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# Smart Doorbell: The Product of IoT Era

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**Abstract:** *The latest leap in the digital world is the Internet of Things. It has led the Digital World to an awe. The Internet of Things (IoT) is the network of inter-connected objects able to collect and exchange data over the World Wide Web. IoT has started superseding the conventional ways of doing basic to complex tasks. It aims at taking the existing passive data to a whole new level of active network. What if your doorbell itself is smart enough to detect the visitor and inform you about him/her at the door? What if the doorbell itself is smart enough to recognize the family members and notify you about their presence at the door with their name? What if the owner can leave a message at the door for the visitors to notify about his absence? One such attempt is the SMART DOORBELL. This project intends to substitute the conventional doorbells. As the name suggests it is intelligent. It will leave no person unattended. Also, it is capable of notifying the owner about a person's visit when the owner is not at home. The proposed system also aims at recognizing the visitor from the existing database of visitors using Image Processing (IP). This can be done using Open CV Libraries with Python on a Raspberry Pi board. This project is a subset of the Smart Home concept.*

**Index Terms:** *Image Processing; Internet of Things (IoT); OpenCV; Python; Raspberry Pi*

## I. INTRODUCTION

This project is step towards the idea of Home Automation. With the increasing penetration of digital world into Smart Objects. The basic and conventional methods of various Appliances like refrigerator, Air Conditioner etc. are taking a whole new, revamped alteration. Many a times, a problem arises that a person visits you and you don't even have an idea about it. That person may be your friend or family circle. This is where the Smart Doorbell can help in easing this unexpected snag. The problems that arise with the conventional doorbells are:

- 1) No notification system to render the notifications to owner about the visitor.
- 2) No message system to inform the visitor about owner absence.

Now the Smart Doorbell aims at solving these problems with some added features too. This Doorbell is capable of solving the conventional doorbell drawbacks by:

- 1) Sending the image of the visitor to the owner on the registered e-mail ID. This is done using Raspberry Pi. The RPi is coded in order to capture the image initiated by switch press, attach the image to the email and send it to the owner.
- 2) Delivering a message recorded by the owner to notify the visitor about the owner's absence.
- 3) Recognizing the visitor from the pre-captured image database of family, friends and other frequent visitors and send the name of the visitor to the owner.

## II. RELATED WORK

A comparative analysis was performed for the cost and features between some of the systems in similar domain already available in the market and the system proposed in this paper. The analysis shows that the proposed system encapsulates the features which are not found together in any of the available product. Moreover, the available products do not use Face Recognition and hence do not distinguish between family, friends and unknown visitor

Table 1: Feature Comparison

Feature using IoT	Smart Doorbell	Existing Camera bells	Conventional
Snapshot of visitor	✓	✓	X
Time of visit speaker	✓	X	X
Message notification for user	✓	X	X
Face Recognition	✓	X	X
Cost	56 \$	90\$	8\$

### III. SMART DOORBELL IMPLEMENTATION:

- 1) *Principle And Technology:* The basis of the Smart Doorbell is the technology- Internet of Things (IoT). It is a technology that has connected millions of users and the devices over the World Wide Web. It's penetration in the digital world is leading to inter connection of huge volume of devices over the internet.

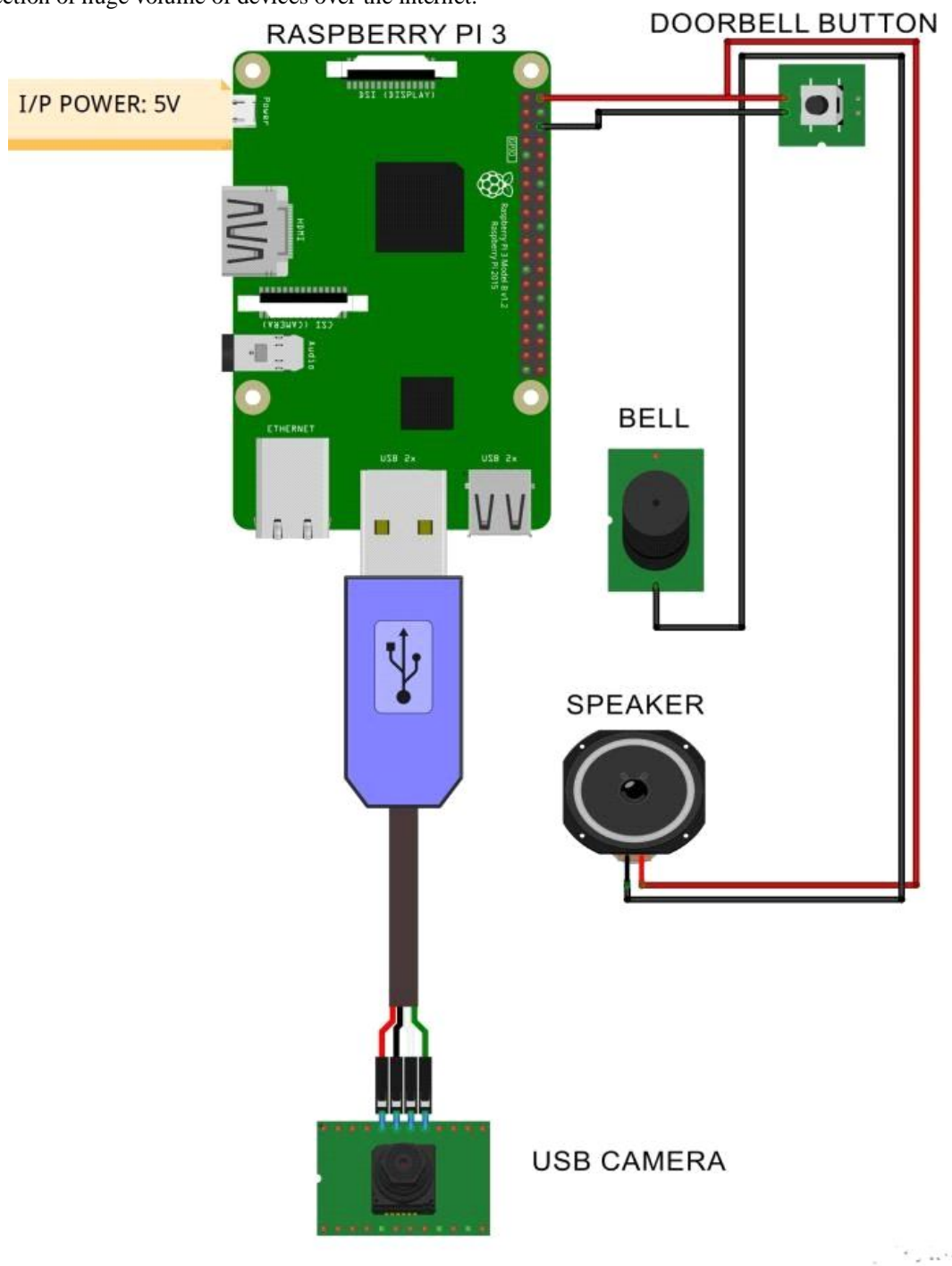


Fig. 1: Circuit Diagram

Raspberry Pi 3 is the latest version of the single board, low- cost high performance computer RPi. 1.2GHz 64-bit quad- core ARMv8 core with Wi-Fi & Bluetooth connection. This development board has the USB Camera, the switch and the bell connected to it at it's GPIOs.

2) *Flowchart*: The flow of the complete process from the button press to the image send is as follows:-

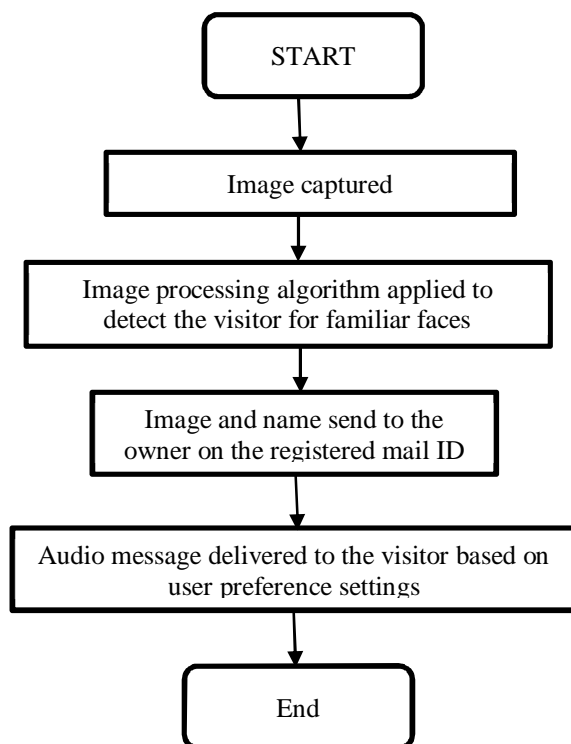


Fig. 2: Flowchart of the system

### 3) *Face Detection Algorithm*

The method used for face detection is Local Binary Pattern Recognition. Image comparison is a significant process which involves comparing two matrices. The process may get complicated if it involves many features that need to be compared. There are 6000 features involved during comparison while recognizing a given face. Time complexity takes a huge toll thereby shunning the feasibility of the face

recognition module. Local Binary Pattern (LBP) is a type of visual descriptor used for classification in Computer Vision. The methodology for pattern recognition using LBP feature is explained in the following flowchart:

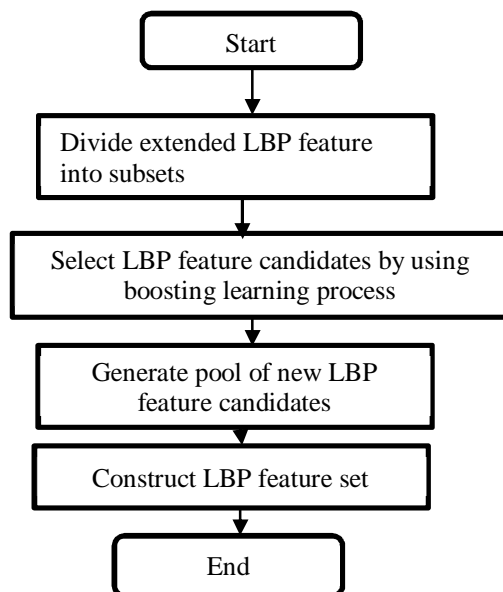


Fig 3: Flowchart of LBP



#### 4) Snapshot of the visitor

The camera module used with Raspberry pi has a capability of taking 760p photos and is easily programmable. The USB cable is inserted into the RPi USB port. The resolution of the image is enough for an easily recognizable image and this ensures fast image processing and sending of image.

#### 5) Software implementation

- a) Enabling the pi cam - Open the raspi-config tool from the Terminal using “sudo raspi-config” - Enable your camera, then go to Finish and you'll be prompted to reboot.
- b) Programming the pi cam: Libraries for use of pi cam are available in Shell (Linux Command line) and Python. The implementation in this project uses ‘python-pi-camera’ library. It is a Python interface to the Raspberry Pi camera module. This library is available in the Raspbian archives. Also, SMIME and SMTP libraries of python are used to attach and send the snapshot to the user's phone through mail.

### IV. OUTPUT

The output console window of Python shows the initiation of doorbell press by saying ‘Someone is at your Door’. This passes the message to camera which in turn takes a snap of the person at the door. The frame is captured without a delay. The image is processed and then sent to the owner's e-mail ID.

```
*****
Welcome to Smart Door Bell (PROTOTYPE_1)
*****

No one is at door

Someone is at your Door
Please Wait for some time, Mail Will be send to you
--- Opening /dev/video0...
Trying source module v4l2...
/dev/video0 opened.
No input was specified, using the first.
--- Capturing frame...
Captured frame in 0.00 seconds.
--- Processing captured image...
Writing JPEG image to '/home/pi/oops.jpg'.
smtp.gmail
ehlo
starttls
reading mail & password
from
successfully sent the mail
^Z
[!]+ Stopped                               python mail_2.py
pi@raspberrypi:~$
```

Fig, 4: Python Output console window

### V. FUTURE SCOPE

- A. Remote Monitoring of homes
- B. Can be modified to theft alert system
- C. Both way voice call system over LTE can be integrated

A significant add on to the system will be an android mobile app which encapsulates all functionalities. The app gives user control over required forms of notifications using preference settings. Moreover, using the potential pi-cam module, live video stream capturing the front of the door can be transmitted to the user on demand. With gradual maturity of raspberry pi security protocols, the proposed system can also be used for night surveillance.

### VI. CONCLUSION

This system overcomes all the problems related to conventional doorbell and also adds some other significant feature. IoT has been gradually bringing a sea of technological changes in our daily lives, which in turn helps to making our life simpler and more comfortable, though various technologies and applications. This system successfully completes the requirements of a Smart Doorbell with an affordable price. Also, it's modification to attain the mentioned future prospects can be acquired without much hassle.



## VII. DRAWBACKS OF IOT

Though IoT has abundant benefits, there are some flaws in the IoT governance and implementation level. The key observations in the literature are that

- 1) There is no standard definition in worldwide
- 2) Universal standardizations are required in architectural level
- 3) Technologies are varying from vendor-vendor, so needs to be interoperable
- 4) For better global governance, we need to build standard protocols.

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