

A Case Study on IoT-Based Home Security Using Raspberry Pi

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Abstract –*Internet of things (IoT) devices are becoming more and more important in our daily lives and have made their way into our homes. One significant usage of IoT is in its integration with smart home systems. Since the smart home system consists of components that can be controlled using the internet, these systems are becoming main source of threats to our daily life due to security loopholes in such systems. As with all technologies, security and privacy are key points to consider when designing and choosing to use IoT devices to make our home smarter. However due to the complexity and the wide selection of the devices used implementing security and privacy is highly difficult. This paper surveys and synthesizes the literature on security that compromises the integrity of smart home systems. This survey is constructed by splitting the smart home systems to its main component and then investigating each component individually. This paper also studied the necessity of HomeOS investigative study in current situation where the home burglaries are rising at an exponential rate.*

Key Words: Internet of Things, Home Security, Home OS, Raspberry Pi 3 Model-B.

1. INTRODUCTION

The first thing you desire when you look at your family and your home is their safety. And thus the idea of advanced home security system comes into picture. The concept of home automation and its safety has been around since late 1970s. But during

the course of time with the advancement of technology, our expectation from home has changed a lot and so have the idea of home security systems. If we look at different home security systems over time, they have always tried to provide efficient, convenient and safe ways for home inhabitants to access their homes.

Smart home can be also known as automated home or intelligent home which indicates the automation of daily tasks. These advanced home security systems will work as “Virtual Watch Guard” of your home. It will protect your home from trespasser, help you to monitor your home remotely. You can also keep watch on kids or elderly people left at home which gives the sense of security and peace of mind. But is this really happening in current situation where the crimes are rising day by day. Most of us often overlook and ignore the importance of home security. The Metropolitan Police Service (MPS) takes burglary very seriously. We understand that it can be both financially costly and emotionally devastating for victims and their families. Proper timely precautions can save you with all such consequences. And installing a smart security system and turning your home into smart home can be the solution to all these problems.

To do an investigative study for home security, we conducted a survey of various people from different backgrounds like people living in urban, suburban or rural areas, working or non-working people, and the ones who stay in different types of accommodations like a flat, row home or a villa. In this survey, we also considered people who have kids staying at

home and/or aged parents who wish to live independently.

Then an evaluation of currently installed security system is done and using that we have tried to find out different security measures adopted by the users.

2. OBJECTIVES

Our work focuses mainly on the security aspect of home security.

- An evaluation of need of security of people from different backgrounds based on different parameters like children and/or aged person staying at home, people living in rural or urban area etc. and finding the impact of these parameters on their need of home security systems.
- To establish the benefits of installing advanced security system.

3. LITERATURE SURVEY

[1] Sushma .N. Nichal, Prof. J.K. Singhhas done abstraction of Smart supervisor system using IOT based on embedded Linux O.S. with ARM11 architecture. In this Paper they have implemented real-time video monitoring system and acquired data. In this system they have also used PIR, temperature, Humidity sensors the system first requires authentication from user to activate the system if the system detect human it will send that data to the server or user smart phone.

[2] According to Suresh S. et al[19], "The system designed for Home observance and Security system consists of sensors that are meant to collect the information that may be employed by the owner to create sensible choices. Passive Infrared Sensor (PIR) is employed to find the motion and therefore the temperature sensing element is employed to find the temperature of the space. Numerous modules specifically the PIR module, temperature module and therefore the GSM module communicate with one another to coordinate and increase the safety of the system. In this, the PIR sensing element and therefore the Temperature sensing element are connected to the Arduino board. The digital signal is distributed to the board. The GSM module is

employed to send and receive signal from the Arduino board. The received signal is distributed to the house owner through a text message via GSM module's path. If the owner needs to modify off the alarm, he sends an indication to the GSM module.

The GSM module can send the signal to the Arduino board. The Arduino board converts this signal into the sensing element comprehensible format and sends it to the sensors. The sensors are transitioned in real time. the most element is that the Arduino board. The motion detection, temperature sensing element and GSM's code is burned within the Arduino chip. On activating the system, the SMS is straight away sent to the house owner. the required signaling is embedded within the GSM module.

[3] Khushbu H Mehta, Niti P Guptahave presented real time monitoring and security system using Raspberry Pi the system allow user to live monitor from any place. In the system Authors have discuss that if motion is detected it will check for face detection if the face is detected it will stored on local storage, they have used background subtraction Algorithm for face detection. Authors concluded that system is able to identify faces and user can able to monitor remotely.

[4] Sowmiya. U, Shafiq Mansoor. J. Have developed to connect any door with internet, in this system user also implemented PIR sensor and camera. PIR sensor used for detecting person and camera used for capturing the video of person comes at door. The video will be send through 3g dongle to authorised person. They have also discussed some advantages of this system. They have concluded use of this system like bank, hospital etc.

[5] Van Der Werff *et al* proposed a mobile-based home automation system that consists of a cellular modem, a home server and most importantly mobile phone with Java capabilities. Here, the home server controls the home appliances via the cellular modem. In the proposed system, the home server is built upon a SMS/GPRS mobile module Sony Ericsson and a microcontroller Atmel AVR-169.

[6] Dr. S. Kanagasuba raja et al has focused on home automation and security system using Raspberry Pi. In this paper authors have implemented security system which detects the

intrusion and captures the video for playing in future. They have also implemented the automation of the home appliances. User can remotely on or off the home appliances.

4. INVESTIGATIVE STUDY

According to the survey of Pune police in the city of Pune which is one of the fastest growing cities in India, in the year 2015 alone, there had been 1200 cases of home burglaries in which only 240 cases were solved. Such burglaries amounted to loss property worth Rupees 15 crore and 72 lakhs out of which only valuables worth rupees 2 crore has been recovered. The Pune police suggest that, every responsible citizen should take some precautionary steps to avoid the home burglaries. If one is going out of station the neighbor should be informed about the same. All the valuables should be kept at a safe space like bank lockers. The security guards should be appointed only after the strict scrutiny from the police from respective area. Society should be protected by CCTV cameras or likewise any advanced home security systems.

If we consider above cases, then the first question which comes to our mind ‘Is our home really secure?’ We start to think whether the security measures we have taken are enough. By placing an appropriate home security system one can protect their home from criminals. Nowadays, safety depends on how well trained you are and how well secured you are.

A home security survey or investigative study is a serious on-sight assessment of a property to determine what the present security status is and to find out any scarcities or excesses of security. It determines the level of protection needed and give suggestions to improve the overall security of your home, if required. Traditional techniques of alarm based security have gained much popularity in past decades. Nowadays, embedded system is designed to provide security due to tremendous improvement in microcontroller unit and widespread applications of GSM technology.

This investigative study is intended to reduce the likelihood of your home being targeted by criminals and make you aware of your concern of home safety.

Although there are no false methods for preventing robbery, but it gives you an idea about monitoring your home, especially when the kids and/or elderly persons are alone or with servant etc.

5. GRAPHICAL METHOD

In this analysis, each response was evaluated by doing coding and all the responses were tabulated and analyzed in a graphical format as shown in **Figure 1**.

In above Pie-diagram, it is observed that, 67 out of 78 studied cases *i.e.* 86% of the people who took the survey are of the opinion that their home is somewhat secure and the rest *i.e.* only 14% are satisfied with their current home security.



Figure 1: Pie-chart: o pinion about existing home security system in percentage

When asked about the kind of security system installed in their home, 97% people still have traditional lock-and-key system which is shown in **Figure 2**.

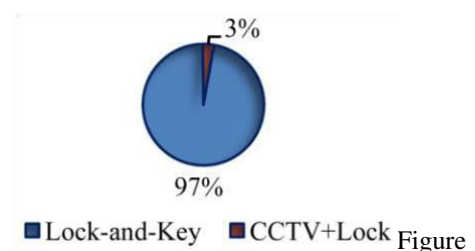


Figure 2: Pie-chart representations of existing home security system

And most importantly, out of 78 studied cases of different types as mentioned previously, 74 *i.e.* near about 95% users think that, one-time investment in smart and intelligent security system is worth to eliminate the cons involved in the traditional security system, which is shown in **Figure 3**.

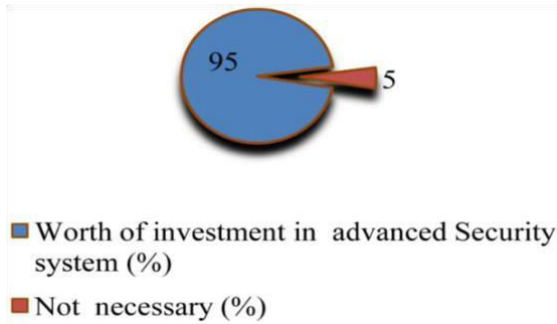


Figure 3: Pie-chart showing % of people in favor of advanced smart home security

6. PROPOSED SYSTEM

The jobs of a modern home security system include identifying an intruder trying to gain access, alerting the homeowner, preventing the intruder and collecting evidence regarding the intrusion. By considering all above points, we would like to propose our home security system as follows:

Initially, our proposed system will capture the biometric of the user for creating first hand database. At the time of entry, this input biometric database will be further accessed by the system for authentication purpose. Then, the database image and the current biometric input image will be matched to give the authorization to the user. If the current input image is the true copy of the database, then the system will respond to the user and give access.

Or for hassle free or easy access the user will give a response by executing an application from his/her Smartphone. Then the input from the application will be taken by the system for comparison with the database. Here, system will give an authentication to the user, if and only if the biometric image and input from the application are matched. Otherwise, the system will send a message to the owner of the home so that the owner can take an appropriate action against the un-authorized person, who is trying to get access to the home.

Note that, to add a new user at any time, owner reserves all rights. The guests or friend can get access to the main door using Smartphone via Bluetooth and/or biometrics, if that person is added in the list of authentic users by the owner.

The door will be set to open automatically, when the owner is in the proximity. Invitations can be sent to family, friends, guests or a handyman and record their database templates so they can enter the home without the owner being actually present in the home. Time slots and limits can be added to this invitations ranging from one hour to “always” and most importantly, can be cancelled at any time.

You can also incorporate distinct levels of security inside the home. Level 0 can give one access to a new person till the main hall of the home. Level 1 access can be granted to people like handyman, plumber etc so that they can go up to say washrooms or likewise. The babysitter or maids or servant who have to work in kitchen, guest room or dining hall can have right of entry under level 2. System can detect if someone tries to violate the prescribed levels. When a person enters the home, the level under which s/he has entered is activated and if s/he crosses the boundary stated in the respective level then immediately the system will sense the unwanted movement and alert the owner about the same.

Figure 4 shows flow chart of the proposed system.

Above proposed model may give proper expected response using intelligent remote monitoring and definitely will prove to be effective and applicable in real time.

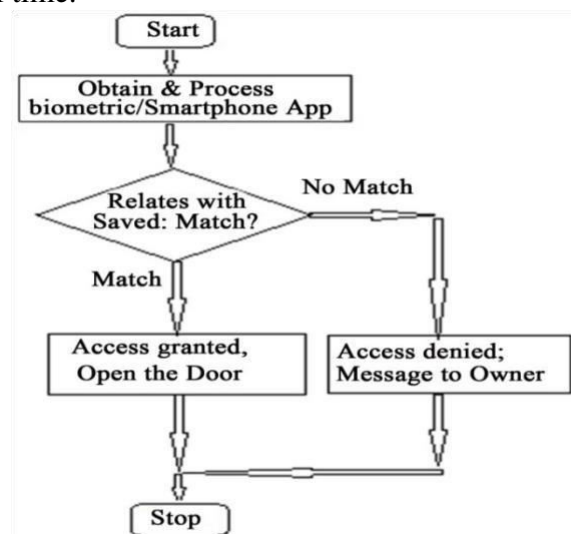


Figure 4: Flow chart of the proposed system

Mostly, home owner who is not an expert in advanced technology may try to reconfigure the

system which may result in complete failure of system. And, the most important thing is that, average customer normally consider the cost of purchasing and installing such system. As a result of it, they may purchase an inappropriate system owing to their unawareness, misinformation or lack of interest towards various security issues. Another important hurdle is that, all guests can't be expected to be careful about security and may also feel insulted if the home entry is restricted to them at some point.

Similarly, senior citizen's limited technological knowledge may be a major hindrance.

7. RESULTS AND DISCUSSION

First of all a questionnaire constituting of 20 questions related to home security was administered to people of diverse backgrounds and then applying graphical method representation yields into following results:

1) Out of all the people who took the survey, 58.57% have some or the other type of adult supervision and other *i.e.* 41.43% don't have any type of adult supervision for their children who are at home when they leave for their work.

Now out of all the children who are left at home 58.54% get the supervision of their grandparents, 36.59% are left in the custody of the babysitters and the others *i.e.* 18.18% get some other kind of supervision. As indicated in graph, working parents are always worried about their children and they feel that advanced security system can give them peace of mind.

2) People who live in urban or suburban area are in need of more security than the people who live in rural areas.

The investigative study thus arrived at the conclusion that 95% of the respondents are thinking that advanced security system is the need of the hour and will definitely be advantageous to achieve the contentment.

The remaining 5% who are not in favor of advanced security system are from rural area. As 95% of people are in favor of advanced security system, such system can be accomplished using various

technologies like wireless sensor network and biometrics etc.

8. CONCLUSION

Security is the issue which is needed in the time of emergency, hence the system must be connected with those who could help in the time of emergency. We have found that most of the security systems are developed using Raspberry Pi because it is cost effective and it is compatible with many programming languages. We can conclude that every person needs cost effective security system. Security factor is most important when it comes to proper implementation and development of automated home security systems. Such system will definitely provide a sense of security to every person at home and will also put their mind at ease.

9. REFERENCES

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