

# Design and Development of an Intelligent Home with Automated Environmental Control

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**Abstract:** Intelligent home automation has become more popular over the decade. Integration of automation in a home security, enhances its self-dependability. An intelligent home, integrated with various smart system modules can provide convenient and safe environment for the inhabitants and home appliances which can be easily controlled and monitored even from a remote distance. In this paper an intelligent home automation and environmental solution is proposed along with the architecture of integrated sensor modules. This proposed system is embedded with electronic lock driven with password verification and biometric finger print scanner. This sensing tools ensure the system to prevent unauthorized access. It is comprised with video recording of unauthorized person or intruder moving around the home or office premises. Moreover, PIR motion sensor, IR sensors would also work as safeguard by helping to capture image and Skype video calling from the inside of home or office. User will also be able to monitor the present condition of the home or office by using Facebook post of image and message status. The implemented system as a prototype for the justification and attestation of the proposals has been tested successfully. The observed data ensures that the system is working efficiently.

**Index Terms:** Smart home, Security, Microcontroller, GSM, Sensors, Cameras.

## 1. Introduction

Smart home is an advanced technological concept for automation and controlling of home appliances through intelligent and coordinated manners using smart devices and technologies [1]. Smart spaces consist of a large number of heterogeneous devices, for instance, multiple sensors, actuators, microphones, cameras, smart appliances and so on. This idea can open a new era of research on technology and networking. With the advancement of electronics and computer science all the appliances and devices are getting tiny and controllable via the microcontrollers and connecting to the internet. All these enabling individuals to enjoy network-based services, such as home energy management, home security, home climate control, and other similar services [2,3]. The number of smart systems is dramatically increasing with the development of newer devices. As a consequence, people of all over the world are becoming more and more dependent on smart systems. Smart home systems can be categorized into four classes such as- home appliances, lighting and climate control system, home security system, home communication system and home entertainment system [4]. Home automation is a process for improving the quality of residents' life by providing flexible, comfortable and a secure environment. Home automation systems are used for controlling the indoor & outdoor lights, heat, ventilation, air conditioning in the house to lock or open the doors & gates to control electrical & electronic appliances, ensuring security with embedded surveillance system and so on using various control systems with appropriate sensors [5,6,7,8,9]. Internet based home automation systems is one of the most popular system in the world market [10]. Controlling and monitoring of a home from remote areas using internet requires a laptop or a

computer, which is not convenient to carry. So, for remote monitoring and controlling of a home both from inside and outside, smart mobile phone-based system is the only effective alternative. Security is a complex domain and defeating all types of threats in a single system is not possible, but some effective measures can be taken into consideration in order to avoid basic security leaks. The dynamic home system [11] uses improved security system to make the home a comfortable zone without any kind of anxiety. There are two types of security system- wired security system and wireless security system [12]. Wireless system is very simple to use and very effective to deploy in the homes or offices. Smart intelligent system [13] consists of the automation and security. In this type of system, a dedicated computer system is used to monitor the whole system and can able to make a decision by taking signals from the sensing, imaging and controlling devices.

In this work, emphasis was given to incorporate all types of facilities that are required for a modern home. The heart of the system is the microcontrollers that are integrated with many other devices. In security system generally PIN or card verification, password identification is being used but the main disadvantage is that password or PIN could be hacked by others and card may be stolen or lost. But the system ensure security as Biometric fingerprint sensor is used and each person's fingerprint is identical. In our proposed system different camera module are used to detect the intruder through immediate video calling and image capturing. In addition, with this feature many others modules are in various stages of development. A complete solution to protect against intruders by any chance, all possible solutions have been proposed to prevent the chance of becoming too firm. That's why we are motivated to do this project. The rest of paper has been organized as follows. Section 2 reviews the related work. Section 3 presents detail description of the proposed system. Section 4 discusses the results. Section 5 provides conclusion of the work.

## 2. Literature Review

Many researchers have developed smart home systems with various features. Dynamic home security system with laser has been implemented by Azfarina Jaafar et. al. [11]. In this paper the authors have showed the system interfacing with webpage and windows 10 mobile applications. They have used Raspberry Pi-2 module for this system. In [12] IOT based home security and automation system has been designed and implemented. They have used the internet to get notification from the home. In this research the Wi-Fi connected microcontroller has been received status by user at distance. Designing and implementing a SMS based home security system has been focused in [13]. They have been used GSM technology to send SMS and two Android applications for user interfacing with the hardware.

Web based online door access controlled and face recognition system has been proposed in [14,15]. In this paper Zigbee based wireless network was used. Zigbee module and electromagnetic door have been used in this purpose. Face detection and recognition system has been used to detect and identify visitors and send an email or an alert message about the current home environment status via GSM network automatically to the home owner's mobile phone. Door and windows monitoring system for home security has been implemented in [16]. In this paper there has an alarming function and warning signal to the nearest police station when someone broke the door or windows. Android application based home security system has been designed in [17]. This paper deals with the system which has been functioned by the android apps with SMS triggering to aware others. Remote home security system and appliances control system have been designed and implemented in [18]. GSM technology has been used to send SMS as a notification from gas, smoke and other types of sensors.

Short message services (SMS) alert based home security system of different sensors has been implemented by Azad and Kumar [19]. They proposed the system with motion sensor, smoke sensor, temperature sensor, humidity sensor and light sensor. GSM network has been used to test this security system. In this system PIC microcontroller has been used as a processing device. N. Agarwal and G.S.Nayak have proposed a remote monitoring home security system [20]. In this system door locked password protected function, IR sensor to detect obstacles at doors and windows and LM35 sensor for detecting fire have added. Programmable logic controlling home security system based on GSM has been focused by Sujatha et. al. [21]. They proposed this system using motion sensor, IR sensor, GSM module and GSM mobile phone. In [22] GSM technology based home security system has been designed and implemented by J.Bangali and A.Shaligram. This system includes temperature sensor, PIR motion sensor, LPG gas sensor, light sensor and humidity sensor. When sensors will receive corresponding signal then the processor send SMS through GSM modem. In this system they have also proposed to use camera to take picture and video, a pc server to upload image. Image tracking based home security system [23] with Arduino microcontroller has been proposed by G.Sushma et.al. In this system two sensors are used. One is vibration sensor and the other is PIR motion sensor. A webcam is placed on the door to capture image to identify intruder. SMS sent to the mobile phone of home owner if anyone tries to open the door forcefully. Authors in [24] developed a home security and automation system using android and Bluetooth interfacing. In this paper door lock and unlock system has been implemented by giving password through Bluetooth.

N. Prince and N. Ifeanyi have showed door controlling system based on microcontroller and computer or phone [25]. In this system they have implemented password based door opening and closing. Android based apps were developed in this system. If password is wrong, then the door will remain locked. In a system [26] visual basic DTMF was used to run several modern features. In this system high security device, finger print sensor, GSM module have used. Laser ray based security system for intrusion detection has implemented in [27]. Modern technology Wi-Fi based

home automation system has been designed and implemented in [28]. In this paper the authors have used a network. In this proposed system the first part consists of web server (connected to Wi-Fi) by which administrator can control the system remotely. The second part consists of hardware interfacing unit. This section provides appropriate interface to sensor and accurate home automation system. Wi-Fi and Bluetooth based security system has been implemented in the [29,30] where all the sensor's notifications go to the user via wireless technology. A PSTN based home security system has been implemented in [31,32]. This is a wired based security system. Also some part of the system was incorporated GSM based wireless module to alert the home owners.

### 3. Proposed System Of Home Automation and Security

The block diagram of the proposed smart home system has been presented in Fig. 1, Fig. 2. In these figure inputs from different modules to and outputs from microcontroller have been depicted. Microcontroller processes the signals coming from the inputs and provides output signals according to the preloaded instructions. The whole proposed system has been divided into two parts i.e. outside of the house and front entrance is shown in Fig 1., inside part is shown in Fig. 2.

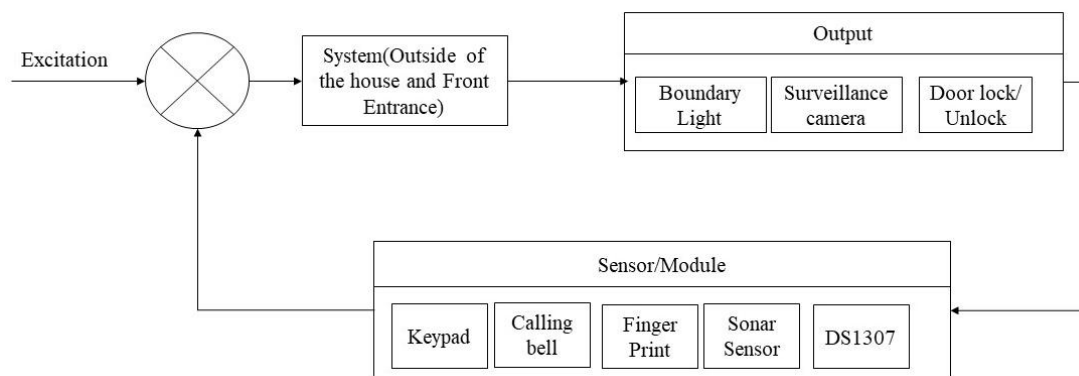


Fig. 1. Block diagram of the proposed system for Outside of the house and Front entrance.

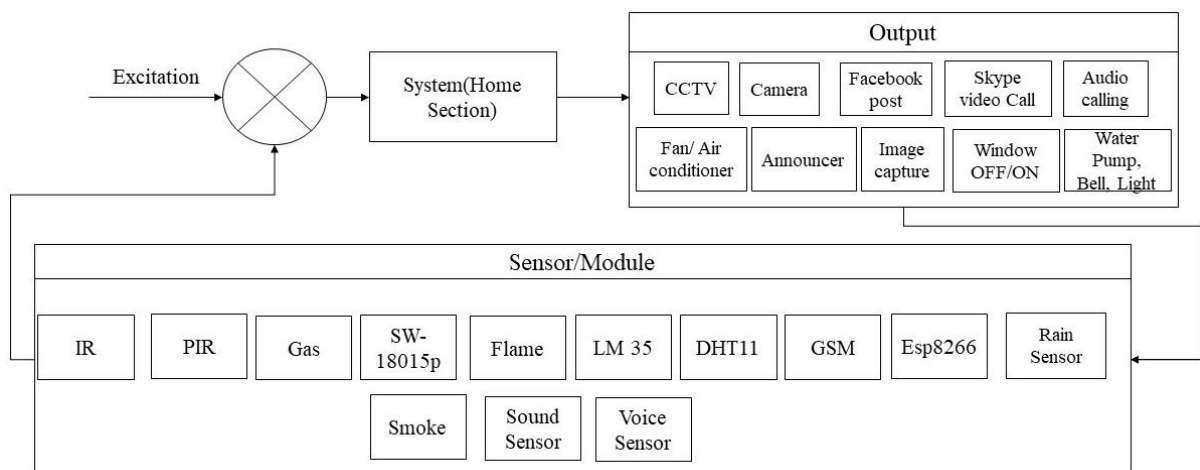


Fig. 2. Block diagram of the proposed system for Home section.

The function of the proposed system was implemented dividing the system into several modules as described in the following sections.

#### A. Outside of the house and Front Entrance

The outside part of this home system is boundary section that consists of boundary walls, lights and surveillance camera.

a. Boundary line and light: The boundary is associated with lights that turn on at the evening and turn off at morning. This automation is controlled by the clock time set up on the microcontroller.

b. Surveillance Camera: When some person comes near the boundary section, the sonar sensor detects the person. Distance (in cm) of the person from the sensor is calculated using the speed of sound. The ultrasonic sensor detects the distance using equation (1) [33]

$$d = c \times \frac{t}{2} \quad (1)$$

where

$d$  = distance,  $c$  = speed of ultrasonic sound in air,

$t$  = time elapse to travel sound from the sensor system to the object and return it to the sensor again.

Output signal of the sonar passed to the microcontroller and it turns on the video camera (security camera) when the distance is less than the threshold value and rings a buzzer to alert the inhabitants of the house. A servo motor has been utilized that can rotate the camera up to 180 degrees. In addition, CCTV system is furnished with recording video footage of any occasions, which may happen. If the person seems to be a harmful one, then the authority can take appropriate steps according to the circumstances.

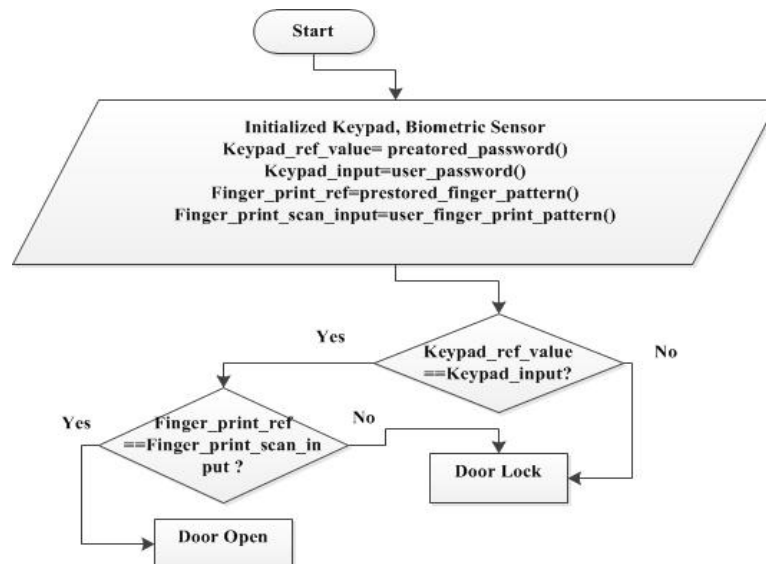


Fig. 3. Flow chart of proposed system (Security).

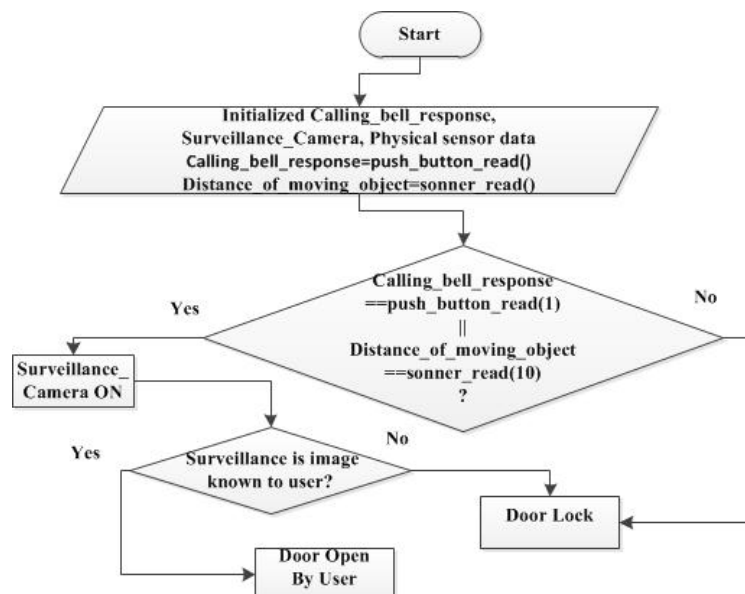


Fig. 4. Flow chart of proposed system (Advanced Security).

c. Front Entrance: Door, keypad system and calling bell are used in this section. A door lock system is placed that functions through keypad interfacing. Once providing unlock password the door will automatically open and after passing a predefined time it will be closed automatically. In Fig.3.the implementation algorithm of the proposed system has been focused. Electronic locker will be open and close according to the following condition. The Biometric fingerprint scanner identify the author to access the home according to the following algorithm in Fig. 3. A calling bell

system has been added to this part. When someone from outside want to enter into the house he will press calling bell switch.

When the calling bell is pressed then the video camera will atomically turn on and person stay in home can view this video at instant which is working according to the algorithm in Fig.4. The owner of the house can give permission to the person to enter into the home using password enabled android applications.

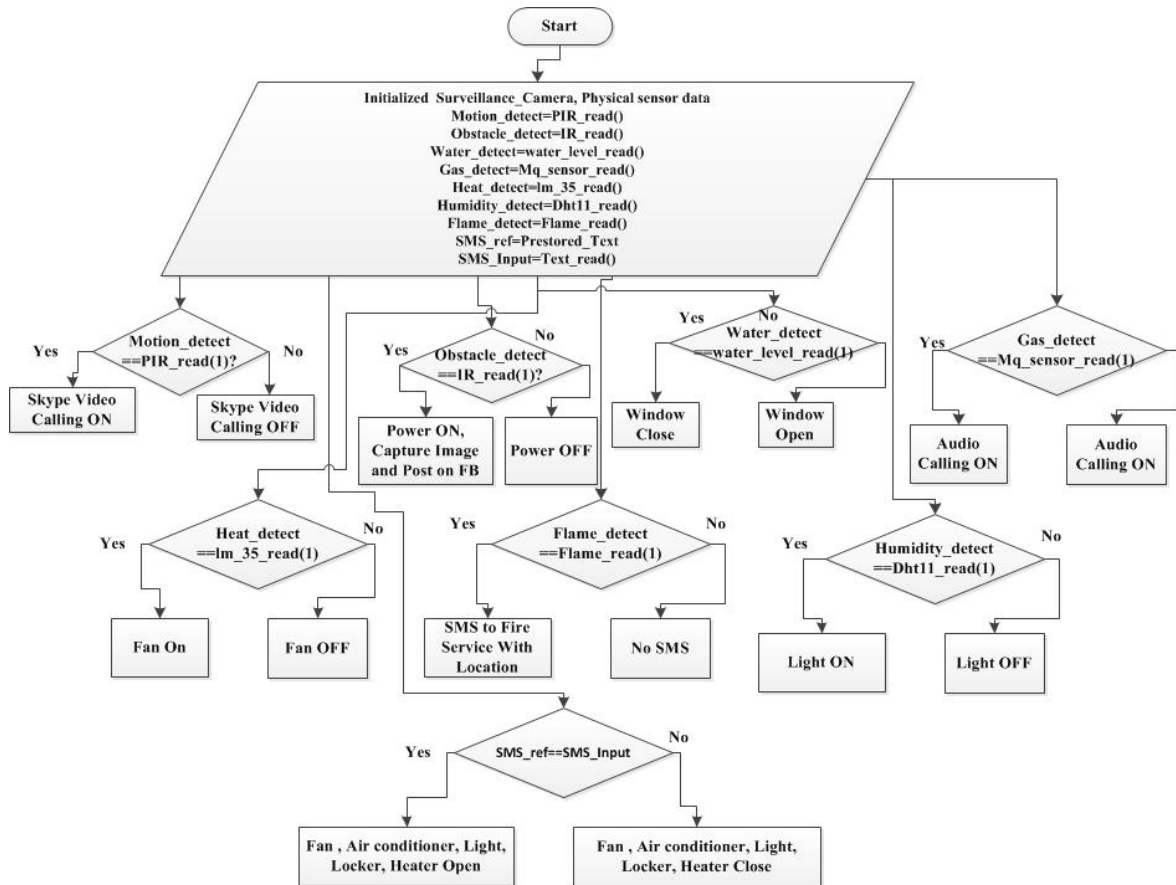


Fig. 5. Flow chart of proposed system (Inside).

### B. Home Section

The proposed system for inside part of the home automation and security has been showed in Fig. 5. In home section many sensors are comprised for different purpose. For this reason, this section is also sub divided into ten sections.

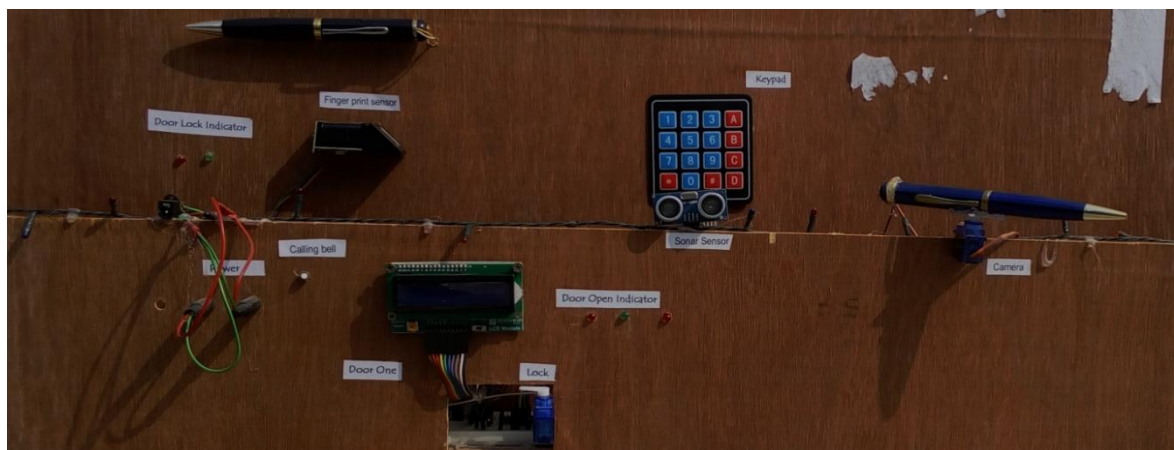


Fig. 6. Circuit for door lock system.

a. Main door: In this part, a door lock system with fingerprint sensor is placed. The person whose fingerprint is stored previously in the system's memory can open the door. The sensor system compares the present scanned image with the stored image and the door is opened depending on the matching result. Door will remain opened for a preset time then will turn off automatically. The circuit arrangement of this part is shown in Fig. 6.

b. Motion Sensor (PIR): This is known as PIR or passive infrared detector. So as to make a sensor that can determine a human body (person), by measuring temperature (applicable to human body temperature). Human body with temperature of skin around 93 degrees F transmit infrared vitality with a wavelength of 8 to 10 micrometers [34].

According to Stefan Boltzmann law, the density of heat flux between the source and the heated surface is expressed as

$$Q = \sigma C(T_1^4 - T_2^4) \quad (2)$$

where: Stefan-Boltzmann constant,

$$\sigma = 5.67 \times 10^{-8} \text{ Wm}^{-2}\text{K}^{-4}$$

C, Constant, which characterizes emission surface and geometric properties.

$T_2$  – source temperature, (K)

$T_1$  – temperature of heated surface, in this case the surface temperature, (K)

The thermal radiation of the PIR sensor obey the above equation [35].

c. Video capturing and live streaming: In this work two CCTV camera and two PIR sensors were placed inside the room. When the main door of the room is locked and if any person entered the room by breaking window then the PIR sensors can detect the presence of the person. The output signal of PIR sensors are passed to the microcontroller to activate skype calling system that shows live video of the room to the owner of room. For this purpose, a servomotor is used to rotate the camera to take picture throughout the room. The camera was so placed that is not easily noticeable. The system is also equipped to upload the image of the room to the Facebook account of the owner. The implemented result of skype video calling is shown in Fig. 10. User will rapidly see the intruder in the home.

d. Kitchen Room: In this proposed system, a kitchen room has been designed incorporated with different types of sensors.

MQ2 sensor works as a comparator circuit. This sensor functions according to Eq (3) and (4).

$$\text{sensor\_volt} = \frac{(\text{float})\text{Sensor\_value}}{1024} \times 5.0 \quad (3)$$

$$\text{Resistance of sensor } R_{s\_gas} = \frac{5.0 - \text{Sensor\_volt}}{\text{Sensor\_volt}} \quad (4)$$

The sensing resistance will be decreased with the increase of PPM (Parts per millions) of the gases.

According to ratio of the sensing resistance  $R_s$  and the fresh air resistance  $R_o$  with respect to PPM, smoke, LPG,  $\text{CO}_2$ ,  $\text{CH}_4$  can be identified. A flame sensor is used to detect the fire inside the kitchen. When flame sensor output is positive microcontroller turns on buzzer and send a SMS to the fire service which is shown in Fig 8. The implemented circuit arrangement is shown in Fig. 7. The audio calling notification for detecting gas in the kitchen room is shown in Fig. 9.



Fig. 7. Kitchen room equipped with flame, gas, smoke and heat sensor.



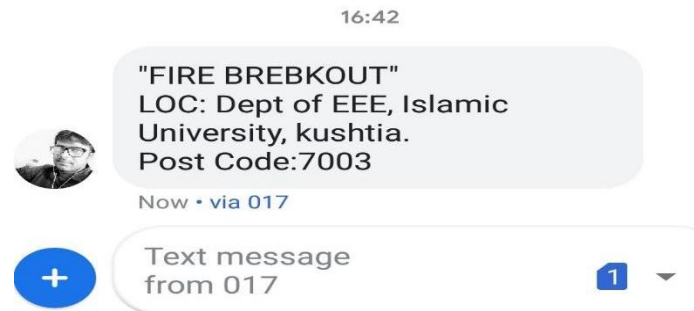


Fig.8. SMS to the nearest fire service

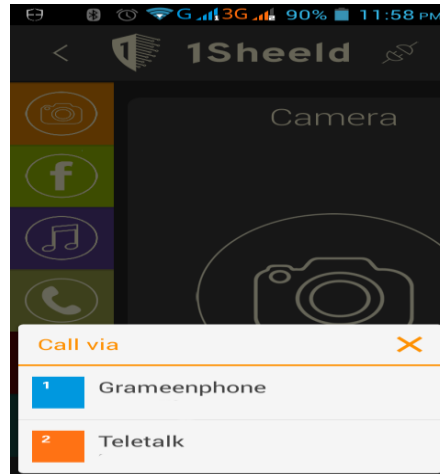


Fig. 9. Audio calling function when Gas has been detected by this sensor.

Heat detection sensor is placed in kitchen to detect unexpected heat. This Sensor measured the temperature using the equation express in (5) and (6).

$$mv = \frac{val}{1024} \times 5000 \quad (5)$$

$$cel = \frac{mv}{10} \quad (6)$$

When the heat is larger than a threshold value (60 degrees centigrade for example) then the corresponding notification will be uploaded on Facebook timeline and an alert will be sent to the authority at that moment.

e. Earthquake Detection: A vibration sensor (sw-18015p sw) has been placed to identify the earthquake. This sensor can identify vibration above a threshold level by acting as a switch [36]. If any vibration is sensed the result can be sent to the remote house owner by instant Facebook posting or a voice call using GSM module.

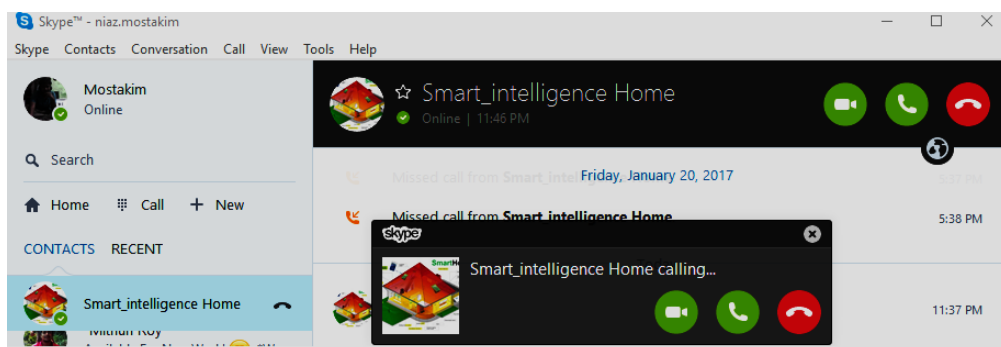


Fig. 10. Skype video calling

f. Humidity and temperature controlling: A humidity and temperature sensor is used on this system to monitor temperature and humidity. Turning on and off of fans and air conditioners can be operated depending on the sensor output.



Fig. 11. Image post on the Facebook TimeLine

g. Notification to the owner about the condition of home appliances: SMS controlled home automation system is proposed on this system. A GSM module is added to enhance the functionality of this system. To ensure the system work properly and aware about the conditions of the appliances notification system has been included that will send through SMS. In this part, fan ON/OFF, Air conditioner ON/OFF; Heater ON/OFF; Store room Opened/Closed, Neighbor announcing ON/OFF functions are added. After activation each and every function, it will notify the author by sending SMS. The operation of GSM Controlling home appliance is shown in Fig.12. The implemented circuit of GSM controlling home appliance is shown in Fig. 14.

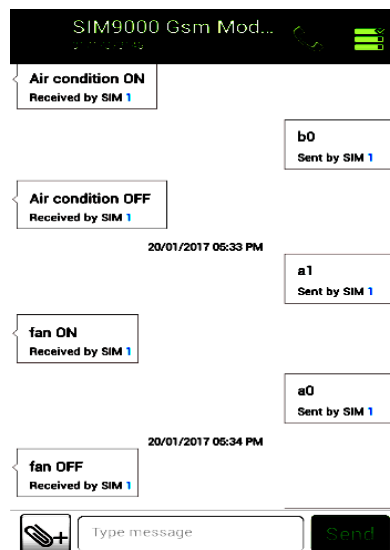


Fig. 12. SMS Controlled home appliance and confirmed these operations through notification.

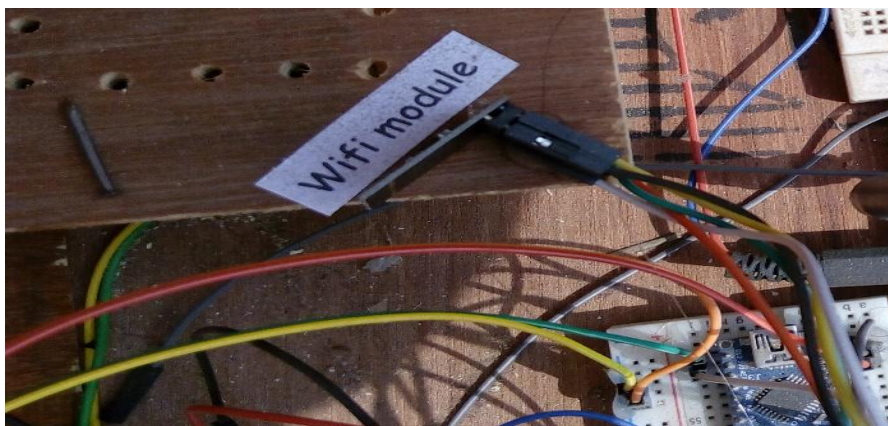


Fig. 13. Circuit Wi-Fi module for connecting household devices to internet.



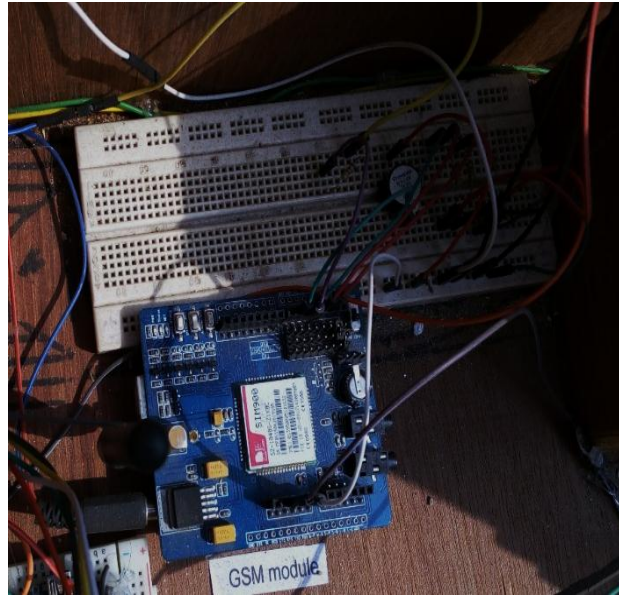


Fig.14. Implemented circuit of GSM module

h. IOT using Wi-Fi Hot-Spot: In Fig. 13 Wi-Fi module was used to create a small network of household devices such as water pump, TV, fan calling bell etc. This Wi-Fi based network was connected to the internet to make the devices controlled from remote areas and using this hotspot the value of the gas sensor is sent to the server. After analysis this PPM value we can detect which gas is leakage.

i. Voice Controlled Device Operation: A voice command based device controlled system has been developed. In this part, bedroom light on and off, bathroom light on and off, computer on and off functions are controlled by voice of an authorized person. In the present work all devices are controlled by a single voice command using android apps via Bluetooth. Implemented circuit of voice controlled home automation is shown in Fig. 15.

j. Locker security: For preventing valuables stored in locker we proposed a sensor to detect the intruder in front of it. If any one comes in front of the locker door and try to damage the locker, then the IR sensor detect the intruder and camera capture the image and post to the Facebook timeline. The captured image and timeline post is shown in Fig. 11.



Fig.15. Circuit for voice command based appliance control.

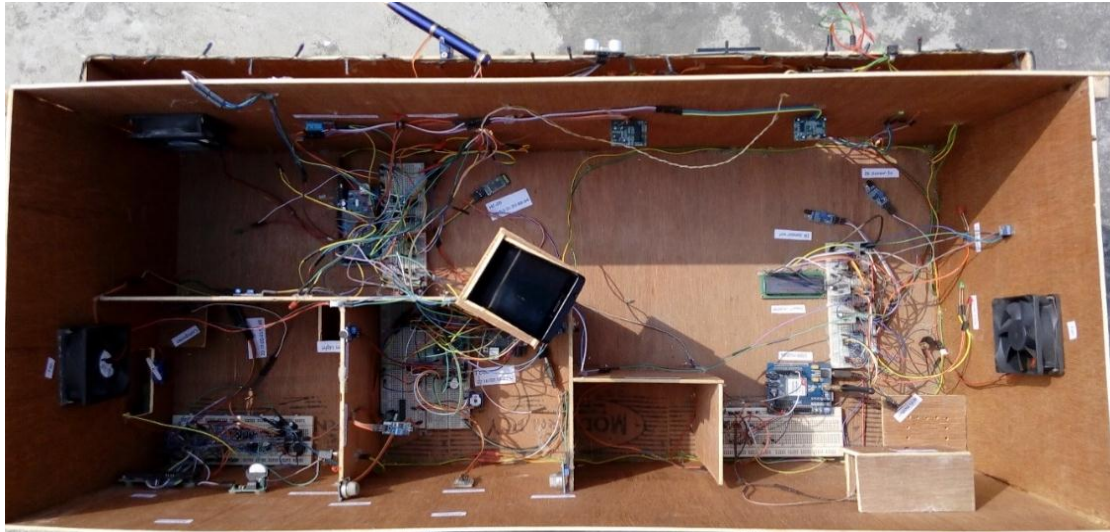


Fig. 16. The whole implemented system (inside view).

#### 4. Result & Discussion

In this work a smart home system which the authors have termed as the “complete home system” has been designed and implemented. Numerous sensors and communication modules have been utilized to make the system a complete one. All the components were seen to function properly. In this system SMS and finger-print based door lock was used. Video camera, actuator for video camera integrated with PIR sensor, gas sensor, smoke sensor, flame sensor, heat sensor, water level sensor etc. were used. Some results of the functionality of the sensors are given in following tables and figures. As we have proposed a prototype for complete home security system and the testing result for all section are showed in Fig. 8, Fig. 9, Fig. 10, Fig. 11 for sending SMS to nearest fire service, audio calling when gas is detected, skype video calling, image captured and post respectively. For detecting the gas leakage and identify the harmful gas is shown in Fig. 17., Fig. 18, Fig. 19. for LPG, smoke and CO respectively.

Table 1. Testing the accuracy and reliability of the system

Name of Device	Condition/value	No of experiments Operation	Performance/result
Mq2(Gas Sensor)	Measure PPM of CO, smoke, LPG	13	Identify individual gas and Send notification through SMS
Heat Sensor	More than 50 degree centigrade	5	Notification through FB post. (90% accurate)
Dht11	Temperature more than 30 and humidity more than 50	10	Control the home temperature and humidity at comfortable condition (99% accurate)
Water Level Sensor	More than 600(Analog value level )	7	Notification through fb post and control the windows. (90% accurate)
Vibration Sensor	High/Low	6	Notification through fb post,(90% accurate)
Camera	After detecting object by Ultrasonic sensor	9	Capture video (75% accurate)
Ultrasonic Sensor	Less than 10 Cm	8	Camera ON to video(75% accurate)
Wi-Fi-Module	Connect to Web browser	7	Control Home appliance
PIR Motion Sensor	High or Low	8	Skype Video calling 95%
GSM module	Identify command	15	OFF/ON through SMS (87% accurate)
Isheild	High or Low	20	SMS, VIDEO, FB post (80% accurate)
Flame Sensor	High or Low	5	SMS to fire service with location, 85% accurate
Smoke detector	Identify GAS and Smoke	6	SMS notification (95% accurate)
Fingerprint Sensor	Matched or not matched biometric print	7	High or low, (100% accurate )

Table 2. MQ2 Sensor data (Rs/Ro) for LPG with respect to PPM

PPM	Rs/Ro
84	1.68
89	1.63
127	1.42
140	1.25
278	1.15
281	1.16
500	0.96
800	0.85
1000	0.7

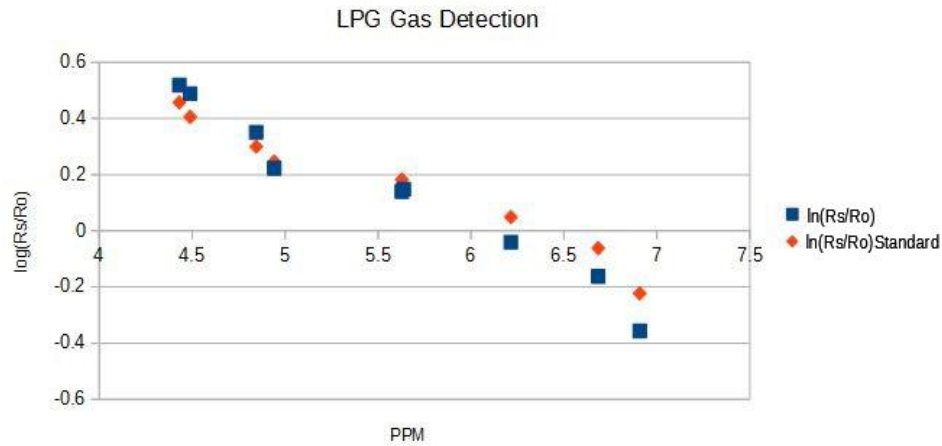


Fig. 17. LPG detection

Table 3. MQ2 Sensor data (Rs/Ro) for Smoke with respect to PPM

PPM	Rs/Ro
47	1.74
79	1.37
213	1.33
275	1.25
287	1.21
350	1.19
389	1.17
409	1.14
469	0.99
552	0.97
1169	0.91

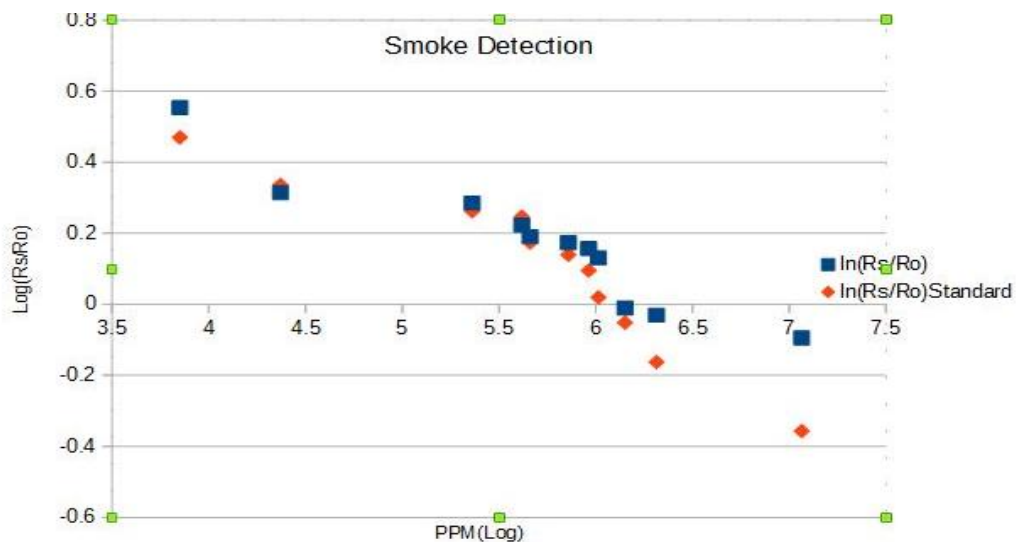


Fig. 18. Smoke detection

Table 4. MQ2 Sensor data (Rs/Ro) for CO with respect to PPM

PPM	Rs/Ro
151	1.37
231	1.3
486	1.28
559	1.18
563	1.16
695	1.12
891	1.01
1201	0.94

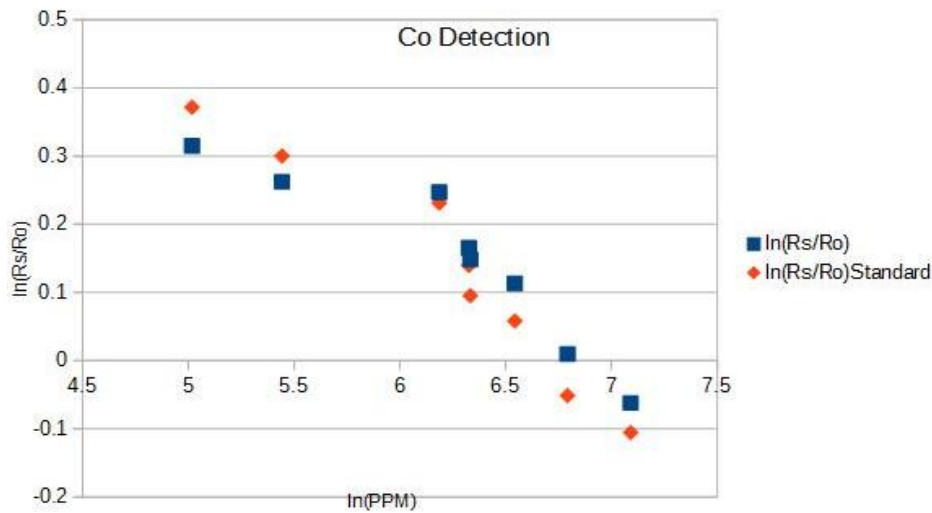


Fig. 19. CO Detection.

## 5. Conclusion

The intelligent home system make humans daily life easier. In this work a home system was designed and implemented to ensure security of home or offices. All possible security threats were tried to mitigate using multi-layer security concept. Controlling of different household devices was made easy by using different sensors and communication modules. In our proposed system video calling, image capturing to identify the intruder have implemented and tested. This feature ensures the security of valuables. Present condition of room can be easily accessible using this system. This system is reliable because different steps of protection level is used to implement this system. If one section is failed to give the notification, then another section will give the notification. This proposed system is much better than other system because in our proposed system multilayer protection automation present and all section accurately working as proposed. In future author will upgrade this system by using image processing to find the personal information of the intruder within very short time and artificial intelligent will be added to this system to get more feature in home automation.

## References

- [1] Pardeep Kumar, An Braeken, Andrei Gurtov, Jari Iinatti and Phuong Hoai Ha. "Anonymous Secure Framework in Connected Smart Home Environments". *IEEE Transactions on Information Forensics and Security*, Vol. 12, No. 4, April 2017
- [2] Y. T. Lee, W. H. Hsiao, C. M. Huang, and S. C. T. Chou, "An integrated cloud-based smart home management system with community hierarchy," *IEEE Trans. Consum. Electron.*, vol. 62, no. 1, pp. 1–9, Feb. 2016.
- [3] D J. E. Kim, G. Boulos, J. Yackovich, T. Barth, C. Beckel, and D. Mosse, "Seamless integration of heterogeneous devices and access control in smart homes," in *Proc. 8th Int. Conf. Intell. Environ. (IE)*, Jun. 2012, pp. 206–213
- [4] Pohl & Sikora, 2005; Valtchev et al., 2002; Friedewald et al., 2005; Zahariadis, 2003; Delphinanto, 2003 "Security of Smart home Environment".
- [5] Kim MH, Shin YT (2016) A study on the smart home service security threat. Proceedings of symposium of Korea institute of communications and information sciences, pp 1069–1070
- [6] Ryu HS, Kwak J (2015) Group key management method for secure device in smart home environment. *J Korea Inst Inf Secur Cryptol* 25(2):479–487
- [7] Lee JG, Yang CS, Kim JH, Kim KJ (2015) A research and development of integrated platform for data security between different smart home devices. *J Korea Inst Inf Commun Eng* 19(5):1173–1179
- [8] L évy-Bencheton C, Darra E, T áu E, Dufay G, Alattar M (2015) Security and resilience of smart home environments. European union agency for network and information security

- [9] Rajiv P, Raj R, Chandra M (2016) Email based remote access and surveillance system for smart home infrastructure. *Perspect Sci* 8(2016):459–461
- [10] Won Min Kang, Seo Yeon Moon and Jong Hyuk Park “An enhanced security framework for home appliances in smart home” . *Journal-Human Centric Computing and Information Sciences* (2017) 7:6 DOI 10.1186/s13673-017-0087-4
- [11] Azfarina Jaafar, Murizah Kassim, Cik Ku Haroswati, Che Ku Yahya “Dynamic home automation security (DyHAS) alert system with laser interfaces on webpages and windows mobile using raspberry PI” *Control and System Graduate Research Colloquium (ICSGRC), 2016 7th IEEE, 16 January 2017*
- [12] Ravi Kishore Kodali, Vishal Jain, Suvadeep Bose, Lakshmi Boppana, “IoT based smart security and home automation system” , *Computing, Communication and Automation (ICCCA), 2016 International Conference on, IEEE, 6 January 2017*
- [13] Mrutyunjaya Sahani, Chiranjiv Nanda, Abhijeet Kumar Sahu, Biswajeet Pattnaik, " Web-based online embedded door access control and home security system based on face recognition", *Circuit, Power and Computing Technologies (ICCPCT), 2015 International Conference, IEEE, 16 July 2015*
- [14] Cristian Chilipirea, Andrei Ursache, Dan Octavian Popa, Florin Pop, “Energy efficiency and robustness for IoT: Building a smart home security system”, *Intelligent Computer Communication and Processing (ICCP), 2016 IEEE 12th International Conference. 10 November 2016.*
- [15] Biplav Choudhury, Tameem S. Choudhury, Aniket Pramanik, Wasim Arif, J. Mehedi, " Design and implementation of an SMS based home security system" , *Electrical, Computer and Communication Technologies (ICECCT), 2015 IEEE International Conference, 27 August 2015.*
- [16] Md Shafiul Islam, "Home security system based on PIC18F452 microcontroller", *Electro/Information Technology (EIT), 2014 IEEE International Conference, 07 August 2014*
- [17] Rupam Kumar Sharma, Ayub Mohammad, Himanka Kalita, Dhiraj Kalita, "Android interface based GSM home security system", *Issues and Challenges in Intelligent Computing Techniques (ICICT), 2014 International Conference, IEEE 03 April 2014*
- [18] G. M. Sultan Mahmud Rana, Abdullah Al Mamun Khan, Mohammad Nazmul Hoque, Abu Farzan Mitul, " Design and implementation of a GSM based remote home security and appliance control system", *Advances in Electrical Engineering (ICAEE), 2013 International Conference, IEEE, 03 March 2014*
- [19] Sheikh Izzal Azid, Sushil Kumar, “Analysis and Performance of a Low Cost SMS Based Home Security System”; *International Journal of Smart Home* , Vol. 5, No. 3, July, 2011
- [20] Nikhil Agarwal, G. Subramanya Nayak; “Microcontroller based Home Security System with Remote Monitoring” ; *International Conference on Electronic Design and Signal Processing (ICEDSP) 2012*
- [21] S. Sujatha, M. Mohamed Irfan, B. Rhaagul; “GSM Based Home Security System Using PLC”; *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering; Volume 5, Special Issue 1, March 2016*
- [22] Jayashri Bangali . Arvind Shaligram; “Design and Implementation of Security Systems for Smart Home based on GSM technology”; *International Journal of Smart Home* Vol.7, No.6 (2013), pp.201-208.
- [23] Gudipudi Sushma, Mary Joseph, A. Ruth Tabitha, M. B. Prashanth Yokes; “Image Tracking Based Home Security Using Arduino Microcontroller”; *International Journal of Innovative Research in Computer and Communication Engineering; Vol.3, Special Issue 8, October 2015.*
- [24] Sadeque Reza Khan and Farzana Sultana Dristy ; “android based security and home automation system” ; *International Journal of Ambient Systems and Applications (IJASA) Vol.3, No.1, March 2015*
- [25] Nwankwo Prince. N and Nsionu Ifeanyi. I; “Design and Implementation of Microcontroller Based Security Door System (Using Mobile Phone & Computer Set)” ; *Journal of Automation and Control Engineering, Vol. 1, No. 1, March 2013*
- [26] M. Gayathri, P. Selvakumari, R. Brindha ; “Fingerprint and GSM based Security System”; *International journal of engineering sciences & research technology*. April, 2014
- [27] K. Govinda, K. Sai Krishna Prasad, Sai ram susheel, “Intrusion Detection System for Smart Home using Laser Rays”; *IJSRD - International Journal for Scientific Research & Development. Vol. 2, Issue 03, 2014, ISSN (online): 2321-0613*
- [28] Ahmed ElShafee, Karim Alaa Hamed, “Design and Implementation of a WiFi Based Home Automation System” ; *International Journal of Computer, Electrical, Automation, Control and Information Engineering Vol:6, No:8, 2012*
- [29] Ulya Sabeel, Nidhi Chandra, "A Smart and Contemporary Home Security System using 802.15.4 standard", *Computational Intelligence and Communication Networks (CICN), 2013 5th International Conference, IEEE, 1 November 2013*
- [30] Kosuke Ishiguro, Runhe Huang, "Implementation of a wireless communication technologies based home security system", *Computer Research and Development (ICCRD), 2011 3rd International Conference, IEEE, 05 May 2011*
- [31] Faizan Farid, Muhammad Rehan, Faiza Faizan, M Tahir Qadri, " Home automation and security system via PSTN", *Education Technology and Computer (ICETC), 2010 2nd International Conference, IEEE, 29 July 2010*
- [32] Ying-Wen Bai, Shi-Chang Chen, " Design and Implementation of Home Intercom and Security Control Systems for Buildings", *Consumer Electronics, 2007. ISCE 2007. IEEE International Symposium, IEEE, 12 November 2007*
- [33] <https://circuitdigest.com/microcontroller-projects/arduino-ultrasonic-sensor-based-distance-measurement>
- [34] Zixuan Song (2011). A Network based Home Surveillance/Monitoring System. Retrieved May 8, 2016 from [people.kth.se/~maguire/DEGREEPROJECT-REPORTS/110604Zixuan\\_Song-with-cover.pdf](http://people.kth.se/~maguire/DEGREEPROJECT-REPORTS/110604Zixuan_Song-with-cover.pdf)
- [35] <http://www.wseas.org/multimedia/journals/heat/2016/a205812-172.pdf>
- [36] <http://www.14core.com/simple-earthquake-detection-sensor-with-vibration-sensor-on-arduino/>



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