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Research Article

Security System Using Facial Recogntion And Voice Activation Based On Iot.

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Abstract

Iot Encourages The Development Of Products That Automate A Variety Of Tasks. Iot Can Be Referred To As A Network Of Devices,Connected Through The Internet And Are Capable Of Executing Tasks, Without Human Involvement. When Applied In The Right Direction, Iot Enabled Devices Are Very Useful For People With Disabilities And Elderly People.The Paper Focuses On This Aspect Of Iot And Uses The Principle To Develop A Device That Will Assist Individuals With Mobility Impairment And Elderly Who Cannot Monitor Safety Of Their Homes Specially While Opening Doors To Guests. The Proposed Device Is Mainly Divided Into Hardware And Mobile Applications For Use. The Hardware Segment Includes An Raspberry Pi, Arduino, Camera,Motor,Light Bulbs And A Channel Relay. The Software Portion Consists Of The Iot And Cloud Platform And Three Apps(One Bluetooth And Two Iot) . The Main Function Of This Device Is To Detect Specific Words In A Person's Voice And Accordingly Activate Or Deactivate The Door Or Light Bulb.Additionally For Security In The Doors There Will Be Facial Recognition That Will Take Place. The User Can Control The Devices From Anywhere And Can Constantly Monitor Using Cloud Platform. Hence The User Can Give The Voice Command Of Opening Doors Once The Face Is Recognized. Initially, This Will Be Put Into Practice Using A Light Bulb And Normal Facial Recognition. The App Will Be Developed Using Java Programming Language. The Most Distinguishing Feature Of The Application Will Be The Presence Of A Microphone Which Will Be The Means By Which Commands Are Given Utilizing Google Voice Api. The Light Bulb And The Mobile Phone Will Also Be Fitted With Bluetooth And Wifi Modules To Maximize The Speed Of Transmission. Particular Care Will Also Be Given To Noise Sensitivity And Speedy Transmission. The Proposed Device Can Also Be Customized To Include A Variety Of Appliances Such As Fans, Air Conditioners Etc. In Addition To Doors And Lockers.

Key Words: Disabilities,Iot,Voice Detection,Facial Recognition

Introduction

Today's Security Systems Have In Fact Advanced In Technology And Security. But The Fact Remains That Even Though State Of The Art Security Systems Exist, They Do Not Have Any Kind Of Provisions For Disabled Or Elderly People. The Vastly Used Technology Behind Most Successful Systems Is Internet Of Things(Iot) That Usually Also Involves A Cloud Based System For Storage And Easy Access. Similarly The Device That Is Developed In This Paper Is Based On A Multitude Of Devices Connected To A Common Internet Connection.

Barsha Et. Al[1] Developed A System For Disabled And Blind People Specifically For Opening And Closing Doors. The System Utilises Basic Microcontrollers And Motors To Do So. In Addition The System Can Also Detect Presence Of Other Things Such As Animals Etc In Front Of The Door That Causes Disturbances. Ghazal Et Al.[2] Further Used Xbee And Rf Transmission To Completely Make The House A Smart Home. It Is Not Voice Or Face Activated But Instead Uses An Application And Controller. Lights,Fans,Humidity Control Etc. Can All Be Controlled With It.D.Sunehra Et Al[3] Used Gsm And Microcontrollers To Create A Voice Controlled Automation System For Homes Aimed At Disabled People. It Also Uses A Bluetooth Module And Allows Both Wifi And Bluetooth Control. It Cannot Be Used For Security Reasons But Can Be Used For Controlling Home Appliances. Face Recognition Is Absent. Isha S. Dubey Et Al[4] Developed A System That Helps Convert Text To Speech. A Similar Principle Is Used In Our Device Where The Text Stored In Correspondence To A Face Is Converted To Speech For The Convivence Of The Elderly. Jabunoun Et Al.[5] Developed An Object Recognition System Aimed Specifically At Blind People.The System Can Identify People That Are In Front Of The Camera And Announce The Name.M.Rajesh Et Al[6]Developed A Device With A Battery Backup That Detects Any Form Of Texts Or Objects That Appear In Front Of The Camera.It Also Is Capable Of Announcing The Name Of The Person/Object.Based On The Principle Of Ocr.P.Vashista Et Al[7]Developed A Device That Acts As A Personal Voice Assistant.Motors,Sensors,Etc Are Connected To The Main Raspberry Pi.Iot And Principles From Robotics Are Also Utilised In The System.Karmal Et Al.[8]Developed A Device That Uses Google Api To Speak For The People Who Are Unable To Speak.It Also Utilises A Text To Speech Converter To Identify Objects And Known People In The Vicinity Using Iot. Bin Sulaiman Et Al.[9] Have Used Microcontrollers And Google Api To Create A System Where Multiple Household Devices Are Connected To A Voice

Control Application. It Can Be Used To Control Doors Etc And Can Be Extended To Facial Recognition. D.A.Chowdhry Et Al.[10] Have Developed A Device That Uses A Sensitive Designated Area On A Persons Face To Identify Their Identity.The Faces Are Also Stored On A Cloud And Also Displayed.

With All The Information Collected From Various Papers, It Was Determined That There Is A Necessity Of A Security System For Blind And Disabled That Incorporates Both Voice Commands And Facial Recognition. Iot And Cloud Being The Most Useful In This Case Was Used As The Main Methodology. Three Different Apps With Bluetooth And Wifi Are Also Developed For A Case By Case Basis. The Raspberry Pi Is Connected To Multiple Devices And Uses High Speed Internet To Carry Out Activities.The Basic Body Of The System Consists Of One Part Of Voice Recognition Where The Door And Other Appliances Can Be Controlled By Voice,And The Other Consists Of Face Detection Where Only Known Persons Will Be Allowed To Enter The Home.The Name Of The Guest Is Also Announced In Order For The People Inside To Hear.

Methodology

Materials

The Most Important Hardware Components That Have Been Used For The Development Of The Device Are I)The Raspberry Pi, Often Called As A Mini Computer, It Comes With 4gb Ram And Expandable 16gb Storage That Can Process Multiple Programs At The Same Time. It Is Specifically Used For Our Project As It Has Excellent Processing Speed And Can Simultaneously Support Both Voice And Facial Detection. Ii)Arduino, The Arduino Is Used In Conjunction With The Raspberry Pi As It Acts As An Adc, Or Analogue To Digital Converter. As We Are Automating Home Devices, It Will Act As An Intermediary. Iii) Camera, It Is The Most Important Component Of The Face Detection Portion Of The Project And Captures Images And Sends It To The Raspberry Pi For Processing.Iv)Channel Relay, Acts As An Interconnection Between The Various Components And Allows Multiple Communication And Working Channels Amongst Different Components.

Iot And Cloud Computing Has Started Taking A Lead In The Methods That Are Used For Development Of New Technology. This Project Will Work On The Principle Of Internet Of Things. When Multiple Devices Are Connected To The Same Internet Network, They Can Be Called As A Network. And This Advanced Security System Will Use It To Sync Both Facial

Recognition And Voice Recognition To The Same Unified Device That Provides A Double Layer Of Security And Ease Of Use And Access To The Disabled Or Elderly.

Working

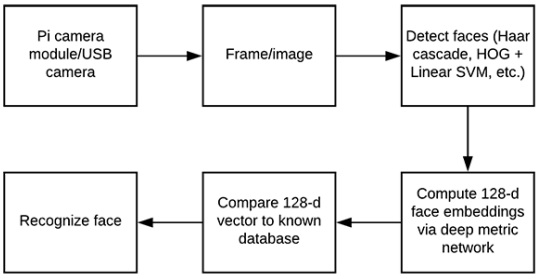

Figure 1 Block Diagram For Facial Recognition

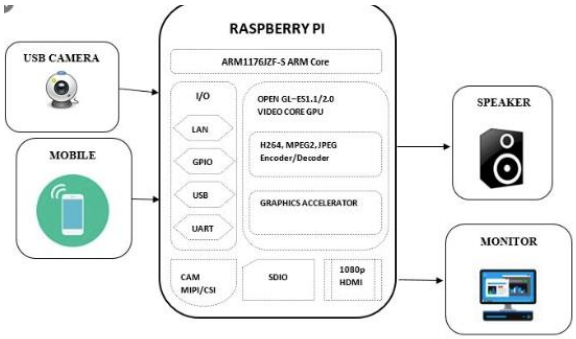

Figure 2 Illustration For The Overall System Using Raspberry Pi

The Main Functional Part Of The Device Is The Raspberry Pi. It Acts As The Control Centre Through Which The Two Modules Viz.Face And Speech Recognition Are Done. The App Interfaces Are Also Explained In Detail.

1)Facial Recognition: Hardware Wise, The Facial Recognition Is Done Through A Camera That Is Connected To The Ras Pi. The Raspberry Pi Acts As A Processor And The Facial Image Is Run Through A Database And Is Checked Whether It Corresponds To A Known Or An Unknown Person. The Raspberry Pi Also Constantly Sends Data To A Cloud Service Where It Is Stored And A Person Can Remotely Access The Data For Cross Verification. Regarding Software, Specialised Open Cv Is Used To Train A Machine Learning Mode Coded Using Python. It Trains The Model To Identify The Predominant Facial Features Such As Skin Tone, Colour Of Eyes, Distinctive Marks On Face, Gaze Pattern Etc. The Faces Of People That Are Allowed To Gain Entrance Into The House Are First Fed Into The Machine And The Machine Is Trained. Different Angles Of The Persons Face Is Used To Enhance Efficiency.

The Camera Captures The Image, Runs It Through The Database And When A Hit Is Achieved It Announces The Name Of The Person Through A Microphone.

2)Voice Recognition: In The Hardware Segment, Google Voice Api On A Smartphone Is Directly Synched With The Raspberry Pi. The Raspberry Pi Is Further Connected To An Arduino That Acts As An Adc And To Channel Arrays. These Channel Arrays Are Further Connected To Light Bulbs Or Dc Motors That Are Capable Of Automatically Opening Doors. While In Software A Specialised Python Library Is Used That Converts The Speech Received Through The Google Api Into A Wav Format. Special Key Words Such As 'Open' And 'Close' Are Sensed And The Action Associated With The Word Is Executed With The Help Of Actuators And The Raspberry Pi.

3)App Interfaces: 3 Interfaces Can Be Used For The Purpose Of This Device. The First And Most Important App Uses Iot In Order To Remotely Voice Control Devices Even If The Person Is Not At Home. The Door Can Be Opened Using This App Only With The Use Of Internet Connection. The Second Interface Is A Web Program That Can Immediately Detect The Face Of The Person And Relays It To The Cloud That Can Be Accessed In A Website. The Final Interface Is A Mobile Phone Application That Uses Bluetooth To Control Home Devices Using Voice Control. This Can Be Used In Case There Is An Internet Failure And Can Also Be Used To Conserve Energy. This Is Also Synched To Google Api But Instead Of Wifi It Runs On Bluetooth.

Results And Discussion

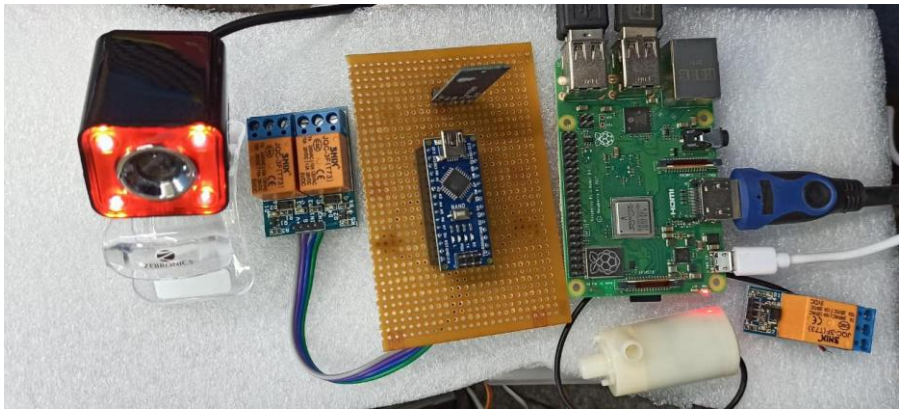

Figure 3 Developed Prototype

The Applications Were Easily Installed On The Phone Of The User And Were Linked To The Google Api. The Device That Was Developed Successfully. When The Individual Stands In Front Of A Camera Installed On The Front Door, The Security Device Was Able To

Distinguish Between A Strangers Face And One That Was Loaded In The Database. The Obtained Accuracy Is 94%,With Slight Exceptions Made For Low Light Conditions. Images Of Each And Every Incoming Person Was Available On The Cloud Server And It Is Updated Every 2 Minutes. The System Also Successfully Announced The Name Of A Known Person According To The Description Of Its Use. In Order To Further Push The System, Multiple People Were Also Encouraged To Stand Infront Of The Camera. The Device Individually Focused On Each Person And Separately Announced Their Identities Whether Known Or Unknown. In Addition, The Mechanical Moment Of The Door Of The House Was Also Be Able To Controlled With The Mere Use Of The Application And Voice Of The User. The Device Responded To Single Word Commands And Executed The Action With Quick Speed And Without Any Delay. Testing Was Also Carried Out In High Noise Conditions But The Results Were Consistent.

The Performance Of The Project Is Measured In Terms Of How Effectively Face Is Recognised By The System And The Lag Between Speaking The Command And The Raspberry Pi Executing The Action. The Lag Was Observed To Be At Around 5 Seconds, That Is Extremely Less When Compared To Existing Papers That Display Approximately Twice The Lag. Face Detection Was Accurate When There Was 0-108 Degree Tilt Of The Face. According To The Graph Below, The Rate Of False Identifications Was Also Approximately 0.7and In Accordance With The Expected Rate.

When Compared To Existing Products In The Market, The Developed Prototype Is Both Cheaper As Well As Easier To Install And Operate. Moreover,There Exists No Established Product That Is Capable Of Both Face Detection And Voice Recognition Using The Same Hardware. This Makes The Device A Novelty.

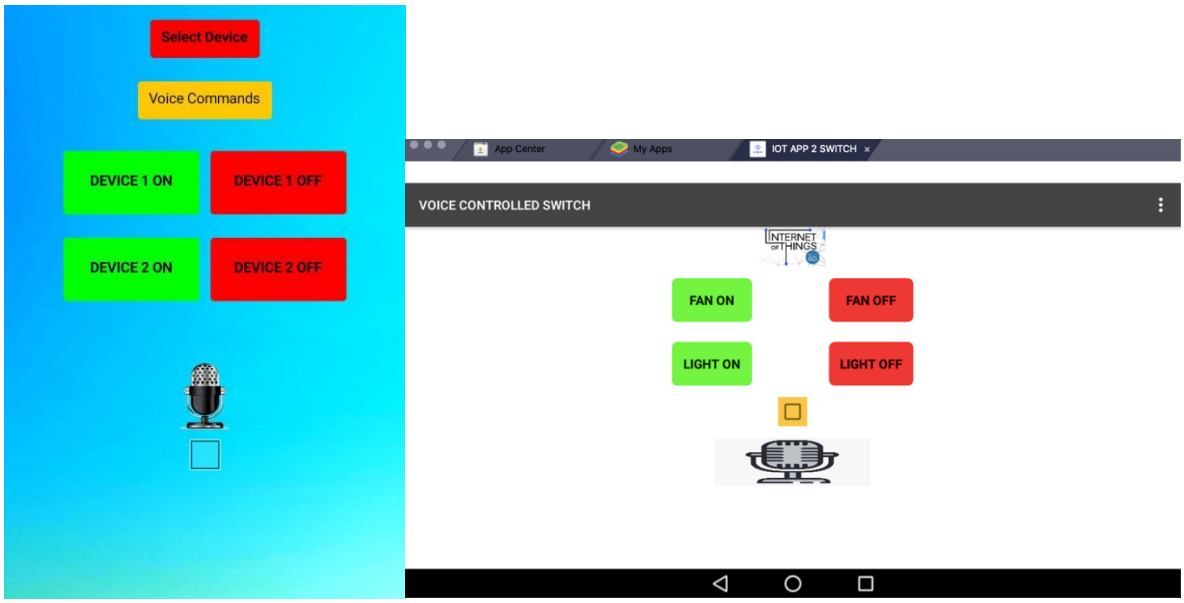

Figure 4 Developed App Interface

Conclusion

In Conclusion The Device That We Have Developed Can Be Used Extensively For The Disabled And Blind. There Exists No Such Device That Can Use Voice Control As Well As Facial Recognition. Hence When A Person Stands Infront Of A Door Equipped With This Device, His Face Is Analysed And Name Is Announced. The People Inside Can Remotely Choose To Open The Door Just By The Help Of A Voice Controlled Application. This Device Is Extremely Cost Efficient And Uses A User Friendly Device And Controlling System To Help Boost Security. Further Improvements In The Device Can Include Reduction Of Size And Increasing In The Speed Of Action. External Security Can Be Used For The Software To Ensure Fail Proof Face Detection.

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