



Web based online Home Automation and security system based on wireless Video Streaming using Internet of Things

Palla Suneetha, Kiran. Venneti

M.Tech (Embedded Systems), ACOE, Surampalem, Asst.Professor (ACOE), Surampalem
vaibhavipalla@gmail.com, enneti.kiran47@gmail.com

Abstract: The present research work proposes an efficient implementation for IoT (Internet of Things) used for monitoring and controlling the home appliances via World Wide Web. IoT can be viewed as an evolution rather than a revolution. IoT involves leveraging connectivity to efficiently collect and analyze the data from various sensors and relay the data to the mobile or personal computer through Wireless connectivity. The idea behind our research work is managing all the functions of a home with a centralized control system. Introducing the Raspberry Pi to the world of home automation provides numerous customizations to turn a regular home into a smart home. Raspberry Pi provides a low cost platform for interconnecting electrical/electronic devices and various sensors in a home via the internet network. The main objective of the present work is to design a smart home using various sensors which can be controlled and monitored by the Raspberry Pi via the Internet of Things (IoT). This will help the house owners to provide a simple, fast and reliable way to automate their environment. This paper focuses on two aspects of smart home i.e. home automation and home security.

Keywords: Home Automation, Home Security, Raspberry Pi, Wi-Fi Hotspot, Live video streaming.

I. Introduction

The Internet of Things lets you automate your home and monitor it from afar around the world. The whole point of smart home is to make simple tasks even easier.

The first aspect of the research work describes about the implementation and deployment of wireless video streaming system and accessibility to Home environment for authenticated people only. The design and development of home automation and security system, based on live video streaming to confirm visitor identity and to remotely monitor and control the electrical/electronic load has been reported in this paper. If any visitors arrive, the Raspberry pi continuously streams the video over the Wi-Fi network. The owner can directly login and interact with the embedded device in real time through webpage.

The second aspect of the research work describes about the home automation system which was implemented around the Raspberry Pi, which includes controlling of an AC light, DC Fan and continuous monitoring of Temperature and Humidity parameters. In addition Temperature controller was inbuilt that turns an air-condition unit or fan on/off automatically under given conditions i.e. when the temperature exceeds 45C. Python codes were written for interfacing each sensor and a prototype of smart home was developed. It has a variety of features such as energy efficient, intelligence, low cost, portability and high performance. Our approach to home automation and security system design is standardized. In this research project, we tried to increase these standards by combining new design techniques and developed a low cost web based online home automated security system. Smart home was fully tested and performance was found satisfactory.

II. Motivation

A number of significant technology changes have come together to enable the rise of the IoT in Home Automation which are listed below

- **Cheap sensors** – Sensor prices have dropped to an average 60 cents from \$1.30 in the past 10 years.
- **Cheap bandwidth** – The cost of bandwidth has also declined precipitously, by a factor of nearly 40X over the past 10 years.
- **Cheap processing** – Similarly, processing costs have declined by nearly 60X over the past 10 years, enabling more devices to be not just connected, but smart enough to know what to do with all the new data they are generating or receiving.
- **Smartphone's** – Smartphone's are now becoming the personal gateway to the IoT, serving as a remote control or hub for the connected home, connected car, or the health and fitness devices consumers are increasingly starting to wear.
- **Ubiquitous wireless coverage** – With Wi-Fi coverage now ubiquitous, wireless connectivity is available for free or at a very low cost, given Wi-Fi utilizes unlicensed

spectrum and thus does not require monthly access fees to a carrier.

- **Big data** – As the IoT will by definition generate voluminous amounts of unstructured data, the availability of big data analytics is a key enabler.

III. Existing & Proposed Systems

A. Past Methodologies

There are different Past methodologies and related work during the evolution of better security and control of wide variety of appliances from remote places via different means viz. Bluetooth, GSM, GPRS, Xbee, Zigbee and Personal area networks. Different kinds of Home automation and security systems during chronological order of their development are GSM based Home Automation System, Bluetooth Based Home Automation, Smart Phone Based Home Automation, ZigBee & Xbee Based Home Automation, GPRS based Home automation system, Wireless Control Systems and Mixed hybrid systems i.e..combination of two or three previous automation systems. Our research work is the high end Online Home automation and security system console based on WiFi. Easy Access, Very simple form of automation, Fast control, Rugged Security are the proponents of our model.

B. Proposed Systems

Every user who is experienced in the existing system may think of a system that may add more flexibility and run with some common applications such as android. This work is designed in such a way to avoid the disadvantages of the existing system. The proposed system supports more elasticity, comfort capacity and safety.

The main objectives is to design and to execute an cost effective and open source home automation system that's capable of leading most of the home and sustain the house automation system. The predictable system contains a great elasticity by using wireless reliable technology to interconnecting various modules to the server of home automation system. This in turn reduces the deployment cost; will add to the flexibility of advancement, and system reconfiguration. The projected system can make use of wireless Wi-Fi HotSpot connections between various sensor, hardware modules and server, and various communication protocols between users and server.

IV. Internet of Things

The Internet of things (IoTs) can be defined as connecting the various types of objects like smart phones, personal computer and Tablets to internet, which brings in very new-fangled type of communication between things and people and also between things. With the introduction of IoT, the research and development of home automation are becoming popular in the recent days. Many of the devices are controlled and monitored for helps the

human being. Additionally various wireless technologies help in connecting from remote places to improve the intelligence of home environment. An advanced network of IoT is being formed when a human being is in need of connecting with other things. IoTs technology is used to come in with innovative idea and great growth for smart homes to improve the living standards of life.

A. IoT Architecture

The IoT-based architecture provides high-level flexibility at the communication and information. It is an approach which is relevant in many different environments such as Wearable's, connected cars, connected homes, connected cities, industrial monitoring, transportation, oil and gas and health care. The IoT project aims to bring out the various opportunities of using IPv6 and other related standards to overcome the disadvantages using of the Internet of Things. The IoT projects proves a dominant and thorough study of all sensible functionalities, mechanisms and various protocols that can be used for building IoT architectures however interconnections may occur between all totally different IoT applications.

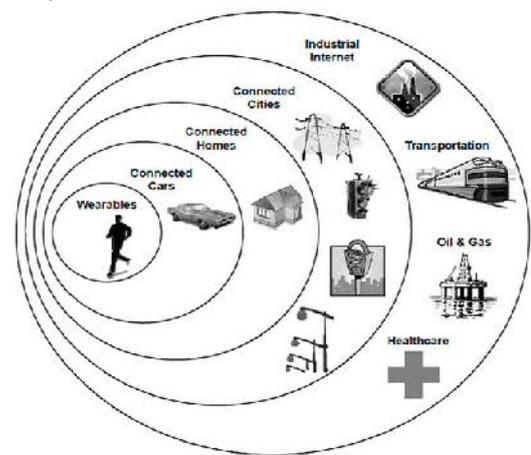


Fig1: IOT Architecture

V. System Architecture

The system Architecture consist of Raspberry Pi 2 module, USB Camera, Wi-Fi Module, a pair of ULN 2003 IC's, MCP3202 IC, DC Motor, a pair of relays, LCD, AC light, DC fan and a buzzer. Raspberry Pi2 is a single board computer consist of ARM7 processor, 40 GPIO pin, 4 USB port, HDMI port, micro SD card slot, Ethernet socket and 3.5mm audio jack. ULN 2003 IC is used to drive DC motor. USB camera feeds real time video to network. It is connected by simple USB port. Captured video can be sent to remote location. It captures video with resolution of 1024x768 pixels. Wi-Fi adaptor is used to connect the Raspberry Pi2 module to internet. Fig. 2 shows the block diagram of proposed system.

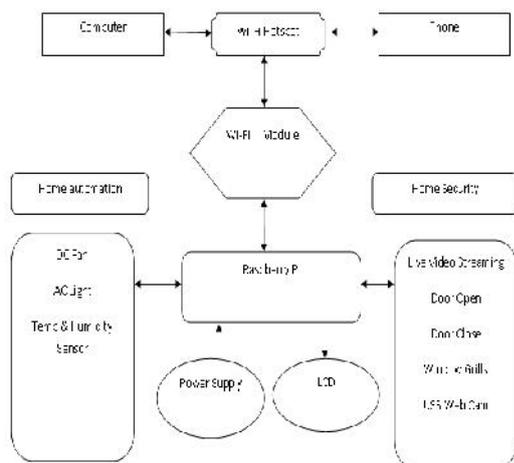


Fig2. Block Diagram of Working model

A. Working

As the system is switched on camera sends the video to remote location using Wi-Fi adaptor. Raspberry Pi2 communicates to cloud via server client model. At client side, client opens the web page and requests the server via entering valid IP address into address bar of web page. User can watch live video from

anywhere in the world. Motion of system can be controlled via pressing the control buttons that are provided on web page. Also the movement of camera is possible with control buttons available on webpage.

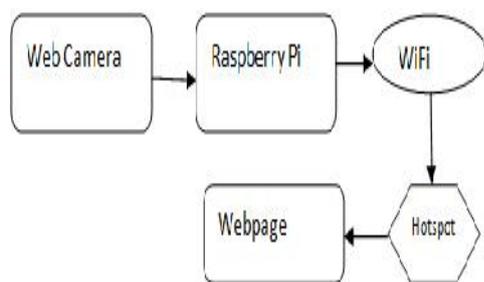


Fig3. Data Flow from USB Camera to Web Page

Fig. 3 shows data flow from USB Camera to web page. First data is collected from USB Camera and sent to Raspberry Pi2 via USB port. Raspberry Pi2 sends this data to cloud using Wi-Fi adaptor with use of server-client model. This video can be watched lively on webpage.

B. Video Streaming using H.264 encoding and decoding

H.264 is industrial video compression standard. It is currently most commonly used format for recording, compression, and distribution of high definition video. After the compression of digital video H.264 convert this video into a format that takes up less capacity. When these compressed data is stored or transmitted, it consume less space and communication time. This Compression technique is most commonly use in digital TV, DVD-Video, mobile TV, video conferencing and internet video streaming uses.

Applications:

H.264 improves compression performance and transmission support. An H.264 encoder can select from a broad variety of compression tools, making it appropriate for proper applications ranging from low-bit rate, low-delay mobile transmission through high definition consumer TV to professional TV production. H.264/AVC is being adopted for an increasing range of applications, including:

- High Definition DVDs (HD-DVD and Blu-Ray formats)
- HD Television broadcasting in Europe
- Apple products including iTunes video downloads, iPod video and MacOS
- NATO and US DoD video applications
- Mobile TV broadcasting
- Internet video

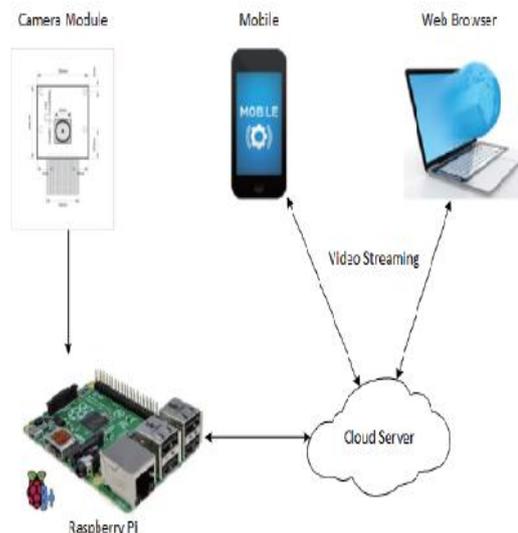


Fig4. Live Video streaming to mobile and laptop

Advantages of the System

1. System is portable and can be used in many places
2. Low cost
3. Common man with basic knowledge of computer can operate it easily

4. Controlling of camera movement and navigation of whole module from web page is possible with PC as well as Android based mobile phone.

VI. System design

A. Raspberry pi

The Raspberry Pi is a low cost credit card sized single-board computer developed by raspberry pi foundation. Raspberry pi is controlled by a modified version of Debian Linux optimized for the ARM architecture. The core of the home automation system is this minicomputer. Here we are using model B plus. The setting up of raspi consists of selecting raspbian OS from prebuilt SD card. The prebuilt SD card consists of raspbian, arclinux, pidora, open ELEC, risc OS operating system. After the OS selection we need to configure raspberry-pi using Raspi -config command. We can enter into raspi desktop using startx command.

B. Wifi Router Configuration

The wifi unit provides the medium for communication. It can be also configured to make security services . The wifi should be configured with a certain address and user commands will be directing through wifi unit. We may use sudo nano /etc/network/interfaces for configuring wifi with raspberry-pi.

C. System working details

When the system is powered up, a “welcome” note is displayed on the LCD followed by the Project Title “Web based online Home Automation and security system based on wireless Video Streaming using Internet of Things”. The Wi-Fi Modem attached to the Raspberry Pi through the USB slot continuously scans for the Wi-Fi Hotspot configured with the user id as project and password setting with project1235 and automatically gets connected to the corresponding network. Once the raspberry pi is connected with the network its assigned an IP address and all the sensors and electrical/electronic load connected with the raspberry pi comes into the network. Once the system is connected to the network automation is done from anywhere around the world. The webpage



raspberrypi:5000 is used for load control and the webpage raspberrypi:8081 is used for live video streaming.

VII. Results

With the right level of ingenuity, the sky's the limit on things you can automate in your home, but here are a few basic categories of tasks that you can pursue:

- Automate your lights to turn on and off on a schedule, remotely, or when certain conditions are triggered.
- Automate your Fan to turn on and off on a schedule, remotely, or when certain conditions are triggered.
- Set your air conditioner to keep the house temperature when you're at home and save energy while you're away.
- Open your blinds during the day and shut them at night (or when it's particularly hot).
- Feed your pets on a schedule and with pre-determined amounts of food.
- Open your garage door with web commands.

Fig5. Practical Implementation details



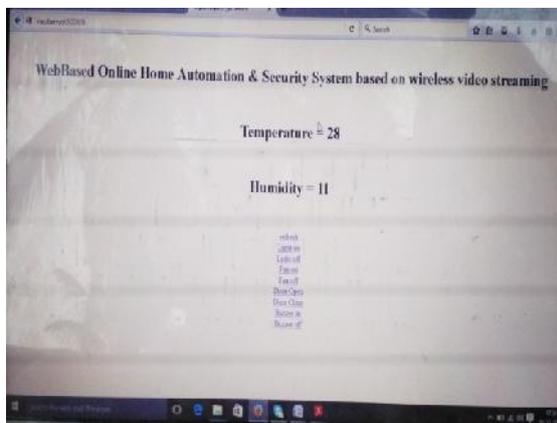


Figure 6: raspberrypi:5000 webpage for controlling the load and monitoring the sensors

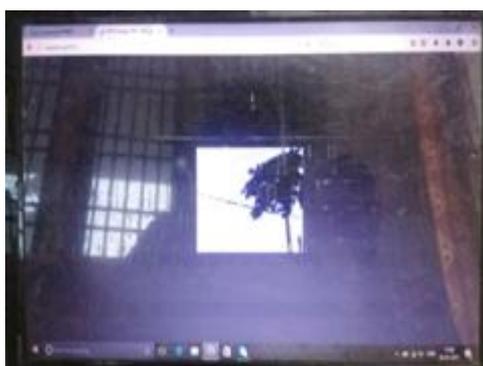


Figure 7: Raspberrypi:8081 webpage for live video streaming

VIII. Conclusion

In this paper, we have introduced the event of a home management and security system exploitation using Raspberry pi and Internet of Things technology. The system is suitable for real-time home safety monitoring and for remotely controlling the home appliances and protection. The system may be

employed in many places like banks, hospitals, labs etc that dramatically cut back the hazard of unauthorized entry. Proof may be given to the safety department if any theft issue happens. The various future applications may be used by controlling various household devices of house with internet, Industrial automation and management through internet, and improvement of security problems in extremely restricted areas. Surveillance system is available with various features. Selection is based on various factors such as cost, video quality etc. Proposed system is cost effective as well as user friendly. It has application in different fields like military, defence, house, office and environment monitoring. System can be enhanced by using face detection and recognition to follow a particular person like children below 4 years so that they are continuously in front of our eyes.

References:

- [1] Bassi, Alessandro. Enabling Things to Talk: Designing IoT Solutions with the IoT Architectural Reference Model, 2013, Vol. 1 No. 1, 1-12.
- [2] Dennis, A. K. 2013. Raspberry Pi Home Automation with Arduino. Packt Publishing
- [3] Upton, E. Halfacree, G. 2014 Raspberry Pi User Guide, 3rd. Ed. Wiley.
- [4] Richardson, M. Wallace, S. 2014 Getting Started with Raspberry Pi, 2nd. Ed. Maker Media Inc.
- [5] Bradbury, A. Everard, B. 2014 Learning Python with Raspberry Pi. Wiley.
- [6] FOUNDATION, RASPBERRY PI. 2014. NOOBS SETUP. Accessed 11 21, 2014. <http://www.raspberrypi.org/help/noobs-setup/>.
- [7] M. El-Desouki, M. J. Deen, Q. Fang, L. Liu, F.Tse, and D. Armstrong, "Cmos image sensors for high speed applications," *Sensors*, vol. 9, no. 1, pp.430-444, 2009.
- [8] U. Muehlmann, M. Ribo, P. Lang, and A. Pinz, "A new high speed cmos camera for real-time tracking applications," in *Proc. IEEE Robot. Autom.*, 2004, vol. 5, pp. 5195-5200.

Authors Biography



Miss. Palla Suneetha received her BTech degree in Electronics and Communications Engineering from Sri Sai Aditya Institute of Science and Technology in the year 2011. and presently pursuing M.Tech in Embedded systems from Aditya College of Engineering. Her areas of

Interest includes Embedded systems and VLSI design and Communication systems.



Mr. Venneti. kiran received M.Tech degree in Embedded Systems from Hindustan University in the year 2011 and presently working as an Assistant Professor in Aditya College of Engineering. His areas of Interest includes Embedded systems and Robotics.