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RESEARCH ARTICLE

RASPBERRY PI BASED SMART LOCK SYSTEM

***Karthick, S., Krithika, S. and Malligaraj, S.**

Department of ECE, Kumaraguru College of Technology, Coimbatore, TamilNadu, India

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ABSTRACT

Our paper deals with a security system that lets the user to see a visitor while main office door is locked. If the user is in the middle of the meeting in a conference room and having a visitor at the door, this system will send a notification to mobile or PC to unlock the front door using a Web browser. If the door bell has intercom facility, the user can talk to the visitor when the bell rings. We have used Raspberry Pi to implement our paper the smart lock system.

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INTRODUCTION

The main objective of the paper is to see the visitor at the main door and to allow them inside the office if the person concerned is in the middle of meeting. Raspberry Pi3 is used to control the whole function in the main door. Raspberry Pi3 model B has 1GB RAM Quad Core 1.2GHz CPU. It is a minimized version of active computer. It has a lot of interfacing units. The Pi Cam is used to take picture of the visitor and a mail is sent to registered mail ID using Raspberry Pi3 with the help of Internet. The user can see the picture of the visitor in their mail and can control the Raspberry Pi3 using IOT. The Raspberry Pi3 receives command from IOT and controls the door lock. The pi cam, door bell and relay unit are connected to the Raspberry pi3 board where in turn Raspberry pi3 is connected to the (Owner`s) PC through Internet. The door bell and Pi cam with Raspberry pi3 board are attached to the office door act as the input device where Pi cam Data is stored in internal memory of Raspberry pi3. The Relay unit is connected to the Raspberry pi3 board where it acts as the output device which controls the door lock.

Problem and analysis

Types of smart locks

Numerical Codes and Passwords: Most common form of electronic lock uses a keypad to enter a numerical code or password for authentication. Such locks provide, an audible response to each press. Combination lengths are usually between 4 and 6 digits long.

Security Tokens: Another means of authenticating users that is in practice is to require them to scan or "swipe" a security token such as a smart card or similar, or to interact a token with the lock. For example, some locks can access stored credentials on a Personal Digital Assistant (PDA) or Smartphone, by using infrared, Bluetooth, or Near Field Communication (NFC) data transfer methods.

Biometrics: Biometrics has become more and more prominent as a recognized means of positive identification. Some electronic locks take advantage of technologies such as fingerprint scanning, retinal scanning, iris scanning and voice print identification to authenticate users.

Problems Existing

The basic problems arrived in smart locks

- Very expensive and hard to install.
- The features vary depending on system.
- The security token design of the door lock system is less impressive than smart technology.
- Alternate physical keys needed to enter in to the room.
- Need to monitor batteries regularly.
- The visitor cannot be viewed.
- Password lock can be easily hacked.
- The above problems are addressed in our paper.

**Corresponding author: Karthick, S.,*
Department of ECE, Kumaraguru College of Technology, Coimbatore, TamilNadu, India.

Hardware description

Raspberry pi3

The Raspberry Pi3 is a series of small single-board computers developed in United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools of developing countries. All models feature a Broadcom System on Chip (SOC), which includes an ARM compatible Central Processing Unit (CPU) and an on-chip Graphics Processing Unit (GPU, a Video Core IV). CPU speed ranges from 700MHzto 1.2 GHz for the Pi 3 and on board memory range from 256 MB to 1 GB RAM.

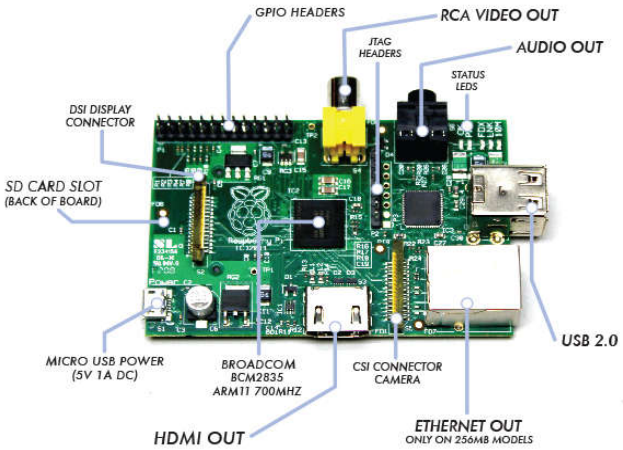

Fig 1 Raspberry Pi3 B+

The Raspberry Pi3 uses a Broadcom BCM2837 SOC with a 1.2 GHz 64-bit quad-core ARM Cortex A53 processor, with 512 KB shared L2 cache

The Raspberry Pi3 is also equipped with 2.4 GHz WiFi 802.11n (150Mbit/s) and Bluetooth 4.1 (24 Mbit/s) based on Broadcom BCM43438 Full MAC (Multiple Access Control) chip and the Pi 3 also has a 10/100 Ethernet port.

Pi cam

The Raspberry Pi 3 and Pi Zero W (Wireless) are equipped with 2.4 GHz WiFi 802.11n (150 Mbit/s) and Bluetooth 4.1 (24 Mbit/s) based on Broadcom BCM43438 Full MAC chip with no official support for Monitor mode but implemented through unofficial firmware patching and the Pi 3 also has a 10/100 Ethernet port. In this module it has a five megapixel fixed-focus camera that supports 1080p30, 720p60 and VGA90 video modes, as well as stills capture. It attaches via a 15cm ribbon cable to the CSI port on the Raspberry Pi. It can be accessed through the MMAL and V4L APIs, and there are numerous third-party libraries built for it, including the Picamera Python library. The header provides 17 Pins that can be configured as inputs and outputs. By default they are all configured as inputs except GPIO 14 & 15.The header provides 5V on Pin 2 and 3.3V on Pin 1. The 3.3V supply is limited to 50mA.The 5V supply draws current directly from your micro USB supply so can use whatever is left over after the board has taken its share. A 1A power supply could supply up to 300mA once the board has drawn 700mA.The easiest way to control the GPIO pins is using the RPi. GPIO Python library.

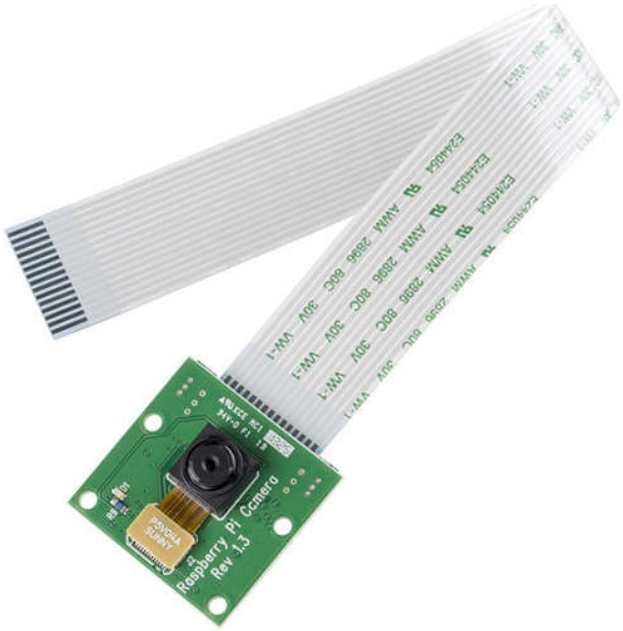

Fig 2 Pi Camera

GPIO (General Purpose Input Output)

Fig 3 Pin Configuration

SOFTWARE DESCRIPTION

Python

Python is a widely used high-level programming language for general purpose programming, created by Guido van Rossum and first released in 1991. Python uses dynamic typing and a mix of reference counting and a cycle detecting garbage collector for memory management. An important feature of Python is dynamic name resolution (late binding), which binds method and variable names during program execution. The design of Python offers some support for functional programming in the Lisp tradition. The language has map(), reduce() and filter() functions; list comprehensions, dictionaries, and sets; and generator expressions. The standard library has two modules (intertools and functions) that implement functional tools borrowed from Haskell and Standard ML.

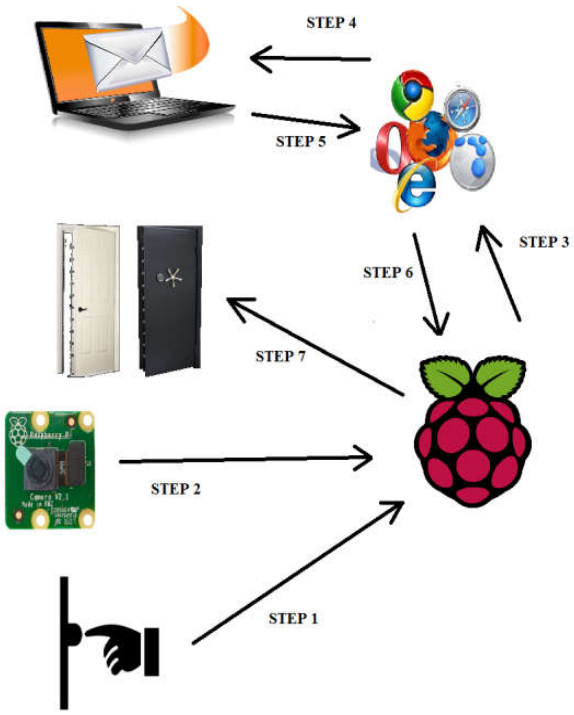

Fig 4 Working Method

SOLUTION AND MECHANISM

Working

- Step 1: When the visitor rings the doorbell (Button switch) the GPIO14 becomes high, the system capture the photo of the visitor through the Pi Cam connected to the Raspberry pi.
- Step 2: Captured photo is sent to the registered email ID configured in the source program.
- Step 3: Photo of the visitor in the mail is verified.
- Step 4: After identification of the visitor, door is either opened or closed.
- Step 5: If we need to get the visitor in to our office, we need to open the door look connected with the Relay switch.
- Step 6: By using Cayenne IOT web server the GPIO pins are individually enabled or disabled.
- Step 7: Through that by making GPIO 17 pin High relay will energize and make the door lock to open circuit

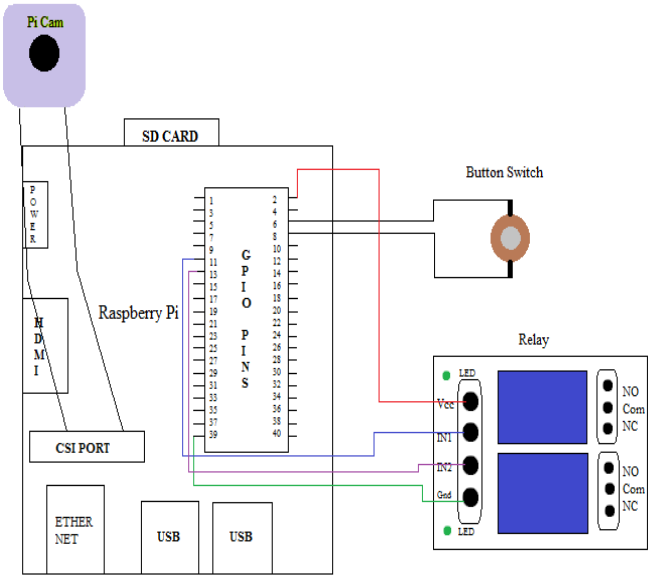

Fig 5 Circuit Diagram

Raspberry Pi runs on standard Raspbian Linux distribution with Ethernet connection (Internet service), GPIO library and software written in python language. Raspberry Pi GPIO 14 Connected to the Switch to make the pin logic level low. Relay connected to GPIO 17 and GPIO 27 which enables or disables the Relay. The Pi Cam connected through CSI Port in Raspberry Pi board.

Conclusion

The Proposed security system is cheap and components are readily available. It is portable and easily upgradable. Adding with different types of sensors along with the proposed system, we can make many smart applications like home automation, Eagle eye monitoring, and Bank door security. Interfacing with servo motor can be useful further to trigger the door to automatically unlock or lock. Smart things compatible alarm system is future improvement of proposed system which notifies intrusion by a loud alarm. This paper is a prototype for various security applications based on raspberry pi and Internet of Things. To ensure that the prototype created during this project can achieve its maximum potential, there are a number of improvements and changes that can be implemented.

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