IoTBasedSmartSecurityandHomeAutomation

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Abstract— **Internet of Things is a system where appliances areembedded with software, sensors and actuators. The devices are ableto transfer data over a network and also communicate with eachother.Thistechniqueisincorporatedinourhousetomaketheappliance sconvenientandautomated.Thisprojectfocusesonbuildingahomesecurity systemwhichwillbewireless.Securityovera network is achieved using AES encryption. Security of house ismanagedbysendingnotificationstotheuserusingInternetincaseofanytre spasser and itcanalsoringanalarm if required.Homeautomation is utilized by using appropriate sensors installed aroundhouse. Raspberry pi is used as a server and controller. Raspberry pihastaskofcontrollingelectricalappliancesandprovidingauthentication and securitytouser.**

Keywords—
InternetofThings(IoT),HomeAutomation,SmartSecurity,IntrusionD etection,RaspberryPi.

I. INTRODUCTION

Today,thereisanincreasingdemandofautomatedsystems so that human intervention is reduced. This paperfocusesonasystemthatprovidesfeaturesofHomeAutomati on relying on Internet of Things to operate easily, inaddition to that it includes a camera module and provideshomesecurity.TheandroidappbasicallyconvertsSmart phoneintoaremoteforallhomeappliances.Securityis

achieved with motion sensors if movement is sensed at theentrance of the house; a notification is sent that contains aphoto of house entrance in real time. This notification will bereceived by the owner of the house via internet such that appcan trigger a notification. So owner can raise an alarm in caseofanyintrusionorhe/shecantoggletheapplianceslikeopenin g the door if the person is a guest. The user can makeuse of this system to control switching on of lights, fan, AC,etc. automatically. [2].We have also incorporated a smokesensor which, on detection of smoke will ring an alarm andalerttheuserontheirphonebySMSalert.

The user can access complete IoT system from anywhereusing Internet. But themicro-controllermust alwayshaveInternetconnectivity[1].RaspberryPiisasmallsizedc omputerwhichactsasaserverforthesystem.TheRaspberryPisyst emfunctionslikeacomputerwithasmallsetup.ItcontainsGPIOpi nsandUSBportsandalsosupportsportforcamera module.Thesepinscanbetoggledon/offusingsimpleprograms.

The project mainly aims to overcome the shortcomings ofhome security systems by providing information of currentsituation when the owner is away from the house. It will alsoenhancetheIoTs'networksecurityusingencryptionanddecry ptionoftheuser'sdata.

Furthersectionsofthispaperareorganisedasfollows:

Section II represents the related work done in the field ofHome Automation. Section III illustrates how the system hasbeen implemented, while it also goes into greater detail aboutworking of the individual components present in the system.The actual control flow of operations in the system has beendemonstrated in section IV .Some further modifications whichcan be done to increase the fidelity and user friendliness of thecurrentprototypehavebeendiscussed insectionV.

II.RELATED WORK

Asperoursurvey,thereexistmanysystemsthatcancontrolhome appliances using Android based phones/tablets. Eachsystemhasitsuniquefeatures.Workondesigninghomeautom ation system model is an ongoing process. The existingsystemshavecertaindeficienciesnamely:Lackofanintuiti veUI, high base cost, lack of a good security system. We havetried to make improvements on the same. Some models thathavebeendevelopedalreadyarediscussedbelow.

Andrea Zanella explained the model of comprehensive surveyofenabling technologies, protocols andarchitecturefor anurbanIOT.Theyexplainedvarioustechnicalsolutionsand best-practiceguidelinesadoptedinthePadovaSmartCityproject, a proof of concept deploymenst ofan IoT in the cityofPadova,Italy,performedincollaborationwiththecitymunici pality.

Pavithra.D explained the model for efficient implementationof IoT in monitoring and controlling the home appliances viaworldwideweb(www).Thismodeliseconomicalandscalable. The model provided control of appliances via a webserveraswellaslocallywithoutinternetaccess[5].

RaviKishoreKodali,VishalJain,SuvadeepBose andLakshmi Boppana explained the model for IoT project whichfocuses on building a smart wireless home security systemwhich sends alerts to the owner by using Internet in case ofanytrespassandraisesanalarmoptionally.Themicrocontrolleru sedinthecurrentprototypeistheTI-CC3200Launchpadboard.Thissystemcansendalertsandthestatu s sent by thewifi connectedmicrocontrollermanagedsystem can be received by the user on his phone from anydistance irrespective of whether his mobile phone is connectedtotheinternet [1].

VamsikrishnaPatchava,HariBabuKandala,PRaviBabuproposed the system for Smart Home Automation techniquewithRaspberry Pi using IoT and it is done by integratingcameras and motion sensors into a web application. RaspberryPi operates and controls motion sensors and video cameras forsensing and surveillance. For instance, it captures intruder'sidentityanddetectsitspresenceusingsimple ComputerVisionTechnique(CVT)[4].

The paper -"Internet of Things Business Models, Users, andNetworks" describes various wireless IoT protocols used insmarthome.Italsodescribestheapplicationprotocolsusedfor IoT. It is useful to recommend the best security features ofdifferentprotocolsandhelpschoosewhichprotocoltouse.[7]

III. IMPLEMENTATION

ThearchitectureofHomeAutomationusingInternet ofThingsisshownin**[Figure-1].**Followingarethemaincomponentsofthesystem:
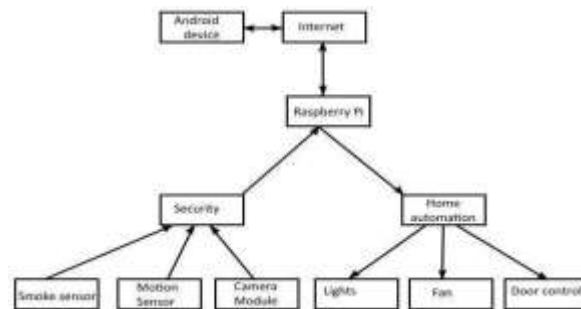

Fig.1.SystemArchitecture

A. RaspberryPi

A Raspberry Pi is a small -sized computer originally designedfor portability, inspired by the 1981 BBC Micro. Eben Upton'screated the device to make a small and affordable device tohelp improve programming skills and hardware understandingof students. Its small size and affordable price made it suitableforvariousapplications.Henceitwasquickly adoptedbymany customers [3]. The Raspberry Pi is a complete Linuxcomputer and provides all its functionalities at a low-powerconsumption level.

B. Sensors

The PIR motion detection sensor can be used to detect anyintrudersatthedoor.Itusesinfraredraystodetectanymovement .Ondetectingmotion, the userisalerted and apicture is captured. MQ-2 module is useful for gas leakagedetection(inhomeandindustry).Itcandetectvariousdange rous fumes of gases like H2, LPG, CH4, CO, Alcohol,Smoke or Propane. For detecting temperature and humidity ofhome,therearevarioussensorsbut,amongthemDHT22digitals ensorispreciseandgivesanaccuratereading.Acamera is attached at home for surveillance activity and forsecuritypurpose.
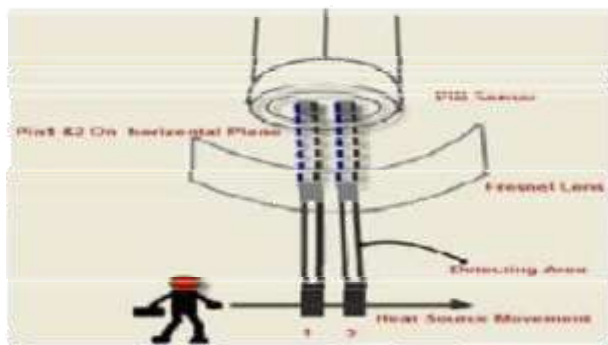
Fig.2. WorkingofPIRMotionSensor

C. Appliances

The various appliances include lights, fans, electronic doorlatchesandsecuritycamera.Ourdesignhasitsownapplication to control the various home appliances and also tomonitorthesecurityfeatures.Usercaninteractwiththeapplicatio ntocarryoutvariousfunctions.Theuserwillreceivealertsontheapp licationifthereisanyattempttobreakintotheirhome.Userwillalso benotifiedincaseofemergencylikefireetc.bytextmessagewithout usinginternet. This further adds security to our system. The data isreceived only by the server at the specified port and data arefurther analyzed. Our project is different in a sense it has itsown software level application to control the home appliancesandprovidingsecurityboth.
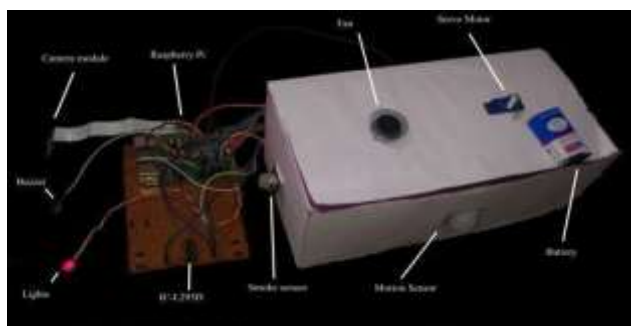

Fig.3. Android ApplicationSkeleton

Fig.4. Hardware Implementation

IV. CONTROLFLOW

Initially the user logs in to our android app by enteringdefaultcredentials.Thereisfacilityforadminaccesstoadd /removeusersandchangethedefaultusernameandpassword.

AES encryption is employed in the app to provide networksecurity. A socket runs at server (Raspberry Pi) ,which is openconstantlyandwaitsforrequestfromuser.

When user clicks on login a client socket is created in androidappandconnectionbeginsbetweenRaspberryPiandthean droiddevice.Theencrypteddataispassedthroughthissocket to RaspberryPi.

At Raspberry Pi side decryption of the data takes place. ThisdecrypteddataisverifiedwiththeentriespresentinRaspberry

Pimemoryitself.Ifcorrectdetailsareprovidedaresponseissentback todevicewhichstartsanewactivity.

This new activity can then be used to control any homeapplianceswithasimpleon/offbuttonUI.Therequestsarehand ledatserver sidebyRaspberryPi.
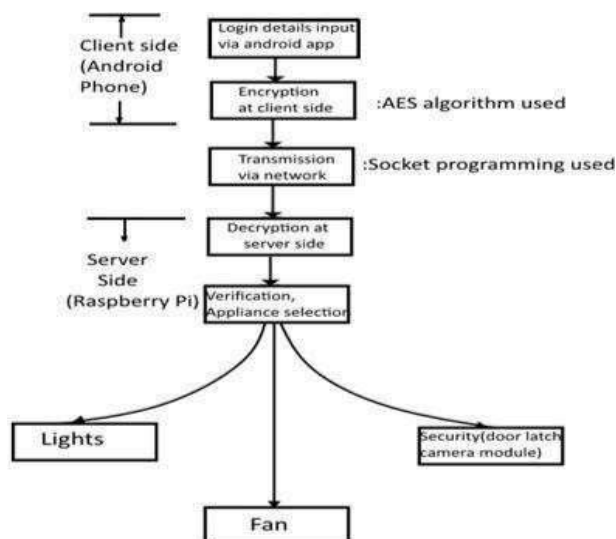

Fig.5.ControlFlow

The GPIO pins of Raspberry Pi are connected to appliancesandaccordingtorequestanyappliancecanbecontrolled easily.

TheRaspberryPiisalsoconfiguredtoprovideautomaticresponse in case of smoke detection or trespasser. A responseis sent to Android device and the user can take appropriateaction. A camera module is used to capture the image in realtime so user can accurately assess the situation. The image issent over the mail to the user's registered email address byusing SMTP. A text message is also sent to user via way2smsAPI so that user can get alerts without internet access from theandroiddevice.

V. CONCLUSION

The prime objective ofourproject is tousean androidsmart phone to control the home appliances conveniently andtoproviderobusthomesecurityandsafetymeasures. Infuture, the system can be improved by integrating the voicecall feature within the same smart phone application throughwhichtheusercancontrolhishomeappliances.Logincanalsobedonewithdifferentupcomingtechnologieslikeretina/fingerprint scanning. We can add image processing toimprove accuracy of the security system. This system woulduse a trusted face database to determine whether an intruder isdetected orif itisafalsealarm.

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