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Door Access Control Using IoT Device

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Abstract

The system is about remotely managed Door accessibility, voice alerting through Smart Phone, and receive captured image of visitor at Door as Email alert. Smart home security control system has become indispensable in daily life. The design and development of a home security system, based on human motion detection and remotely monitoring technology, to confirm visitor identity and to control Door accessibility has been reported in this paper. This paper describes about the implementation and deployment of wireless control system and accessibility in to a home environment for authenticated people only. A PIR motion sensor and Camera module are used to detect motion and capture images respectively are dedicatedly make the security system alive as per the request. Electromagnetic door lock module operate the door accessibility, has been designed and developed. The proposed system uses controller interface system with Raspberry Pi, which is low cost and consume smaller amount of power. When visitor motion detected at Door, Camera module interfaced to Raspberry Pi capture images, save it on system and send it as Email alert via TCP/IP. The concerned authority can control the system and view video stream of camera module through Smart mobile Phone. The system also provided concerned authority to use Smart Phone to send command for voice alert when intruder identified.

Keywords—PIR; Raspberry Pi; PiCamera module; SSHclient; Door acess;Voice alert; Email alert.

I. INTRODUCTION

An efficient, low power consumption and low cost embedded access control system for Smart home security and remote monitoring[3] based on motion detection is very important for wide range of commercial and security application. Many countries are gradually adopting smart home security control system. Today most of the home and office appliances that we interact with contain microprocessors. All of these appliances have some user interface, but many users become frustrated with the difficulty of using the complex functions of their appliances. The proposed system have added features like view video stream through mobile phone. Additionally, voice alert or siren activated to alert neighbors when intruder detected. The system identifies the visitor's presence, capture and transfers the image through email automatically to homeowner to recognize the visitors. The system also generates voice output whenever a person tries to enter into the house. The user can directly login and interact with the embedded device in real time without the need to maintain an additional server. It has a variety of features such as energy efficient, intelligence, low cost, portability and high performance.

II. SYSTEM ARCHITECTURE

Smart home security system consists of two components, Embedded Control Unit (ECU) is part of Smart home where security system implemented and Remote Control Unit (RCU) is a framework implemented on Users smart phone.

A.Embedded Control Unit (ECU)

ECU is an efficient, low power consumption and low cost embedded access control system for Smart home security and allows user to remote monitoring and controlling. ECU consists of Raspberry Pi set up with Raspbian Operating System on installed SD card. PIR motion sensor and PiCamera interfaced with Raspberry Pi to detect visitor's motion at Door and capture image respectively. Captured images with time and date are saved on SD card. Raspberry Pi configured for enabled SSH and camera. ECU Candidates for providing interfaces because they are common, have communication capabilities to allow connection to appliances, and are already being used for a wide range of different applications. Our framework includes an abstract specification language for describing appliances, a two-way communication protocol, and automatic interface generation software that allows user interfaces to be customized to users and the devices they are using.

The most important part of any home security system is accurately detecting visitor who enter and leave through the door. An entrance guard can be managed remotely, detecting visitors at Door and alerting to user via mobile phone is the most natural way to perform security. The proposed system have added features like view video stream through mobile phone. Additionally, voice alert or siren activated to alert neighbors when intruder detected. The system identifies the visitor's presence, capture and transfers the image through email automatically to homeowner to recognize the visitors. The system also generates voice output whenever a person tries to enter into the house. The user can directly login and interact with the embedded device in real time without the need to

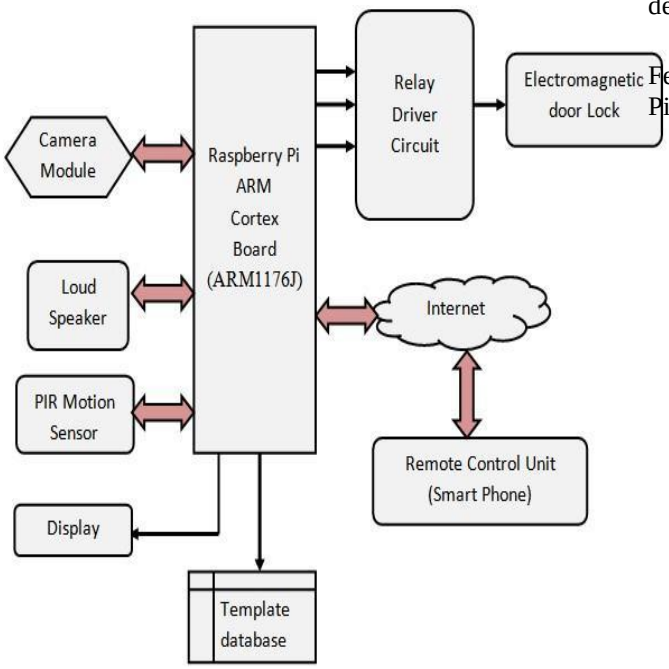
maintain an additional server. It has a variety of features such as energy efficient, intelligence, low cost, portability and high performance.

B. Remote Control Unit (RCU)

RCU is a software tool implemented on Users Smart Phone. Provide GUI (Graphical User Interface) to send predefined Linux Terminal Commands via SSH to ECU. SSH is a secure protocol and the most commonly used to administrate and communicate with Linux servers. RCU is implemented on android platform using Java Script on JDK
(Java Development Kit) and Eclipse IDE.

III. BLOCK DIAGRAM

The System architecture of Smart Home Security System is shown in the figure 1. Raspberry Pi, PiCamera and Power supply forms the entire security system to be installed at the required place. PIR motion sensor is connected to GPIO pins of Raspberry Pi. We can use LCD monitor for setting up Raspberry web server. Loudspeaker mounted at Audio Jack of Raspberry Pi. Relay Driver circuit with IC ULN2003 is interfaced to Raspberry Pi to control Electromagnetic Door Lock. The image captured can save with time and date on SD card or USB Pen drive connected on Raspberry Pi.



IV. SYSTEM DESCRIPTION

The remote monitoring and controlling of ECU over the Internet can be mechanized by setting up certain network architectural design strategies such as SSH and applying Internet protocol (IPV6) communication standards. If any visitors arrive, ECU capture image of visitor, save it and sends it to an appropriate email including the details of time and date of captured image. The owner can directly login and interact with the ECU. The images captured and the video recorded will be directly streamed on user pre-decided android app on Smart Phone. User can access the video directly using the Static IP address or can also stream on local domain with the help of websites.

A. Raspberry Pi

Raspberry Pi board is a miniature marvel, packing considerable computing power into a footprint no larger than a credit card. The processor at the heart of the Raspberry Pi system is a Broadcom BCM2835 system-on-chip (SoC) multimedia processor. This means that the vast majority of the system's components, including its central and graphics processing units along with the audio and communications hardware are built onto that single component hidden beneath the 512 MB memory chip at the centre of the board. It's not just this SoC design that makes the BCM2835 different to the processor found in your desktop or laptop, however. It also uses a different instruction set architecture (ISA), known as ARM. The Raspberry Pi, by contrast, is designed to run an operating system called GNU/Linux Raspbian. Hereafter referred to simply as Linux. Unlike Windows or OS X, Linux is open source: it's possible to download the source code for the entire operating system and make whatever changes you desire.

Features of the Raspberry Pi.

- Model B+ Raspberry Pi with Mounting Points and
- 512MB RAM.
- Broadcom BCM2835 ARM11 700 MHz
- Integrated Video core 4 Graphics GPU capable of playing
- Full 1080p HD Video.
- 4 x USB Ports (Max Output 1.2A).
- Board Power Draw: 600mA.
- HDMI Video Output.
- 10/100Mb Ethernet Port for Internet Access.
- Micro SD Flash Memory Card Slot.
- 40-pin 2.54mm Header Expansion Slot (Which allow for peripherals and expansion boards)
- Dimensions 85 x 56 x 17mm.
- The Raspberry Pi is boot by external memory card with Raspbian Jessie images

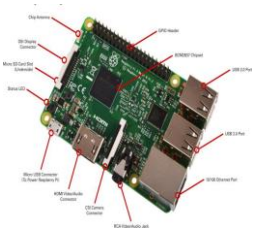


Figure 2: Raspberry Pi3

B. RaspberryPiCamera Module

The Raspberry Pi Camera Module is a custom designed add- on for Raspberry Pi. It attaches to Raspberry Pi by way of one of the two small sockets on the board upper surface.

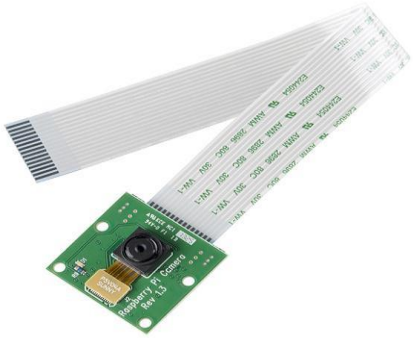


Figure 3: Raspberry PiCamera Module

C. PIR motion Sensor

The PIR (Passive Infra-Red) Sensor is a Pyroelectric device that detects human body motion by measuring changes in the infrared levels emitted by surrounding objects. This motion can be detected by checking for a high signal on a single I/O pin. Incorporating a Fresnel lens and motion detection circuit. High sensitivity and low noise. Output is a standard 5V active low output signal. Module provides an optimized circuit that will detect motion up to 6 meters away Inexpensive and easy to use, The Output can be connected to GPIO pins of Raspberry Pi directly to monitor signal.

V. SYSTEM IMPLEMENTATION

The System was implemented on a Raspberry pi development board in Linux environment, which supports SMTP (Simple Mail Transfer Protocol), TCP/IP, HTTP. The web server Flash File System supports dynamically generated files that can include output data from hardware resources. This type of file is called an embedded server page (ESP).

VI. SOFTWARE IMPLEMENTATION FOR RCU

Software tool RCU implemented to provide GUI (Graphical User Interface) of SSH client as shown in Figure 5 to send predefined Linux Terminal Commands via SSH to ECU. SSH is a secure protocol and the most commonly used to administrate and communicate with Linux servers. SSH Client is implemented on android platform using Java Script on JDK (Java Development Kit) and Eclipse IDE. Android is the first complete, open, and free mobile platform. Developers enjoy a comprehensive software development kit. Eclipse is an integrated development environment (IDE) used for implementing Android application. It is based on Java IDE. Eclipse is written mostly in Java and its primary use is for developing Java application.

VII. EXPERIMENTAL RESULT

The experimental setup shown in the Figure 5 is monitoring the environment for visitor at the Door, the ECU sends the Email alert indicating the update visitor to the authorized users and the user then sent command using SSH Client over Internet to ECU for controlling action which is shown from Figure 5 to Figure 9, respectively. Based on command ECU run the Python script and activate respective devices. For example, a command with the subject ON CAMERA ALERT was sent to ECU to active PiCamera, capture image and it as Email alert if any Visitor at Door found.

VIII. CONCLUSION

This paper presents the design and the implementation of an interactive Smart home security system with Email alert, Web enabled video streaming and remote control of Voice alert and Door accessing system using Smart Phone. The Smart mobile Phone based monitor and automatic control of equipment is forming a trend in automation field. Replacing PC with low-cost single chip processor which can make administrators to get parameters of different remote devices and send control information to field equipments at any time through Internet.

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