INTELLIGENT ACCESS CONTROL SYSTEM FOR SAFETY CRITICAL AREAS IN INDUSTRIES

A Mini Project Report submitted
in partial fulfillment of the requirements for the award of the degree of

Bachelor of Technology
in
Computer Science and Engineering

by

Vanka Hari Janardhan	**(16N31A05P9)**
S Vinay	**(16N31A05J6)**
Thota Manikanta Naga Hanuman	**(16N31A05N0)**

Under the esteemed guidance of

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Assistant Professor

Department of Computer Science and Engineering
Malla Reddy College of Engineering & Technology
(Autonomous Institution- UGC, Govt. of India)
(Affiliated to JNTUH, Approved by AICTE, NBA & NAAC with 'A' Grade)
Maisammaguda, Kompally, Dhulapally, Secunderabad – 500100
website: www.mrcet.ac.in

2019-2020

CERTIFICATE

This is to certify that this is the bonafide record of the project entitled "Intelligent Access Control System for Safety Critical Areas in Industries", submitted by Vanka Hari Janardhan (16N31A05P9), S Vinay (16N31A05J6) and Thota Manikanta Naga Hanuman (16N31A05N0) of B.Tech in the partial fulfillment of the requirements for the degree of Bachelor of Technology in Computer Science and Engineering, Department of CSE during the year 2019-2020. The results embodied in this project report have not been submitted to any other university or institute for the award of any degree or diploma.

Internal Guide
Ms. Likitha Reddy
Assistant Professor

Head of the Department
Dr. D. Sujatha
Professor

External Examiner

SMARTBRIDGE
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Ref: SB/SIP-2019/IOT/018 **Date: 31st May 2019**

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Mr./Ms. Vanka Hari Janardhan** pursuing B.Tech. in Computer Science Engineering from Malla Reddy College Of Engineering And Technology has successfully completed his summer internship from **6th May 2019** to **31st May 2019**.

During this period he had learned the concepts of **Internet of Things (IoT) with IBM Cloud** and successfully completed a project **"Intelligent Access Control System For Safety Critical Areas In Industries".**

Refer the enclosed **Certificate of Merit** for his performance during the tenure of internship.

We wish him all the best for his future endeavours.

For **SmartBridge Educational Services Pvt. Ltd.,**

SmartBridge Educational Services Pvt. Ltd. Hyderabad

Amarender Katkam,
Director – Technical

SmartBridge Educational Services Pvt. Ltd.
Plot No.550/F, Road.No.92, Jubilee Hills, Hyderabad - 500092, Telangana - INDIA
Phone : 040-65884422, www.thesmartbridge.com

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Certificate of Merit

This is to certify that **Mr./Ms. Vanka Hari Janardhan** has completed his/her internship program from **6th May 2019** to **31st May 2019** with **Internet of Things (IoT) With IBM Cloud** as the specialization. He/She had secured an overall score of **9.7 out of 10** with criteria defined below.

Assessment -1	13
Assessment -2	15
Assessment -3	14
Assignments	15
Project Work	20
Punctuality	10
Mentor Score	10
Over All Score	97

GitHub Link for the Assignments & Project Work

https://github.com/V-H-J

Date: 31st May 2019

Nagarjuna Madluri

Program Manager (SIP-2019)

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Ref: SB/SIP-2019/IOT/016

Date: 31st May 2019

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Mr./Ms. S Vinay** pursuing B.Tech. in Computer Science Engineering from Malla Reddy College Of Engineering And Technology has successfully completed his summer internship from **6th May 2019** to **31st May 2019**.

During this period he had learned the concepts of **Internet of Things (IoT) with IBM Cloud** and successfully completed a project **"Intelligent Access Control System For Safety Critical Areas In Industries"**.

Refer the enclosed **Certificate of Merit** for his performance during the tenure of internship.

We wish him all the best for his future endeavours.

For **SmartBridge Educational Services Pvt. Ltd.**,

Amarender Katkam,
Director – Technical

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Certificate of Merit

This is to certify that **Mr./Ms. S Vinay** has completed his/her internship program from **6th May 2019** to **31st May 2019** with **Internet of Things (IoT) With IBM Cloud** as the specialization. He/She had secured an overall score of **9.6 out of 10** with criteria defined below.

Assessment -1	12
Assessment -2	15
Assessment -3	14
Assignments	15
Project Work	20
Punctuality	10
Mentor Score	10
Over All Score	96

GitHub Link for the Assignments & Project Work

https://github.com/iamvinaysridhar

Date: 31st May 2019

FOR

Nagarjuna Madluri

Program Manager (SIP-2019)

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Ref: SB/SIP-2019/IOT/017 **Date: 31st May 2019**

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Mr./Ms. Thota Manikanta Naga Hanuman** pursuing B.Tech. in Computer Science Engineering from Mallareddy College Of Engineering And Technology has successfully completed his summer internship from **6th May 2019** to **31st May 2019**.

During this period he had learned the concepts of **Internet of Things (IoT) with IBM Cloud** and successfully completed a project **"Intelligent Access Control System For Safety Critical Areas In Industries".**

Refer the enclosed **Certificate of Merit** for his performance during the tenure of internship.

We wish him all the best for his future endeavours.

For **SmartBridge Educational Services Pvt. Ltd.,**

SmartBridge Educational Services Pvt. Ltd. Hyderabad

Amarender Katkam,
Director – Technical

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Certificate of Merit

This is to certify that **Mr./Ms. Thota Manikanta Naga Hanuman** has completed his internship program from **6th May 2019** to **31st May 2019** with **Internet of Things (IoT) with IBM Cloud** as the specialization. He had secured an overall score of **9.5 out of 10** with criteria defined below.

Assessment -1	8
Assessment -2	15
Assessment -3	12
Assignments	15
Project Work	15
Punctuality	15
Mentor Score	15
Over All Score	95

GitHub Link for the Assignments & Project Work

https://github.com/thotamanikanta

Date: 31st May 2019

Nagarjuna Madluri

Program Manager (SIP-2019)

DECLARATION

We hereby declare that the project titled “Intelligent Access Control System for Safety Critical Areas in Industries” submitted to Malla Reddy College of Engineering and Technology (UGC Autonomous), affiliated to Jawaharlal Nehru Technological University Hyderabad (JNTUH) for the award of the degree of Bachelor of Technology in Computer Science and Engineering is a result of original research carried-out in this thesis. It is further declared that the project report or any part thereof has not been previously submitted to any University or Institute for the award of degree or diploma.

Vanka Hari Janardhan (16N31A05P9)
S Vinay (16N31A05J6)
Thota Manikanta Naga Hanuman (16N31A05N0)

ACKNOWLEDGEMENT

We feel ourselves honored and privileged to place our warm salutation to our college Malla Reddy College of Engineering and Technology (UGC-Autonomous) and our principal Dr. VSK Reddy who gave us the opportunity to have experience in engineering and profound technical knowledge.

We express our heartiest thanks to our Head of the Department Dr. D. Sujatha for encouraging us in every aspect of our project and helping us realize our full potential.

We would like to thank our internal guide Ms. Likitha Reddy and Project Coordinator Dr. S. Shanthi for their regular guidance and constant encouragement. We are extremely grateful to their valuable suggestions and unflinching co-operation throughout project work. We would like to thank our class in charge Mrs. V. Suneetha who in spite of being busy with her duties took time to guide and keep us on the correct path.

We would also like to thank all the supporting staff of the Department of CSE and all other departments who have been helpful directly or indirectly in making our project a success.

We are extremely grateful to our parents for their blessings and prayers for the completion of our project that gave us strength to do our project.

With regards and gratitude

Vanka Hari Janardhan (16N31A05P9)

S Vinay (16N31A05J6)

Thota Manikanta Naga Hanuman (16N31A05N0)

ABSTRACT

In some industries it is necessary for the workers to wear safety helmets and shoes while working. So, to check weather workers are taking safety precautions or not we are proposing this system. We can train our classifier to identify helmet and safety shoes with Clarify API. There will be video streaming near the entry of the industries where we can first detect the face of a person and if any person is present then we can capture the image of that moment and send it to Clarifai API to detect whether the person is wearing helmet or shoe. If the person is wearing shoe and helmet, we can give him access by opening the door. If he is not wearing then we can restrict his access by not opening the door. We can even warn him through voice commands to take the safety precautions.

Project Highlights: Interfacing Camera and audio device with Raspberry Pi, Face detection using Open Computer Vision, Visual recognition using Clarifai API, Text to speech conversion using Raspberry Pi.

Hardware: Raspberry Pi with 16GB Micro SD Card, Speakers, Camera and Servo Motor.

Softwares: Python IDE and Clarifai Visual Recognition API.

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(1) INTRODUCTION TO THE INTERNET OF THINGS

Internet of Things (IoT) is the networking of physical objects that contain electronics embedded within their architecture in order to communicate and sense interactions amongst each other or with respect to the external environment.
In the upcoming years, IoT-based technology will offer advanced levels of services and practically change the way people lead their daily lives.
Advancements in medicine, power, gene therapies, agriculture, smart cities, and smart homes are just a very few of the categorical examples where IoT is strongly established.
Over 9 billion 'Things' (physical objects) are currently connected to the Internet, as of now. In the near future, this number is expected to rise to a whopping 20 billion.

There are four main components used in IoT:

1. **Low-power embedded systems**
   Less battery consumption, high performance are the inverse factors play a significant role during the design of electronic systems.

2. **Cloud computing**
   Data collected through IoT devices is massive and this data has to be stored on a reliable storage server. This is where cloud computing comes into play. The data is processed and learned, giving more room for us to discover where things like electrical faults/errors are within the system.

3. **Availability of big data**
   We know that IoT relies heavily on sensors, especially real-time. As these electronic devices spread throughout every field, their usage is going to trigger a massive flux of big data.

4. **Networking connection**
   In order to communicate, internet connectivity is a must where each physical object is represented by an IP address. However, there are only a limited number of addresses available according to the IP naming. Due to the growing number of devices, this naming system will not be feasible anymore. Therefore, researchers are looking for another alternative naming system to represent each physical object.

There are two ways of building IoT:

1. Form a separate internetwork including only physical objects.
2. Make the Internet ever more expansive, but this requires hard-core technologies such as rigorous cloud computing and rapid big data storage (expensive).

In the near future, IoT will become broader and more complex in terms of scope. It will change the world in terms of

"anytime, anyplace, anything in connectivity."

IoT Enablers :

- **RFIDs:** uses radio waves in order to electronically track the tags attached to each physical object.
- **Sensors:** devices that are able to detect changes in an environment (ex: motion detectors).
- **Nanotechnology:** as the name suggests, these are extremely small devices with dimensions usually less than a hundred nanometres.
- **Smart networks:** (ex: mesh topology).

Characteristics of IoT:

- Massively scalable and efficient
- IP-based addressing will no longer be suitable in the upcoming future.
- An abundance of physical objects is present that does not use IP, so IoT is made possible.
- Devices typically consume less power. When not in use, they should be automatically programmed to sleep.
- A device that is connected to another device right now may not be connected in another instant of time.
- Intermittent connectivity – IoT devices aren't always connected. In order to save bandwidth and battery consumption, devices will be powered off periodically when not in use. Otherwise, connections might turn unreliable and thus prove to be inefficient.

As a quick note, IoT incorporates trillions of sensors, billions of smart systems, and millions of applications.

Application Domains:

IoT is currently found in four different popular domains:

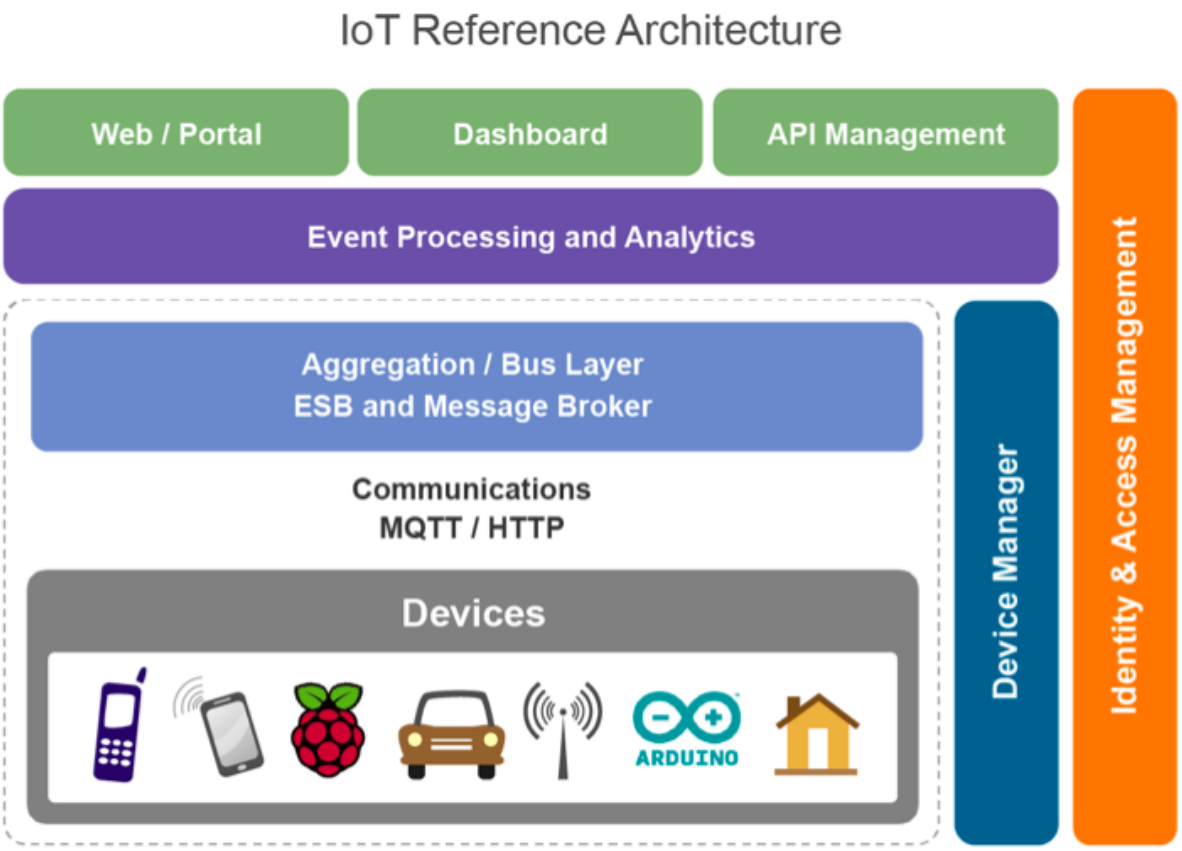
1. Manufacturing/Industrial business - 40.2%
2. Healthcare - 30.3%
3. Security - 7.7%
4. Retail - 8.3%

Modern Applications:

1. Smart Grids
2. Smart cities
3. Smart homes
4. Healthcare
5. Earthquake detection
6. Radiation detection/hazardous gas detection
7. Smartphone detection
8. Water flow monitoring

(2) PROJECT WORKING PROCESS

Let us see the architecture of IOT.



The following steps need to be performed in this project:

Connect the Raspberry Pi to a system using VNC Viewer

Install Raspbian Operating System on the Raspberry Pi 3 Model B using a Micro SD Card

Install Python IDLE version 2 or 3 in the Terminal

Install OpenCV Software, Clarifai API and Python Text to Speech module on the device using Terminal

Connect USB Camera to the Raspberry Pi and install the camera modules in the device

Classify the images

Workers with only Helmet

Workers with only Boots

Using the Clarifai API and then train the model.

Verify that JSON code is generated for above activity.

Coding Part Steps

Write code for the Camera to start video recording and clicking pictures and saving them in specified directory.

If the camera is not able to read the person's image, then an audio must be played via speaker asking them to stand in position for face detection.

These images are verified with those trained models in Clarifai API and an accuracy score is generated.

Based on the accuracy score, the program will decide whether the worker is to be allowed access.

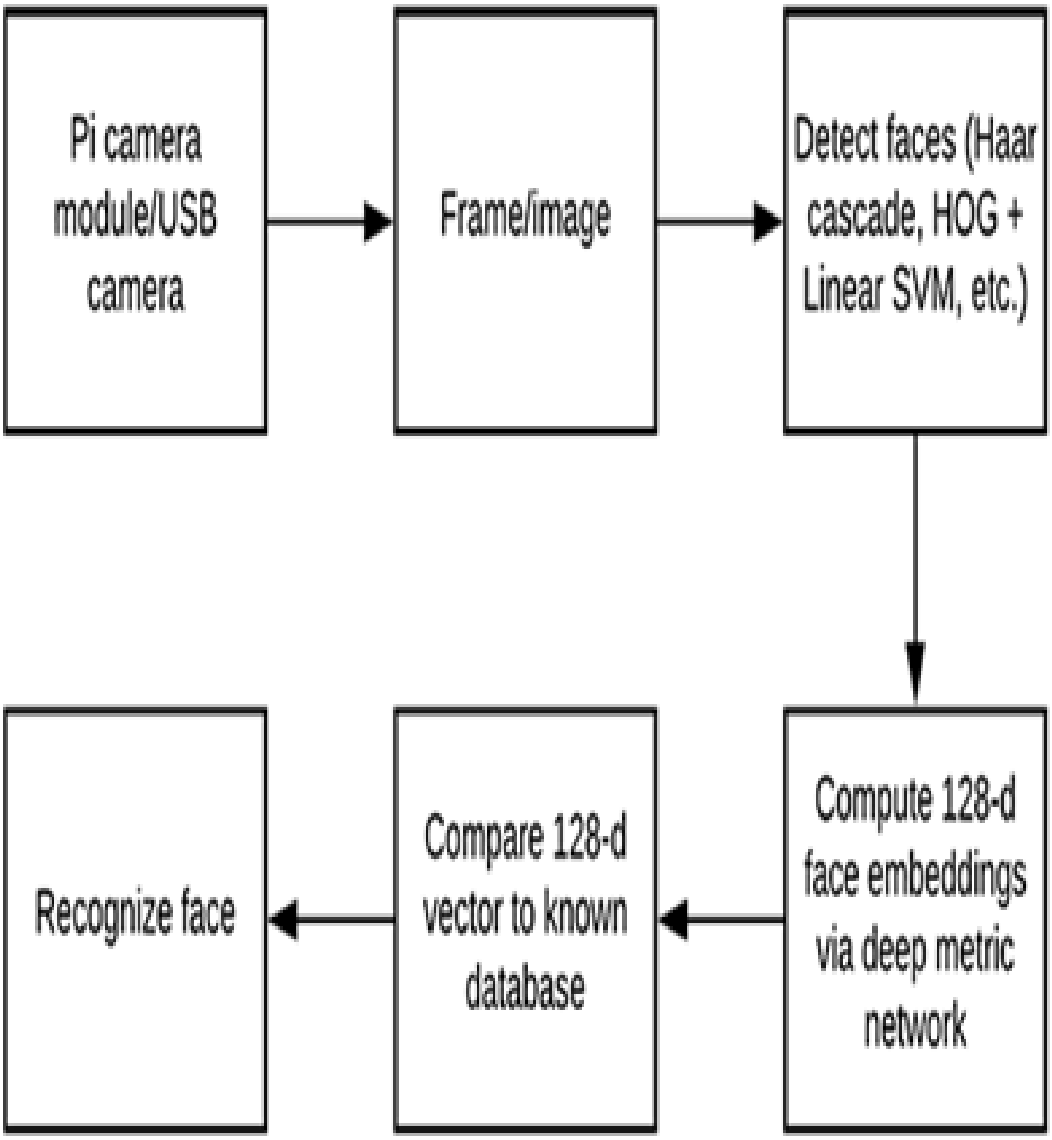
It will convert text to speech and give output via a speaker, i.e. if a person is found with both helmet and boots then he is given access. Else, he will receive a warning from the Speaker saying that access is restricted.

A Servo Motor must begin rotating when access is allowed. Else, it will not rotate.

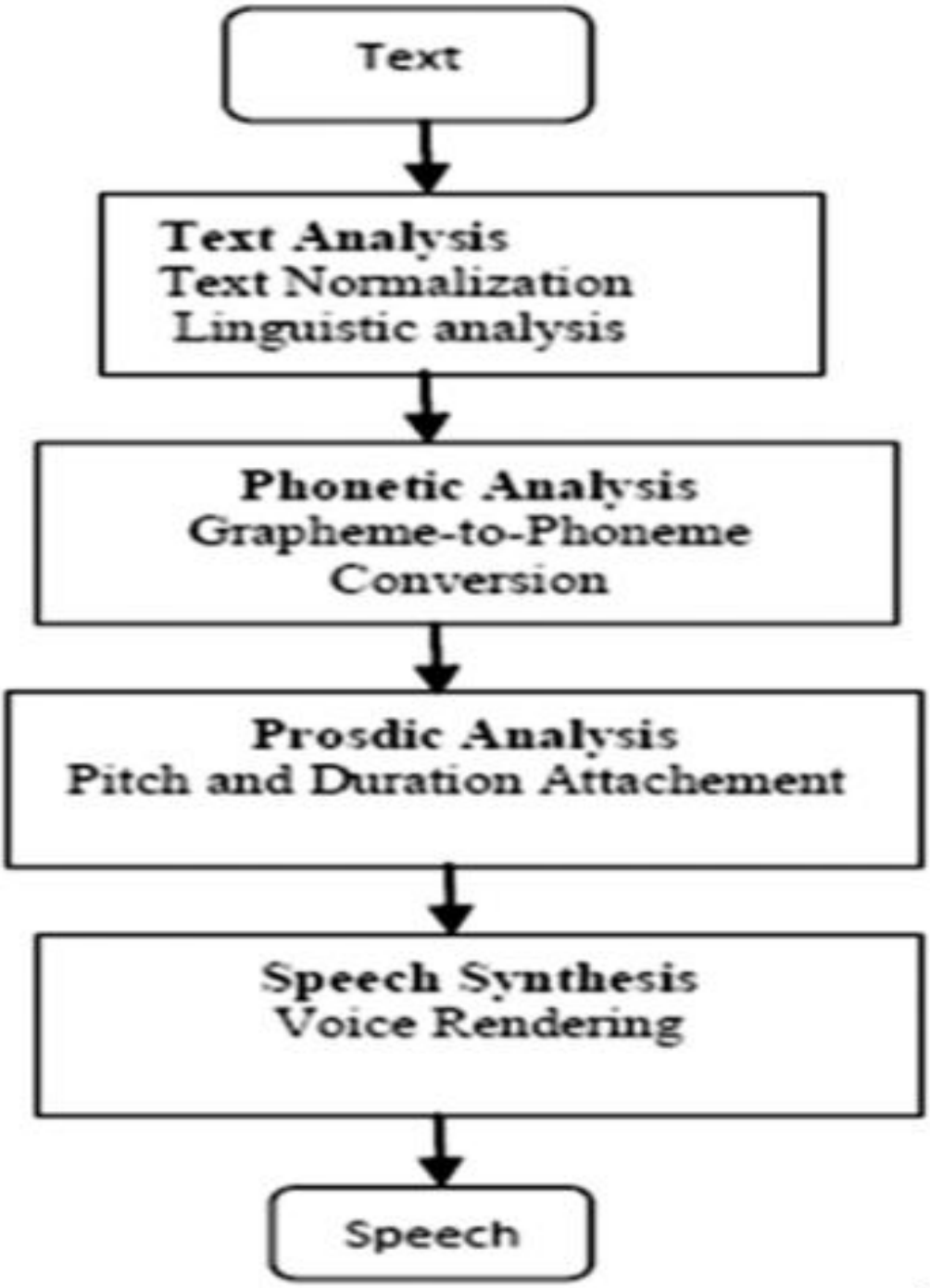
You can check the JSON code generated in Python IDLE using the online JSON Viewer for more clarity on the image and its accuracy.

(3) BLOCK DIAGRAMS

Block Diagram for Face Recognition Algorithm



Block Diagram for Text to Speech Conversion



(4) COMPONENTS USED IN PROJECT

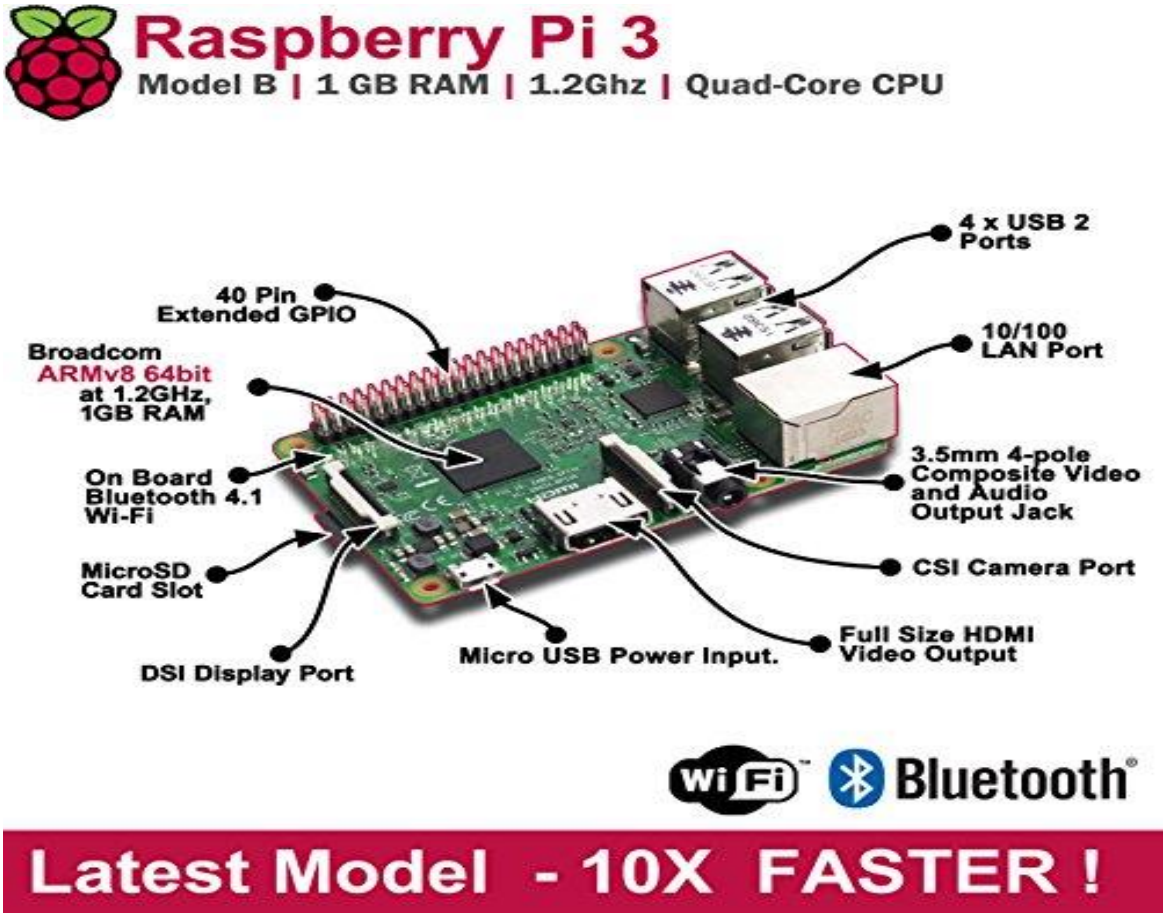
The components used in this project are classified into two types:

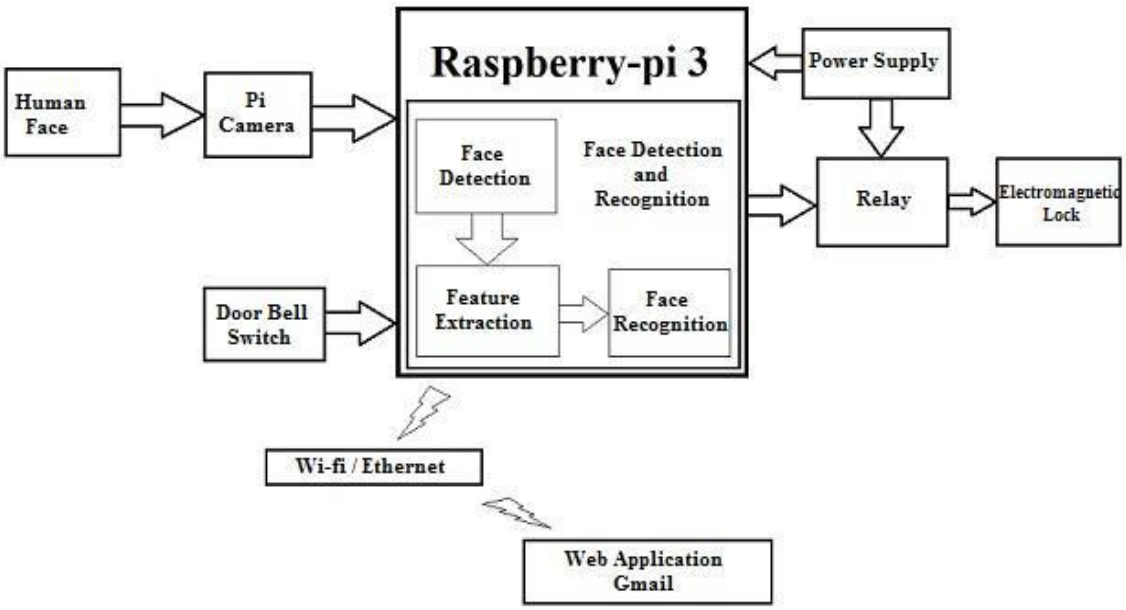
1. Hardware Components
2. Software Components

Let us see the **Hardware Components**.

(1) Raspberry Pi 3 Model B

Raspberry Pi® is an **ARM** based credit card sized **SBC** (Single Board Computer) created by Raspberry Pi Foundation. Raspberry Pi runs Debian based **GNU/Linux** operating system Raspbian and ports of many other OSes exist for this SBC.





SoC: Broadcom BCM2837

CPU: 4× ARM Cortex-A53, 1.2GHz

GPU: Broadcom VideoCore IV

RAM: 1GB LPDDR2 (900 MHz)

Networking: 10/100 Ethernet, 2.4GHz 802.11n wireless

Bluetooth: Bluetooth 4.1 Classic, Bluetooth Low Energy

Storage: microSD

GPIO: 40-pin header, populated

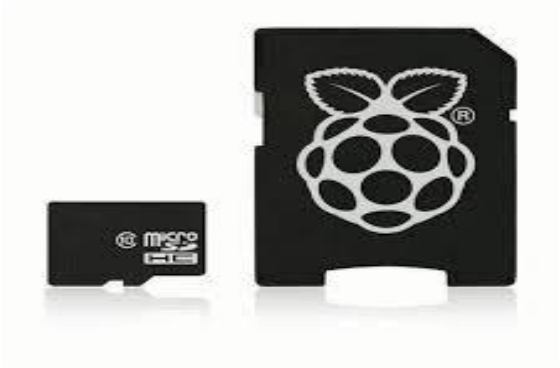
Ports: HDMI, 3.5mm analogue audio-video jack, 4× USB 2.0, Ethernet, Camera Serial Interface (CSI), Display Serial Interface (DSI)

(2) USB Camera

A: Original image B: Detected image

- HD 720p video calling and HD video recording, 2.4 GHz Intel Core2 Duo, 2 GB RAM,200 MB hard drive space
- Video capture: Up to 1280 x 720 pixels, Logitech Fluid Crystal
- Crisp 3 MP photos Technology, Hi-Speed USB 2.0
- Compatible with: Windows 10 or later, Windows 8, Windows 7, Works in USB Video Device Class (UVC) mode with supported video-calling clients: macOS 10.10 or later, Chrome OS, Android v 5.0 or above

(3) Micro SD Card



Capacity: 16/32/64/128GB *ANY

Capture more photos

Share more of your favorite photos and videos with your friends and family

Organize and transfer your photos, videos and music with included SanDisk Media Manager software

Record more video on the go, even in full HD

Play more of your favorite music

(4) Speakers

Achieve impressive sound from this JBL Link voice-activated speaker. Bluetooth technology ensures solid connectivity to your smartphone to play your favorite music, and the built-in Google Assistant provides hands-free operation on a variety of tasks. This JBL Link voice-activated speaker works with both iOS and Android devices for optimal convenience.

(5) Servo Motor

A **servo motor** is a closed-loop system that uses position feedback to control its motion and final position. In industrial type **servo motors** the position feedback sensor is usually a high precision encoder, while in the smaller RC or hobby **servos** the position sensor is usually a simple potentiometer.

Now let us see the **software components** we need.

(1) NOOBS (New Out of Box Software)

An easy Operating System installer for the Raspberry Pi

NOOBS is designed to make it easy to select and install operating systems for the Raspberry Pi without having to worry about manually imaging your SD card.

About

On first boot NOOBS will repartition your SD card and allow you to select which OSes you want to install from a list. This OS list is automatically generated from both locally available OSes (i.e. those contained in the /os directory on disk) or those available from our remote repository (network connection required).
Only the latest version of each OS will ever be displayed meaning that you can be sure that you have installed the most up-to-date release of your selected OS.

On any subsequent boot you can then press the SHIFT key to enter the NOOBS interface and easily reinstall your choice of OSes.

The NOOBS interface provides the following functionality:

- **Install**: Installs the selected OSes onto your SD card. Changing this selection erases all OSes currently installed.
- **Edit Config**: Opens a text editor allowing the command line and config for the selected installed OS to be edited.
- **Online Help**: [Networking Required] Open a browser that displays the Raspberry Pi Help page (http://www.raspberrypi.org/help/), allowing people to quickly access help and troubleshooting.
- **Exit**: Quits NOOBS and reboots the Pi into the OS boot menu.
- **Language Selection**: Allows you to select the language to be displayed.
- **Keyboard Layout Selection**: Allows you to select the keyboard layout to be used.
- **Display Mode Selection**: By default, NOOBS will output over HDMI at your display's preferred resolution, even if no HDMI display is connected. If you do not see any output

on your HDMI display or are using the composite output, press 1, 2, 3 or 4 on your keyboard to select HDMI preferred mode, HDMI safe mode, composite PAL mode or composite NTSC mode respectively.

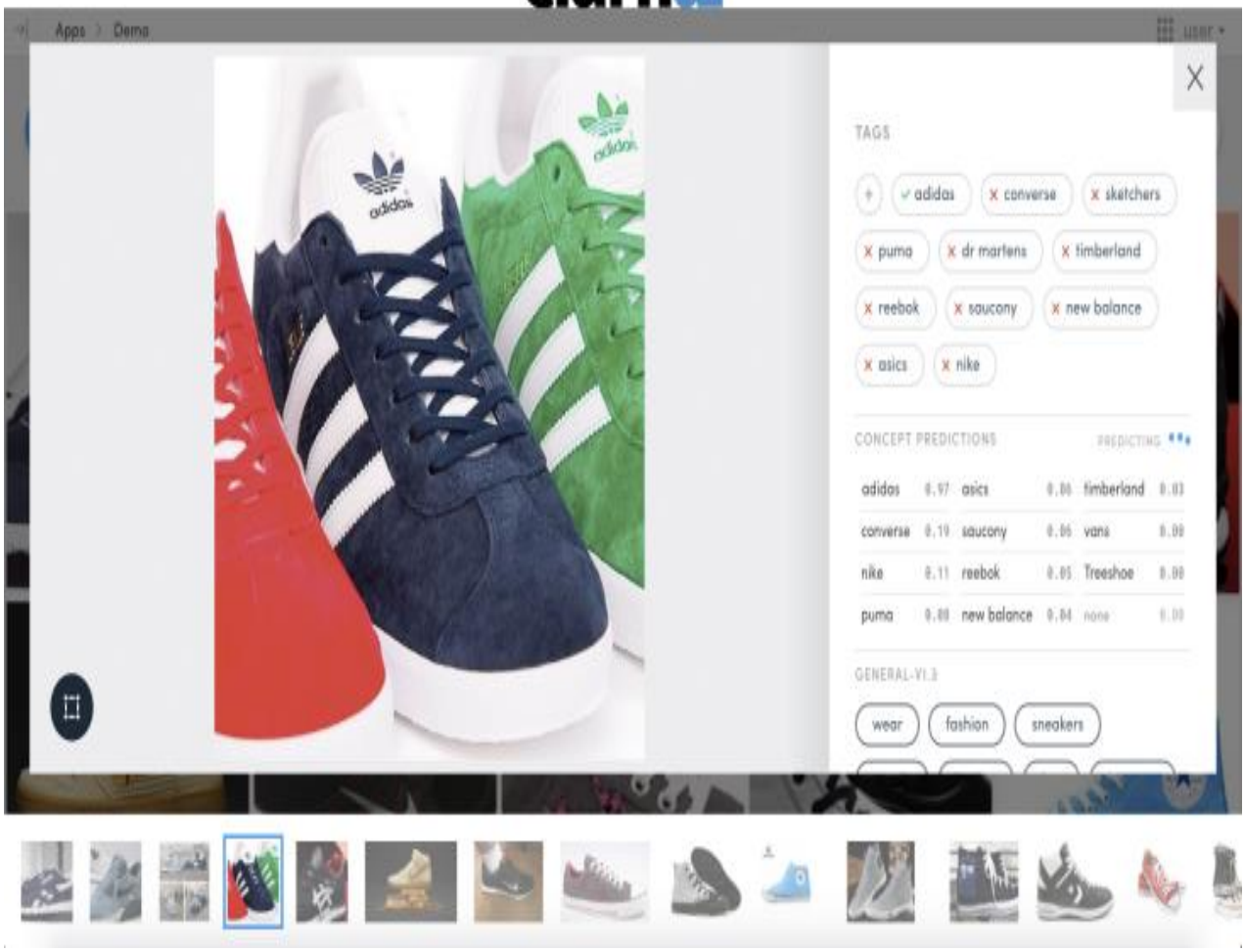
(2) Python IDLE

- IDLE is integrated development environment (IDE) for editing and running Python 2.7.3
- The IDLE GUI (graphical user interface) is automatically installed with the Python interpreter. IDLE was designed specifically for use with Python.
- IDLE has a number of features to help you develop your Python programs including powerful syntax highlighting.

(3) Clarifai API

Clarifai Inc. is an artificial intelligence (AI) company that specializes in computer vision and uses machine learning and deep neural networks to identify and analyze images and videos. The company offers its solution via API, mobile SDK, and on-premise solutions. Clarifai is headquartered in New York City with two satellite offices in San Francisco and Washington D.C. Clarifai API produces an accuracy score for each image and classifies them under the appropriate class.

clarifai


Apps
Demo
TAGS
adidas
converse
sketchers
puma
dr martens
timberland
reebok
saucony
new balance
asics
nike
CONCEPT PREDICTIONS
adidas 0.97 asics 0.86 timberland 0.83
converse 0.19 saucony 0.86 vans 0.00
nike 0.11 reebok 0.05 Treeshoe 0.00
puma 0.00 new balance 0.04 none 0.00
GENERAL-V1.3
wear
fashion
sneakers


clarifai

(5) IMPLEMENTATION

(5.1) INSTALLATION COMMANDS

First, we have to install Raspbian OS in the Micro SD Card present in the Raspberry Pi 3 Model B device.

Step 1: Download the Required Software and Files

Step 2: Get the SD Card and the Card Reader

Step 3: Check the Drive in Which the SD Card Is Mounted

Step 4: Format the SD Card

Step 5: Write the OS on the SD Card

Step 6: Eject the SD Card

Download VNC Server and VNC Viewer and Install them

Steps to perform to connect Raspberry Pi to VNC Viewer

1. Connect ethernet of Raspberry Pi to ethernet of laptop

2. Connect micro USB of raspberry pi to USB of laptop

3. Go to network and sharing center

4. Go to details in Wi-Fi

5. Go to properties and then sharing and click on allow option and then select Ethernet

6. IPv4 address will be present

7. use the following IP address

- 192.168.137. *
- check subnet mask values
- in CMD

- ping 192.168.137.255
- arp -a

->copy non 255 address in VNC viewer

username - pi

password - raspberry

If not connecting

➔ Then in CMD ping raspberrypi.mshome.net

Take that IP address and paste in VNC viewer and set up the OS

preferences -> raspberry pi configuration -> check whether VNC is enabled

Next, type the following commands in the terminal to install camera modules and change to enable camera in configurations.

sudo apt-get install fswebcam

fswebcam -S 20 123.jpg

Next, we have to install OpenCV software. Follow below commands

sudo apt-get update && sudo apt-get upgrade

sudo apt-get install build-essential cmake pkg-config

sudo apt-get install libjpeg-dev libtiff5-dev libjasper-dev libpng12-dev

$ sudo apt-get install libavcodec-dev libavformat-dev libswscale-dev libv4l-dev

$ sudo apt-get install libxvidcore-dev libx264-dev

$ sudo apt-get install libgtk2.0-dev libgtk-3-dev

$ sudo apt-get install libatlas-base-dev gfortran

$ sudo apt-get install python2.7-dev python3-dev

$ cd ~

$ wget -O opencv.zip https://github.com/Itseez/opencv/archive/3.3.0.zip

$ unzip opencv.zip

$ wget -O opencv_contrib.zip https://github.com/Itseez/opencv_contrib/archive/3.3.0.zip

```
$ unzip opencv_contrib.zip

$ wget https://bootstrap.pypa.io/get-pip.py
$ sudo python3 get-pip.py
$ pip3 install numpy
$ cd ~/opencv-3.3.0/
$ mkdir build
$ cd build

$ cmake -D CMAKE_BUILD_TYPE=RELEASE \
    -D CMAKE_INSTALL_PREFIX=/usr/local \
    -D INSTALL_PYTHON_EXAMPLES=ON \
    -D OPENCV_EXTRA_MODULES_PATH=~/opencv_contrib-3.3.0/modules \
    -D BUILD_EXAMPLES=ON.

make -j4
$ sudo make install
$ sudo ldconfig
```

Next, we have to install Clarifai API and Python Text to Speech on the Raspberry Pi

- ➔ sudo pip install clarifai
- ➔ sudo pip install pyttsx
- ➔ sudo apt-get install espeak

Connections for Raspberry Pi to Servo Motor

Servo Motor	Raspberry Pi
Brown	Ground (Pin No 6)
Yellow	GPIO 7 (Pin No 26)
Red	3V3 (Pin No 1)

(5.2) PYTHON SOURCE CODE

final code.py - A:\SmartBridge\Intelligent Access Control System\final code.py (3.6.3)

File Edit Format Run Options Window Help

```
import numpy as np
import cv2
import time
from datetime import datetime
import pyttsx
from clarifai.rest import ClarifaiApp
from clarifai.rest import Image as ClImage
import RPi.GPIO as GPIO

GPIO.setmode(GPIO.BCM)
GPIO.setwarnings(False)
GPIO.setup(7, GPIO.OUT)
p = GPIO.PWM(7, 50)
p.start(7.5)


app1= ClarifaiApp(api_key='f05450e2dce34fe39034900d9fe5d1d7')
#app1= ClarifaiApp(api_key='a75a5d1ddf924167a62f700e800b31be')
model1 = app1.models.get('hb')

face_cascade = cv2.CascadeClassifier('haar-face.xml')

def voice():
    engine = pyttsx.init()
    engine.say(Voice)
    engine.runAndWait()
    time.sleep(2)

cap = cv2.VideoCapture(0)
print 'camera is initialized'
```

```
while True:
    Voice='please stand in the position...we are capturing your image'
    voice()
    time.sleep(5)
    ret, img = cap.read()
    if ret:
        gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)

        faces = face_cascade.detectMultiScale(gray, 1.3, 5)

        for (x,y,w,h) in faces:
            cv2.rectangle(img,(x,y),(x+w,y+h),(255,0,0),2)
            roi_gray = gray[y:y+h, x:x+w]
            roi_color = img[y:y+h, x:x+w]
            picname = datetime.now().strftime("%y-%m-%d-%H-%M")
            picname = picname+'.jpg'
            cv2.imwrite(picname,img)
            print "Saving Photo"
            pic='/home/pi/Downloads/111.jpg'
            print pic
            pic1='/home/pi/Downloads/'+picname
            print pic1
            image = ClImage(file_obj=open(pic, 'rb'))
            response=model1.predict([image])
            data1 = response['outputs'][0]['data']['concepts']
            print data1
            for row in data1:
                if row['name'] == 'helmet':
                    if row['value']>= 1.590712e-08:
                        x=1
                    else:
                        print 'please wear the helmet'
```

```
            time.sleep(2)
            t=model1.predict([image])
            data2 = t['outputs'][0]['data']['concepts']
            print data2
            d="Men"+"'"+"s"+" "+"Sandals"
            e="Men"+"'"+"s"+" "+"Boots"
            for row in data2:
                if row['name'] ==d:
                    if row['value']>0.00001:
                        y=1
                elif row['name'] ==e:
                    if row['name']>0.00001:
                        y=1
                else:
                    z=0
            if(x==1 and y==1):
                print "you can enter inside"
                p.ChangeDutyCycle(12.5) #180°
                time.sleep(2)
                p.ChangeDutyCycle(7.5)
                Voice = 'you   can   enter   inside'
                voice()

            else:
                print "your     entry is restricted"
                Voice = 'please     wear     the    shoes  and   helmet  to  enter'
                voice()
                time.sleep(10)
```

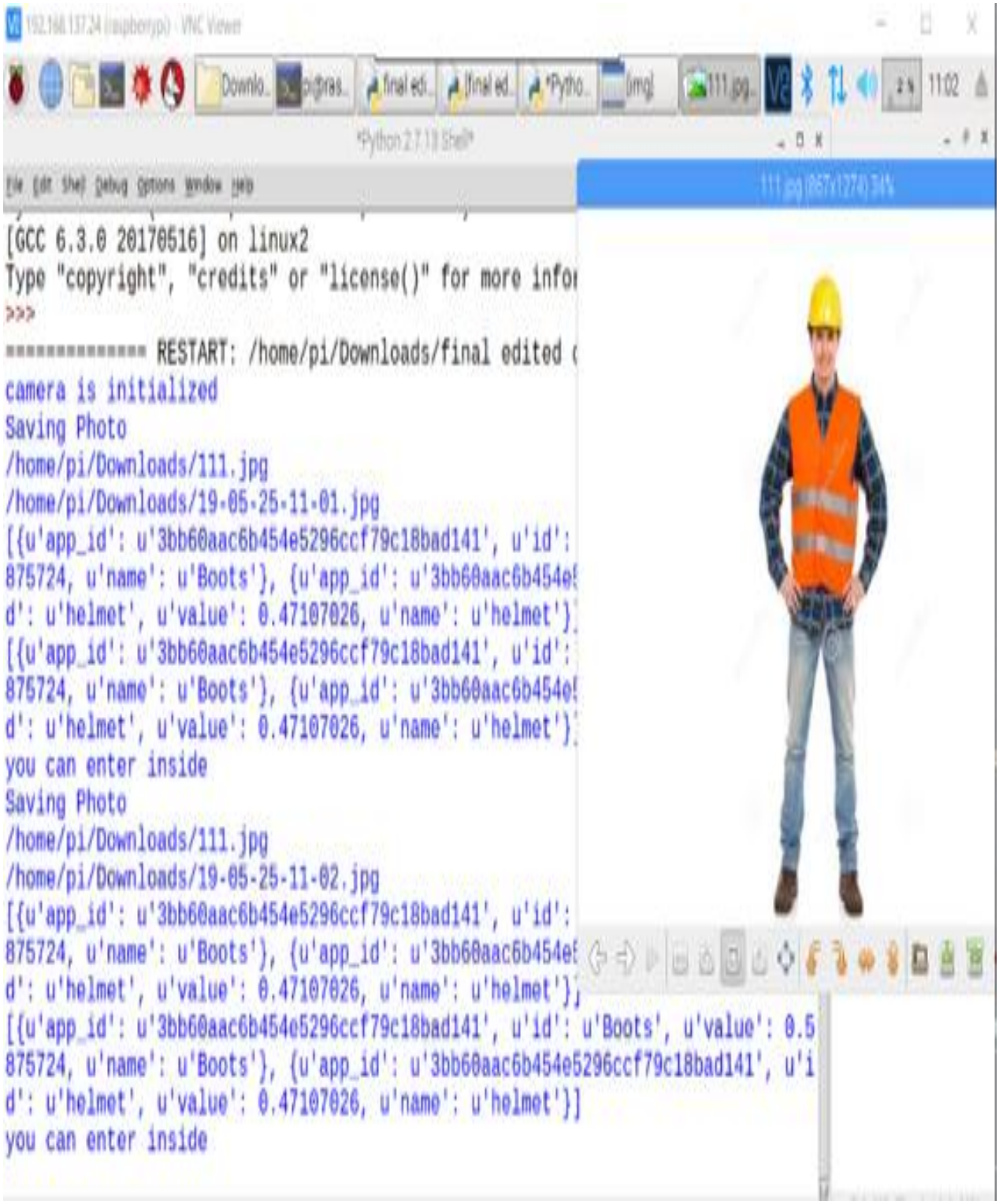
```
    cv2.imshow('img',img)
    time.sleep(0.1)
    k = cv2.waitKey(30) & 0xff
    if k == 27:
        break

cap.release()
cv2.destroyAllWindows()
```

(5.3) OUTPUTS

When an image with no helmet and boot is passed, then entry is restricted.

When an image with both helmet and boot is passed, then entry is allowed.



(6) CONCLUSION

The IoT has the potential to dramatically increase the availability of information, and is likely to transform companies and organizations in virtually every industry around the world. As such, finding ways to leverage the power of the IoT is expected to factor into the strategic objectives of most technology companies, regardless of their industry focus.

The number of different technologies required to support the deployment and further growth of the IoT places a premium on interoperability, and has resulted in widespread efforts to develop standards and technical specifications that support seamless communication between IoT devices and components. Collaboration between various standards development groups and consolidation of some current efforts will eventually result in greater clarity for IoT technology companies.

Therefore,

- IoT will lead to new standards and platforms (APIs, data analysis) in the nearest future.
- Practically all platforms are going to be open source as there is very little possibility to monopolize the IoT market by any, even the biggest, company.
- A new wave of productivity growth is to be expected with overall improvement in quality of life.

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