

## GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES A SURVEY ON HOME AUTOMATION USING INTERNET OF THINGS

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### ABSTRACT

Recent technology advances are evolving the objects we use in our daily lives into smart objects. IOT (Internet of things) is a interconnected network of physical devices, components, hardware equipments and items embedded with software, electronics, sensors, in which these objects connect and exchange data. We are moving towards smart homes, implemented using home automation. Home automation system using IOT uses computer or mobile devices to automatically control home appliances and functions through internet. This is a survey paper that implements home automation system through integration of cloud networking using IOT. This study focuses on home security enhancement using Passive Infrared sensor (PIR), digital door locks, Light Dependent Resistor (LDR). Energy efficiency for home is improved using Zigbee that optimizes the power consumption and Programmable Logic Controller (PLC) for power generation and finally smart meter for power monitoring. Care for elderly and physically challenged people is provided using smart water bottle and xbee technology. This paper also proposes survey on other smart home automation technologies.

**Keywords:** *Internet Of things( IOT), Home automation , PIR ,LDR , Intel Galileo, smart bottle, Zigbee, xbee.*

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### I. INTRODUCTION

Smart home security is very important for commercial applications. Most of the world countries adopt smart control system. Present scenario illustrates home and office appliances as more interactive ones and these appliances has user interface, but users find it frustrating because of the difficulty in using the non-friendly functions of those appliances. This survey illustrates a framework that enables its customers to communicate with such appliances using a user interface device module that they are holding right with them. Smart mobile phones are the most commonly used interfaces as they could be connected with any device or components. The surveyed home automation domain finds in using an appliances, and software that enables the user interfaces being personally customized to users of the security systems and the components that they are working with [3]. The most prominent responsibility of random kind of home security systems are being accurately able to identify the visitor who leave and enter by the door entrance. A door entrance protector can be controlled remotely, identifying visitors at door and alarming users through the cell phone are the wide common procedure to integrate security. The surveyed systems has many new features such as viewing the streaming videos through personal digital assistants or portable electronic equipments [5].In addition, voice siren are enabled to make neighbors aware in case of intrusion in to the house . Suppose in case of a breakthrough in the house these systems send a notification to the owner or a customer to indicate the break through by capturing the images or any motion.

Thus such smart home integrates technology and services through home networking. This work concentrates on the three aspects of home automation that is security services, energy management and care for elderly and physically challenged people. Security is a growing need throughout the world. Security based access controls restricted using PIR(Passive Infra Red) sensor is interfaced to Raspberry Pi controlled to detect the presence of human.LDR(Light Dependent Resistor ) is used in security alarms. The unauthorized access to the home is monitored throughout digital door lock system. Saving of electric energy is equal to its production. Smart meter detects high voltage and intimates corresponding devices. PLC (power line communication) monitors energy generation.

The major existing infra-red or Bluetooth devices has been evolving in the technical markets and are generally particular to a application and they cannot be applied as an alternative. Those electrical appliances that are connected through Bluetooth cannot be managed from a distant location [3].The features such as turning on an air-

conditioner while returning to home cannot be done with help of such systems. To the contrast, the surveyed work gives a cost efficient and simple solution for wireless home automation and security systems in homes [4][5]. The major problem undergone by the present home surveillance systems are in contributing the facts that pertain to a specific scenario where clients or customers are far away from home and this is considered to be the important property of home automation systems.

The following sections of the surveyed paper has been organized as follows: the architecture of the studied system and their detailed overview which been explained in section

The section III illustrates the study carried on the block diagram and major system components used in home automation. The section IV describes the system design and the features of the components used Section V presents the implementation of home automation technologies and their working related to software environment. Section VII describes the survey on other home automation technologies and their featuring. Section VIII undergoes with issues on such technologies proceeded by section IX conclusion and then proceeded by the references.

## II. STUDY ON SYSTEM ARCHITECTURE OF SMART SECURITY

The smart security systems for home divides itself into two major categories , which are The ECU which is the major element of the automation home systems where the secure features are executed and the RCU which is a reliable model of framework which is implemented on the customers mobile phone.

### A. Embedded Control Unit (ECU)

Embedded Control Unit one of the most performance friendly, with lower consumption of power and used in home security systems. ECU encompasses Raspberry Pi which operates in Raspbian Operating System that is installed in the SD card. The motion sensor PIR and Pi-Camera are made contact with the Raspberry-Pi circuit to identify guest/visitor's movement at the door and are liable to capture their images respectively. The images being captured are saved on SD card with date and time . The Raspberry-pi is configured to enable the use of SSH and camera port.

### B. Remote Control Unit (RCU)

Remote Control Unit is the major set of instruction execution component that is implemented with the customers android mobile phone. This helps with providing Graphical User Interface to communicate the terminal commands of Linux platform from SSH to ECU. The SSH is one of the secure protocols and the most commonly used one to communicate and administrate using Linux servers. RCU is executed and implemented on the android platform by using the Java Script through Java Development Kit and IDE of Eclipse platform.

## III. ANALYSIS OF BLOCK DIAGRAM ON HOME AUTOMATION

The block diagram of the project regarding smart security for home system is depicted in the figure 3.1. The Raspberry's Camera and the power supply makes up the whole of entire security system that is to be installed at the desired place. The motion sensor PIR is connected to General Input Output pins of Raspberry Pi kit. We can also use the LCD screen monitor display for setting up Raspberry-pi web server. The speaker will be connected via the audio jack of Raspberry Pi equipment. The relay driver circuit IC which is interfacing with the Raspberry Pi circuit in order to control electromagnetic door lock. The captured image could be saved with date and time on USB Pen drive or SD card connected on Raspberry Pi.

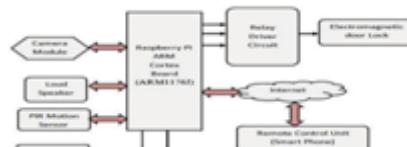


Figure 3.1: General Working of Home Automation Systems

#### IV. SYSTEM DESIGN

The IOT is implemented mainly through sensing and monitoring of devices. Sensing is provided as a services on cloud. Cloud computing acts as an front end to access IOT. Sensors are used for sensing, which monitors the parameters such as temperature, gas, LDR, smoke and fire. Respective parameters are compared with their threshold value stored in the cloud .If the parameter value exceeds the threshold value, respective alarms are activated and several actuation may be done by itself or intimated to the user and takes action according to the users command.

##### A. Raspberry-pi features

The board of Raspberry Pi [2] has been a small miniature mystery , thus packaging enough amount of performance in computing where the marks laid by the credit card systems are longer. Then the main control unit of Raspberry Pi circuit device is a processor which is the Broadcom and system-on-chip processor thus supporting multimedia. This means that the vastly majority of the system's individual components thus including its graphical and central access processing blocks along with the audio and communications hardware, are built into the single equipment hidden behind the 512 Megabyte of memory chip at the middle of the board.

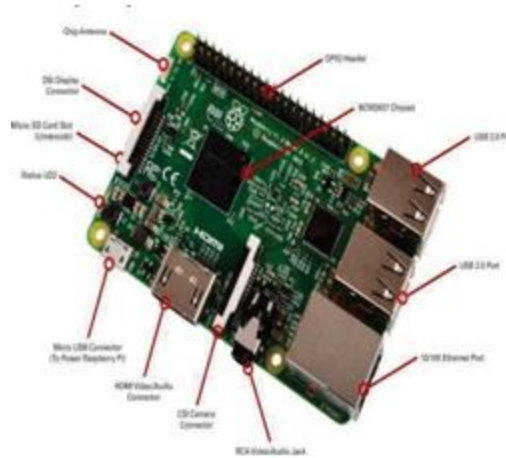


Figure 4.1: Raspberry-Pi kit description

##### B. Passive Infrared motion Sensor

These sensors are a form of equipment works by pyro electricit that recognizes objects or any kind of movements by calculating the changes caused by infra red rays from the objects that are surrounded .The single Input/output pin helps in locating these movements through a high signal level. By enabling lens of Fresnel and detecting motion by a circuit we can detect movement of high relativity. The standard output is 5V which a low active signal. These modules give a well-fair integrated-circuit that will detect some hundred centimeters of motion which less expensive and simple to handle, The result could be passed to the general input output pins of Raspberry Pi and HDMI port are straightly connected to screen to display the signal output.



Figure 4.3: Passive Infrared motion Sensor

## V. SYSTEM IMPLEMENTATION

The home automation for security will be implemented by using Raspberry-pi kit which is controlled by a python programming language or embedded C at the terminal of linux. It also supports many protocols such as Simple Mail Transfer Protocol, , HTTP, SNMP etc. The flash file system dynamically supports the results that are generated from some physical devices/resources. The file that is generated or wrapped is called an ESP (Embedded Server Page).

## VI. IMPLEMENTATION OF SOFTWARE FOR REMOTE CONTROL UNIT

The software tool related to the RCU is implemented in order to provide the Graphical User Interface for the SSH client unit and to relay the already defined commands of a terminal linux to ECU through SSH. SSH is one of the most protective protocols and widely applied to communicate and work with the servers of linux platform. The client of SSH is deployed in the platform or a framework of android either using scripts written on java using Java Development tool Kit or several IDE. Developers of software will enjoy a good comprehensive software development kit.

## VII. CASE STUDY ON OTHER SMART HOME TECHNOLOGIES

The IOT is implemented mainly through sensing and monitoring of devices. Sensing is provided as services on cloud. Cloud computing acts as an front end to access IOT.

### 7.1 Smart Home Security Control:

#### A. Passive Infrared sensor:

Passive Infra red is an electronic device which accepts infrared light emitted from various objects. PIR senses the presences of human through infrared radiations.

Human body emits invisible infrared radiations at a specific body temperature. Apparent motion of human in front of other objects such as wall with different infrared temperature is captured and forwarded through email.

#### B. Digital Door Lock:

Digital Door Lock system uses a Raspberry Pi control board which is installed on both lock and user mobile device. If a person enters invalid password more than a certain limit or if a person causes physical damage to the lock ,image of the person is captured and forwarded to the user's mobile device. In case, if a user loses his key, then pressing a specific key on door ,captures the user pictures and sends to the clients mobile for validation. Client can remotely access the door lock.

Difficulty in operating the door by carrying heavy load is overcome by the communication between the controller and user's mobile device via Bluetooth and opens door automatically. If a valid person is recognized by the door operates automatically.

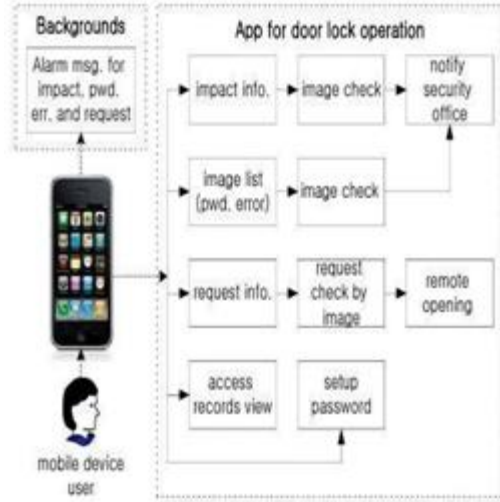


Fig 7.1 Door locks operation using Mobile application

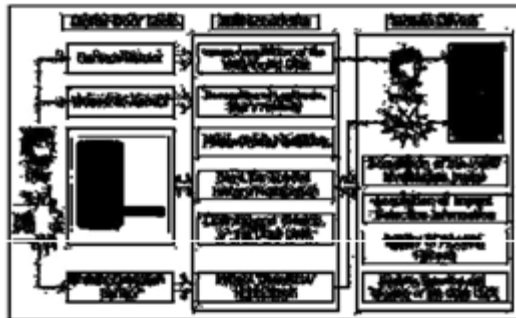
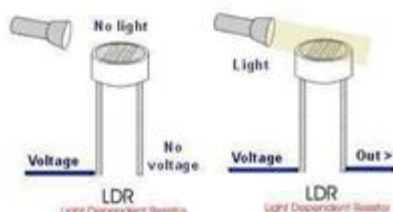


Fig 7.2 Alarm operation during a trespass entry

**C.LDR (Light Dependent Resistor):**

LDR is made of high resistance semiconductor. The photons present in light are absorbed by the semiconductor ,when light with high frequency falls on it. The absorbed energy is utilised by electrons and jumps into the conduction band. Thus the excited electron lowers the resistances and conducts electricity.

For example during fire accidents, the light from the flame falls on the semiconductor, triggering electrons to conduct electricity. This electricity is used for active the buzzer alert



7.3 Working of LDR

## 7.2 Smart Home Technology for Elderly and Physically Challenged People:

### A. Easy handling of home appliances using Xbee:

The Xbee modules give an opportunity in order to simplify the operations via a cloud based access to data and their devices.. This system, without moving around to the most nearest control point allows the people to command their desired devices.

A remote containing a set of buttons, LDC and LED lights are provided. The LCD display is used to state the current action undertaking. LED lights are used to indicate the particular device on which action is performed. On pressing specific button, the corresponding RF signals are generated and transferred to the master board, which processes the received signals and transfers it to microcontroller that triggers the switching circuit according to the current state of the device(ON or OFF state).

### B. Smart Water Bottle:

The intake of water is important for health as it helps to build the respiratory organs, increases metabolic rates and the ability to fight disease especially among elderly people. Most of the elderly people are aware of the importance of water consumption. But none of them were knowledgeable about the proper methods for water consumption, such as adequate amount or correct time interval, etc. These difficulties are overcome by smart water bottle.



Fig 7.4 Smart water bottle application

Goal of the IOT water bottle is to provide user with specific and accurate data about his water in taking level and guide users to next target intake amount the weight sensor is installed in the water bottle that automatically records the amount of water after each consumption. The sensor transfers the recorded water intake amount to the app owned by the user. The app self digitizes the data and provides the next intake period along with amount of water to be consumed to user.

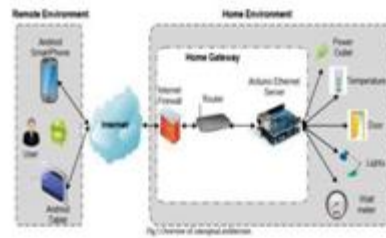
## 7.3 Energy management in smart home:

Energy management can be implemented using two factors.

### A. Zigbee:

This is a mesh of network specification used for low-power wireless LANS which helps to cover a large area. ZigBee was mainly designed in order to provide very high data throughput commonly in some applications which results in less duty cycle and thus lowering the power consumption.





7.5 Zigbee extension for LAN'S

### B. Power Line Communication

Power Line Communication is a technology of communication that helps in sending data through available cables carrying power. These power cables can be powered up to retrieve the power at the same time.

### C. Smart Meter:



Fig 7.6 Smart Meter appliance

Smart meter is an electronic meter which senses about the incoming low/high voltage values and transfers information about the high peak voltages to the connected appliances. The appliances which received information can act according to that voltage by changing itself.

## VIII. ISSUES RECOGNIZED FROM STUDY

There are so many issues confronted with automated home security systems. Some of the potential issues recognized or identified has been listed below.

- These technologies could be hacked easily by a hacker or a technology analyst.
- Their standards are too high to study or understand.
- These technologies are out of range to afford.
- They highly unsatisfy clients in case of power consumption.
- At times their functionality is questionable.
- They use or consume huge sensor powers which are either harmful.
- Technological advancements made humans more inactive, as such home coming technology evacuates human mind to trust them more faithfully.
- Security breaches in messaging system as these devices could access message databases.

## IX. CONCLUSION

This survey paper describes the survey on implementation and also the working of an efficient GUI based smart automation security for home with mail alarm communication, streaming enabled through web of videos also with

door system access with the help of android mobile phones. This kind of monitoring and control with help of phone devices that can be controlled automatically, making evolution in the field of automation.

In this most of the human efforts and interactions are eliminated through the automated system. This system also intimates the user with the information provided by the sensors using IOT. It provides the remote access to the systems and devices. This overall study provides an ultimate design of a safe, automated, advantageous and energy efficient home automated system using IOT.

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