Automated Doorbell and Door Control System Using Raspberry Pi

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Abstract:
Home automation using IoT (Internet of Things) has emerged as a recent technological trend. In this paper, we will describe the working and implementation of an automated doorbell using Raspberry Pi. Automated systems are largely used nowadays since it is efficient and reliable. Also, these types of systems are greatly helpful for aged and physically challenged people since using IoT, we can remotely control appliances through a flexible web interface. This internet doorbell can also be used for keeping a track of the number of people visiting and ringing the doorbell.

Keywords: Home Automation, Raspberry Pi, Camera surveillance, smart doorbell, Internet of Things(IoT), Python, interactive webpage, visitor log, google SMTP server

I. INTRODUCTION

Internet of Things allow objects to be sensed and controlled remotely across existing network. Internet has created a huge impact in our lives. Hence the concept of IoT can speed up our daily activities and help us live a smart life. "Things" can refer to any type of devices, sensors which collect data through existing technologies and autonomously allows the flow of data between them in order to accomplish various tasks. This concept can be implemented in several real-world problems. With the help of Raspberry Pi, which is a small computer on a single circuit board, we have made a doorbell which is capable of performing functions such as displaying live footage once the doorbell is pressed, mailing a snapshot of the visitor to the user, unlocking the door upon receiving instruction from the user or playing a pre-recorded mp3 file in case the user is unable to receive the guest.

II. HARDWARE IMPLEMENTATION

In this model of Internet Doorbell, we are using a mini sized computer. Here the Raspberry Pi is a credit card sized single board computer with a central processing unit(CPU) and also a chip graphics processing unit(GPU). Its CPU speed ranges from 900MHz to 1.2GHz and it has a RAM of 512MB to 1GB. The space for the Raspberry Pi is made by a mini SD card, which can be a maximum of 64GB. The Raspberry Pi has and HDMI port for monitor connections, 4 USB ports for connecting other accessories. It has also got an inbuilt wi-fi module for an endless wi-fi connection. The latest version of this device has got 40 separate pins. From which 26 are GPIO (General Purpose Input Output) Pins and the rest of the pins are for power supply and ground. The Raspberry Pi 3 Model B is wired up with a normal type of battery operated calling bell. The live wire of the electric bell is parallelly connected with a GPIO pin of the Rpi device and the other is connected with the ground. It is connected with the GPIO pin number 17. As soon as the bell is rung, a short pulse of PWM is sent tom the Raspberry Pi as an input. So, this is the actual role of the calling bell in this project. It plays a very important role in this project as it initiates all other hardware devices and roles

included with this setup. The Raspberry device is wirelessly connected with a wi-fi router system with a static IP address. The role of the router system is to provide an identification to all the devices (with static IP addresses) and help all the devices connect together. This is very important as the host can access the actual doorbell from any part of his house and with any mobile device, just by connecting itself with the main router system. Here in our project we have used TP-LINK router system which has triple antennae and has a better wi-fi range.

Figure.1. Raspberry pi 3 model b

Here we are using a normal android phone as a camera for monitoring all the activities in front of the door. The camera of the mobile can be easily accessed with the help of a client server application, which will be discussed later in the software part. For this particular project we can use any kind of spare android phone camera, without any restrictions. The camera will also be instructed to take a snapshot of the visitor and send it to the Raspberry device.
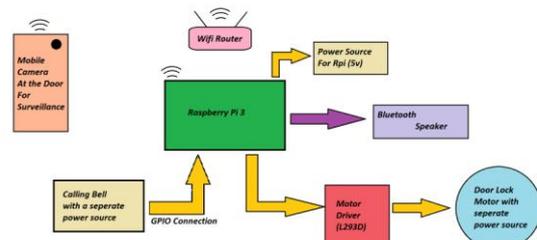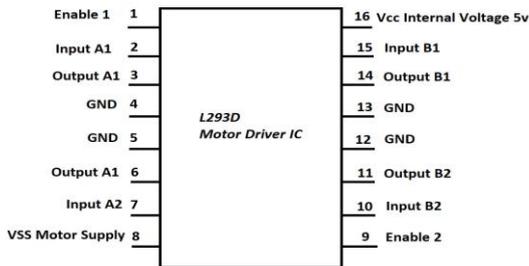

Figure.2. Block diagram of the system

We have also connected a wireless Bluetooth speaker with the Raspberry Pi device. The speaker is securely kept at the door. It's one and only role is to notify the visitor about the status of his request made to doorbell. In simple words it notifies the visitor, either the host is at home or not. The speaker can also convey to the visitor also if he/she is not allowed inside the premises. The sole decision is made by the host and the speaker just interprets his/her decision with the help of some recorded mp3 files. Motor Driver L293D is connected with the Raspberry pi device. It is used for driving the direction of the motor of the door lock in any desired direction. The motor drives any motor shaft either in the clockwise direction or in the counter-clockwise direction. For driving a single motor shaft, we use two input pins from the GPIO pin set, a common ground connection and a separate potential difference (ranged from 9V to 36V) for running the motor. The motor driver itself requires 5V to operate itself. The input logic for driving the motor in our desired directions is given below:

Table .1. Input logic of motor

INPUT A	INPUT B	RESULT
0	0	*Idle [No rotation] [Hi-Impedance state]*
0	1	*Counter-clockwise Direction*
1	0	*Clockwise Direction*
1	1	*Idle [No rotation]*

At last at the door end, we have a door lock which operates with the help of a motor, the motor driver with the help of a desired logic input drives the motor to unlock the door knob as soon as the host allows the Raspberry Pi to do so with the help of a software part. The instructing part to unlock the door lock will be explained in the software implementation.


Figure.3.Block Diagram of Motor Ic

III. SOFTWARE IMPLEMENTATION

In this system, as soon as the doorbell is clicked, the output signal is tapped by the GPIO pin no. 17 of Raspberry Pi. So, pin number 17 in our Raspberry Pi is kept as an input pin. The backend codes of this project is handled by several Python files. There is a parent Python file, doorbell.py, and a few other child python files. Whenever the input in pin no. 17 is high, then this parent file calls the rest of the child Python files. At first, a child python script, snapshot.py is called which takes the snapshot of the visitor. To achieve this, we have installed a spare android phone, used as a camera near the entry gate. We are using a third-party application known as IP Webcam where we have to start the server, the IP address and the gateway of connection to this server is written in the python file(Snapshot.py). With the help of OpenCV python

module, we can easily take the snapshot of the visitor as soon as the bell rings. Now we come back to the parent Python file, and another file named Email.py is called again with the help of a file calling python function. This file mails the snapshot of the visitor to the user which is useful in several ways. The user receives the picture of the visitor which increases security and also a record of the number of people visiting is maintained. This mail doesn't go to the spam folder since we are using SMTP server of Google. These tasks are performed as soon as the bell is pressed, within a moment, since these are pre-instructed in the scripts. In the later parts of the tasks, we need host's intervention for unlocking the door or informing the visitor that he/she is unable to receive the visitor or he/she is not at home. Any mobile or computer device, when connected to a router system, the router sets an IP address against their individual MAC address. The devices which are used in this system, including the raspberry pi, need to be connected to the same network. To achieve this, we have created a HTML file. The raspberry Pi can also be used as a hosting server. In this system, the HTML page we have created is being hosted by the Raspberry Pi.
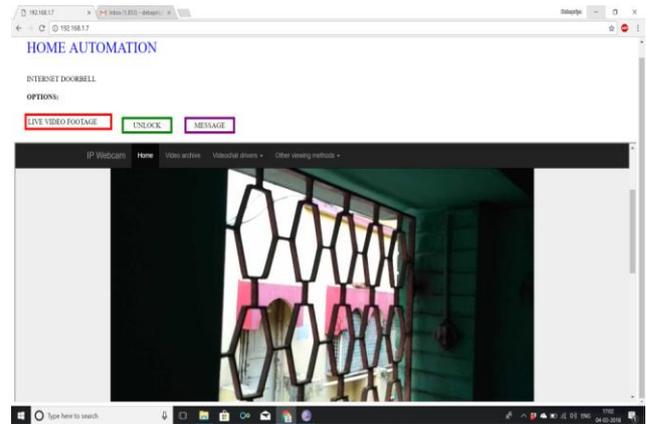
Figure.4. Html page showing live footage

As we can see from the figure of the HTML page. There are buttons for viewing live video footage, unlock the door and sending a message to the visitor by playing a mp3 file from the speaker which is also installed near the entry gate. Showing the live video footage is also done by IP webcam. As soon as the user presses the unlock button, the door unlocks, letting the visitor in. If the user is unable to attend the guest, the user clicks the message button which notifies the visitor that the host is not available. The message is a pre-recorded mp3 file.

IV. CONCLUSION:

This system of Internet doorbell will be really helpful in the current trend of home automation since it is simple and cost-effective to implement. This doorbell will help to keep record of visitors and will also aid in security since the user will be able to view the live footage of the guest. After all the human race is becoming smarter in investing and implementing in such a technology.

V. REFERENCES:

[1]. Raspbian.org, 'FrontPage - Raspbian'. [Online]. Available: http:// www.raspbian.org/ [Accessed: 7-April- 2018].

[2]. Shivakrishna, B.; Venugopal, T., "Design and Development of Daughter Board for Raspberry Pi to support Wi-Fi Communication" IJESC,vol.07,issue.02, Feb 2017

[3]. Shital; Shiva Murthy, G.; Ramakrishna Prasad, A.L., "Arduino Based Home Automation System" IJESC,vol.07 ,issue.10, Oct 2017

[4]. Narendra Kumar, T.; Chandra kala, T., "Smart Home Automation System Using Raspberry Pi" IJESC,vol.06, issue. 05, May 2016

[5]. Vamsikrishna Patchava; Hari Babu Kandala; Ravi Babu, P., "A Smart Home Automation Technique with Raspberry Pi usig IoT" IEEE International Conference on Smart Sensors and Systems, DOI: 10.1109/SMARTSENS.2015.7873584

[6]. RON Robotics, 'L293D Motor Driver IC'. [Online]. Available:https://www.rakeshmondal.info/L293D-Motor- Driver [Accessed: 8-April- 2018].