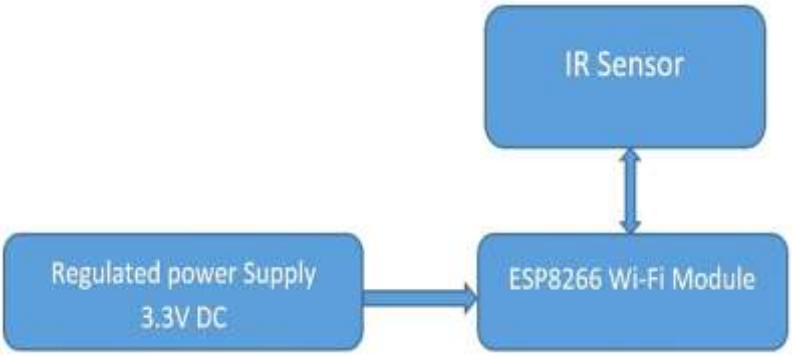


Fig.8: Internal block diagram of Wireless Door Sensor

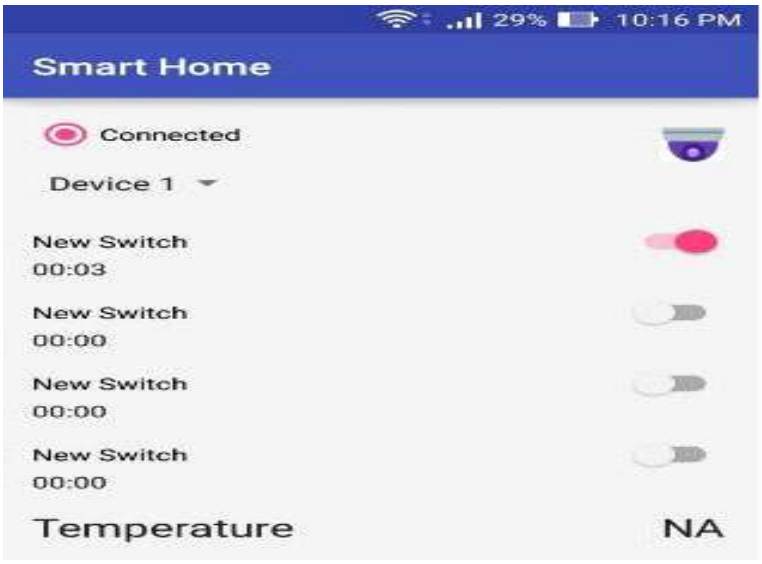
IV. RESULTS AND CONCLUSION

In this proposed system we send the command via android mobile in JSON format.

Fig.9: Initially the bulb is in off mode and module is waiting for command to execute.

Mobile app

When the switch is turned on in the mobile app, the mobile app sends the following command to server.




```
{
"cmd": "send",
"type": "mobile",
"to": "Device 1",
"data": "1000"
}
```

The server decodes the above JSON command and forward to wireless switch whose id is “Device 1”. The wireless switch decodes JSON string and fetches data and changes the state of switches on/off depending on the data. The device will send the response to server in JSON format as follows

```
{
"cmd": "send",
"type": "module",
"data": "1000",
"from": "Device 1"
}
```

The node JS server receives response from the wireless switch module and notifies to all active mobile users who are all connected to the server to update status of switches in all the mobiles. The nodeJS server send the following command to all the mobile clients.

```
{
"cmd": "send",
"data": "1000",
"from": "Device 1"
}
```

Fig.10: The final output response with bulb turned on accordance with the request from the mobile app.

Fig.11: Above figure shows live video streaming on android app.

The webcam connected to Raspberry-pi captures video and we can stream the video in LAN with the help of "Motion" software. This software captures video and stores in memory only when motion is detected.

REFERENCES

[1]. G. Kortuem, F. Kawsar, D. Fitton, and V. Sundramoorthy, "Smart objects as building blocks for the internet of things," Internet Computing, IEEE, vol. 14, pp. 44-51, 2010.

[2]. R. J. C. Nunes and J. C. M. Delgado, "An Internet application for home automation," in 10th Mediterranean Electrotechnical Conference (MELECON 2000), Lemesos, 2000, pp. 298-301.

[3]. 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.

[4]. S. Anwaarullah and S. V. Altaf, "RTOS based Home Automation System using Android," International Journal of Advanced Trends in Computer Science and Engineering, vol. 2, pp. 480- 484, January 2013.

[5]. Interactive Applications for Smart Living," in 2nd International Conferenceon Innovations in Bioinspired Computing and Appplications (IBICA 2011), pp. 309-312.

[6]. D. Javale, M. Mohsin, S. Nandanwar, and M. Shingate, "Home Automation and Security System Using Android ADK," International Journal of Electronics Communication and Computer Technology (IJECCT), vol. 3, pp. 382-385, March 2013.

[7]. J. Potts and S. Sukittanon, "Exploiting Bluetooth on Android mobile devices for home security applications," in Southeastcon, 2012 Proceedings of IEEE Orlando, FL 2012.

[8]. R. A. Ramlee, M. H. Leong, R. S. S. Singh, M. M. Ismail, M. A. Othman, H. A. Sulaiman, et al.,"Bluetooth Remote Home Automation System Using Android Application," The International Journal of Engineering And Science, vol. 2, pp. 149-153, 11, January 2013.

[9]. M. Yan and H. Shi, "Smart Living Using Bluetooth Based Android Smartphone," International Journal of Wireless & Mobile Networks, vol. 5, pp. 65-72, February 2013.

[10]. N. Swamy, O. Kuljaca, and F. L. Lewis, "Internet-based educational control systems lab using Net Meeting" IEEE Transactions on Education, vol. 45, pp. 145-151, 07 August 2002.

[11]. K. K. Tan, T. H. Lee, and C. Y. Soh, "Internet-based monitoring of distributed control systems - An undergraduate experiment," IEEE Transactions on Education, vol. 45, pp. 128-134, May 2002.