IOT Based Secured Smart Home

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Abstract- *The more the technology advances into thefuture, the more it makes the life of people depending on iteasier and one of such technologies is Automation. Theterm Automation can be coupled with- no effort, ease ofperforming a task and less human involvement. Internet ofThings is such other term which envisions every objectaround us as an integral part of the Internet.*

In this paper,we suggest a highly intractable and environmentallysustainable form of Home Automation System usingInternet of Things a means to control the appliances athome via a online platform with access to the Internet ,The necessity of security is increasing these days, ranging from thefts, burglary, accidents, LPG gas leakage and fire detection etc, which all are important aspects of a Home Security System. The keycomponents of this system are a GSM-Arduino and a Raspberry Pi and Things speak online platform to monitor and control the dataprovided by the Raspberry Pi and also to send,receive and process the requests. The Raspberry Pi acts asthe brain of this system, processing the requests,responding to the requests made by the Androidapplication, communicating with the Arduino and also actsas a server to store the data given by the sensors. All thesensors and actuators are connected to the Arduino whichis connected to the Pi using a USB cable. Our mainobjective of developing this model is to create a homeautomation system which interacts with the user throughvarious push notifications based on concerned parameterswhich is also eco-friendly.

Keywords- Arduino,, Internet, Internet of Things (IoT), Microcontroller, Raspberry Pi, Sensors, Smart Home Security System, GSM, SMS, multi sensor, theft alarm, Multi-Functional Secured Smart Home

I. INTRODUCTION

AMulti Functional Secured smart home is one that includes advanced automation systems which can provide its inhabitants, the sophisticated monitoring and control facilities over us various functions. For example, a smart home may have automated facilities for controlling lights, fans, air conditioners, temperature, multimedia systems such as home theater systems etc., security, window, door operations, curtains and many other functions. In the past few decades the demand for home automation has increased at a great pace [1]. Home automation system is key to improve the quality of residents, also to facilitate flexible ,comfortable and secured environment [2]. A smart home consists of three elements (i) internal home network, (ii) intelligent control and (iii) home automation with wired/wireless access gateways [3].An adaptive smart home would be the one that provides convenience for remote access to, the home appliances. Thus a smart home provides an user the convenience, comfort, remote control facility, connectedness of all appliances/gadgets and updated information of all activities inside the house.

A secured smart home aims to keep the home safe from intruders and external dangers that includes fire accidents and LPG gas leakage. Usually the appliances and gadgets inside home are connected to specific sensors, which help to reduce human labor and physical effort, by sensing and proactively responding to their needs, automatically. A Home Security System should provide security and safety for a home, by alarming the home inmates from intruders, burglary, natural calamities and accidents such as fire accident, gas leakage, animal invading etc. In this paper, we aim to develop a prototype multi-functional home security system, and discuss related technologies using GSM and concept of IOT using Thing-speak an open source IOT platform .

In a secured smart home, security is an important aspect and feature [4]. Technologies involved in a home security system have been changing significantly the last few decades, and will be changing much further in the upcoming years [5]. The emerging concept of secured smart home offers a safe environment, operational convenience and a comfortable life for its occupants. Generally a home security system alerts the home inmates in terms of alarm systems, thereby keeping their valuables safe from intruders. The features of a home security system, may offer more advanced functionalities. There is a great need of advanced home security system these days, alsoto protect property, detect crime, notify the fire or LPG gasleaketc., thereby giving peace of mind to all residents of a home. The sense of being safe from intruders makes a person more focused, productive and healthy. Hence, installing an advanced home security system to our homes may help in giving us an additional layer of defense against any potential burglars.A pocket-sized microprocessor called Raspberry Pi3 and similarly sized microcontroller called Arduino Uno satiates the core functionality of this Home Automation System(HAS) as they

are highly efficient and portable chips with all the built-in capabilities to support the requirements of HAS. The main advantage of using these boards are that they can connect to existing wireless technologies such as Wi-Fi [6], ZigBee, X10 and soon, using dedicated shields. The Raspberry Pi can be loaded with database technologies such as MySQL which would cut the requirement of using a Personal Computer to process the queries.

II. RELATED WORK

There are many definitions of home automation technology available in the literature. K. Bromley, M. Perry, and G. Webb. in , [7] Describes home automation as the technology within the home to enhance the quality of life of its occupants, through the provision of different services such as tele health, energy conservation and multimedia entertainment. There has been significant research into the field of home automation. The X10 industry standard is one of the oldest standard identified from the author's review which provides limited control over household devices through the home's powerlines. Recently, research into the field of home automation technology has continued to receive much attention in academia. A. R. Al-Ali and M. Al-Rousan, in [8], developed a Java technology based homeautomation system. An embedded board physically connectedall the home automating devices and, through integration witha personal computer based web server, provided remote accessto the system. The use of Java technology, which incorporatesbuilt-in network security features can produce a securesolution. However, the system requires an invasive andexpensive wired installation and the use of a high endcomputer system. N. Sriskanthan, F. Tan and A. Karande in [9] ,Introduced a Bluetooth technology basedhome automation system, which consists of a primarycontroller and a number of Bluetooth sub-controllers. Eachhome device (appliance) is physically connected to a localBluetooth sub-controller. The home devices communicatewith their respective Bluetooth sub-controller using wiredcommunications. From the sub-controller all communicationsare sent to the primary controller using wirelesscommunications. It is most desirable for each home device tohave a dedicated Bluetooth module. However, due to the fiscalexpense of Bluetooth technology, a single module is sharedamongst several devices. This architecture basically reducesthe amount of physical wiring required and hence theinvasiveness of the installation, through the use of wirelesstechnology. However, the architecture does not completelyreduce the invasiveness of the installation due to theincorporation of some wired communications. Moreover thesharing of a single Bluetooth module between numerousdevices has the disadvantage of suffering an access delay. H. Ardam and I. Coskun, in [10]proposed home and office automation system using telephone based remote controller. The system differs in that allcommunications occur over a fixed telephone line and notover the Internet. The system can be accessed using anytelephone that supports dual tone multiple frequency (DTMF).

T. Baudel and M. Beaudouin-Lafon, in [11] Proposed a novel control network, using handgestures. The controller uses a hand glove to relay handgestures to the system. The problem with the system lies in theinaccuracy of hand gestures, with the potential for normal armmovements being inaccurately interpreted as commands.Mainly, there is the risk of user exhaustion if repetitive handgestures are required. T. Saito, I. Tomoda, Y. Takabatake, J. Ami and K. Teramoto, in [12] Defined a home gateway as the point of access between a public access network and a personal areanetwork , with a power line based homeautomation system, and the Internet service they had developed a web server based home gateway tointerconnect IEEE1394.This makes system more attractive to home owners, a real time AV transcoding capability was also included. The system offers aninsightful look into the development of a home gateway. N. Kushiro, S. Suzuki, M. Nakata, H. Takahara and M. Inoue in, [13] Proposed a home energymanagement focused home gateway, which connects the homenetwork with the Internet. The system was installed in twentyhouses in the Tokyo area. S. Ok and H. Park, in [14] Implements the initialprovisioning function for home gateway based on open servicegateway initiative platform.D. Yoon, D. Bae, H. Ko and H. Kim, in [15] Implemented the HomeGateway and GUI for Control the Home Appliance. Khusvinder Gill, Shuang-Hua Yang, Fang Yao, and Xin Lu ,in[16] proposed Cloud-Based Services Regarding Household Living: Toachieve high-level home automation, third-party servers andconfigured smart home systems are recommended to addressdata privacy and authentication concerns in inter-home,multiple-device smart environments. Smart home systemshave been extended to intelligent building systems, with bothindoor and outdoor scenarios being involved. In addition,regional environment information is used in the dynamic intermediate layers of the architecture.

III. MAIN BODY OF THE PAPER

The system uses Arduino Uno for centralized operation as micro-controllers are becoming the core of digital circuit design these days. Arduino Uno and Raspberry Pi microcontrollers are used in this system. Web-cam is connected to Raspberry Pi as all the digital pins of arduino were used. Whenever a sensor detects intruder motion snapshot is taken by the web-cam and sent over email. The technology used here is GSM (Wireless technology) interface with arduino Uno to send messages , also monitor data over

thingspeak server and make call in-case of any burglary and fire accident or LPG leakage as it can provide connectivity to the devices from anywhere in the world. The technologies or scripting languages required to read and maintain the sensors and records for to keep data record ,we created channel over thingspeak platform through which we can easily monitor and control data of all sensors.

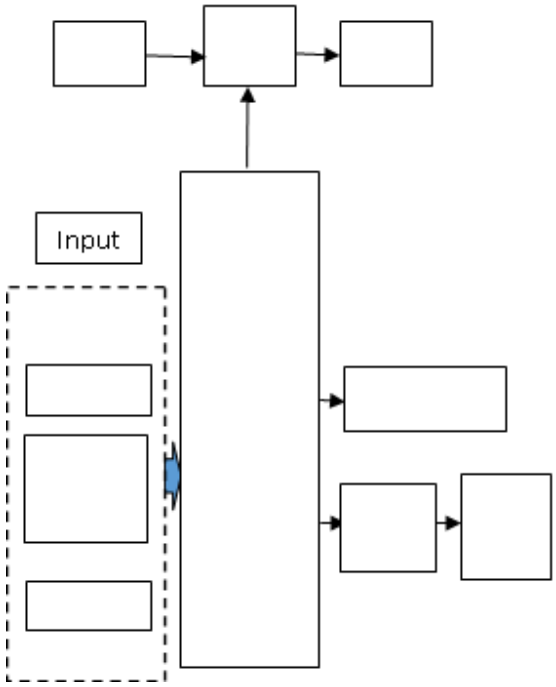

Fig.1. Block diagram for SSH system

Basically the block diagram (in Fig.1) can be divided into three sections. Which include Inputs, Outputs and microcontroller.The inputs to the micro-controller include temperature sensor (DHT22), PIR Sensor and Gas sensor (MQ). Buzzer, GSM Module areoutputs to the micro-controller. The GSM modem unit isbuilt using SIMCOM SIM 900a Modem .Web-cam isconnected to Raspberry Pi using an USB port. If PIR sensordetects motion it signals to both arduino and Raspberry Pimicro-controllers.

Once we install the Smart Secured Home system at our place , first we need to enter the password through keypad. If the password matches with the set password SSH System gets activated. a message is sent to the owner saying that the system got activated. The message is also displayed on Thingspeak channel On the other hand if the password gets miss-matched, we are provided with two more trails to re-enter the valid password. If a person fails to enter the correct password in these two attempts a delay of 2 minutes is provided to enter the password again. In this mean time we get an alert-message that somebody has tried to deactivate or activate the system. While the system is active and if the P.I.R sensor detects any motion in any room, it sends signal to Arduino and Raspberry Pi. Then arduino activates the buzzer , GSM module and Raspberry pi sends signals to web-cam, web-cam captures the image and photos are sent to the owner via email message. Snapshots also helps to overcome the problem of false alarm if any. Upon the activation of GSM module first we get a phone call as later we also get a message that there is motion in a respective room. The buzzer keeps on beeping till we de-activate the system by entering the password again. If we de-activate the SSH System then also we get a message. We can view status of system on channel created in thingspeak and also on L.C.D . 40- degreesto +125 degrees is the range of DHT22 sensorwhich is used to measure temperature [17]. The temperature of the house is displayed on L.C.D screen even if the system is de-activated. In case of any fire accident if the temperature goes beyond 65 degrees then also we get a message as, ”FIRE alert!! temperature exceeded above specific range”. The sensor MQis used to monitor the smoke and L.P.G level in the house. If the smoke level goes beyond 200ppm immediately we get a message as, ”Abnormal increase in smoke-level”. It is important to note that prolonged exposure to smoke level over 150ppm may lead to death. On de-activating the system PIR sensors, buzzer become inactive and door gets automatically opened. We have kept relay circuit separate from this , such that we can turn ON/OFF appliances in our home with our mobile phone .

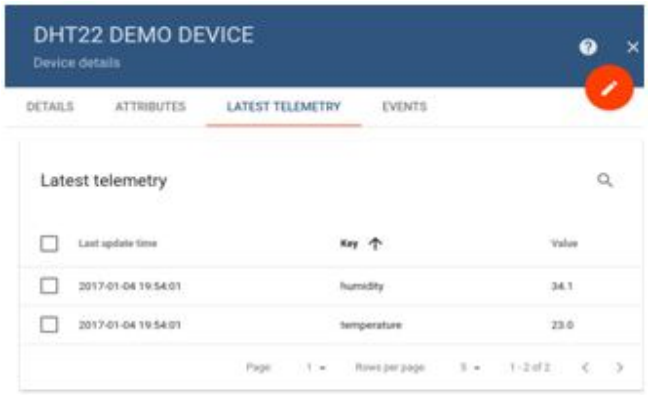

Fig.2. Real time data monitoring

Fig.2. Graph of Temperature and Humidity Monitoring over Thingspeak

Table 1. Accuracy of DHT22 temperature sensor

Time	Measured Temperature in degrees	Actual Temperature in degrees	Accuracy in %
09:00 A.M	31.71	31	97.7
09:30 A.M	32.32	32	99
10:00 A.M	34.30	33	96.2
10:30 A.M	34.76	33	94.9

III. PERFORMANCE AND EXPERIMENTS

A series of experiments were done to find the accuracy of temperature sensor (DHT22) in our SSH System. The status of each hardware component such as buzzer, PIR, temperature sensor, gas sensor, GSM is tabulated in table II.

(a) Temperature sensor:-

Temperature recorded by temperature sensor (DHT22) was observed and verified with the actual temperature. Figure 4 depicts the accuracy of temperature sensor used in our system. The actual temperatures were taken from[24]. The average accuracy rate of the Temperature (DHT22) calculated from the table I, is 96.95 percentage which wascalculated at different times in a day. 99 percent accuracy was found when the temperature sensor was provided with a separate power supply. In figure 4 the temperature measured by our sensor and theactual temperature are depicted in the form of a graph.

(b)PIR Sensor:-

The maximum distance a P.I.R Sensor detects human motion is 10 meters. However by a series of experiments it wasobserved that a P.I.R Sensor's accuracy is high in range of5 to 7 meters.

The prototype, SSH System developed in this paper may help developing the low cost home-security system whichcould be installed in our houses before/after construction. Thedemonstrated system can be directly scaled-up in a house withfew basic steps. The system is extendable and more levelscan be further developed. Home automation could be betterimplemented in a smart home which can be controlled usinga smart phone through wireless technology. Various wireless technologies like Bluetooth, WIFI, GSM, NFC (Near FieldCommunication) can be used to control our home appliancesand also make our homes much secure. In future this systemcan be powered with wireless camera to transmit status of securitylevels to authorized persons.

IV. RESULTS

Table2: Status of each Parameter

System Status	PIR Status	Gas Sensor	Temperature Sensor Status	Buzzer status	GSM Module Status
Upon activation	ON	ON	ON	OFF	Activation SMS
Motion Detected	ON	ON	ON	ON	SMS and CALL
Upon Deactivation	OFF	OFF	ON	OFF	Deactivated SMS

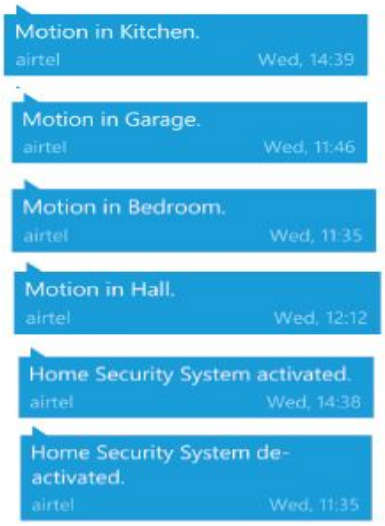

Fig.4Messages sent by GSM module.

V. CONCLUSION

The Multi-Functional Secured Smart Home (SSH) System, proposed in this paper is very simple and easy to use. The GSM based security system helps to communicate between pre-configured number and system with ease. Web-cam takes photos whenever PIR sensor signals the micro-controller and sends it to the user over email. This provides an additional security to our home. As GSM is a wireless technology the user can get alerts anywhere in the world thus making thesystem independent of location. For instance, the owner is alerted through an SMS if motion is detected in any room while system is activated, whenever system gets activated and de-activated, on fire detection and smoke detection over a certain range. Data easily monitored and controlled using IOT (Rpi-3).GSM technology is also used to call the owner when motion is detected and when an incorrect password is entered more than three times. AT commands have been used in the system to explore the services of mobile and control the services flexibly. The factors on which time

taken to send a message depends on range of a specified network and its coverage area.

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