IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

SMART HOME: A SURVEY ON SMART IoT TECHNOLOGIES

[1] Akshay M. J, [2] Revathi T, [3]Shrinidhi Hegde, [4]Ramya M V, [5]Ranjana Shenoy K

[1]Assistant professor, [2]Student, [3] Student, [4]Student, [5]Student

[1]Department of Information Science and Engineering,

[1]Jawaharlal Nehru National College of Engineering, Shimoga, Karnataka, India

Abstract: Smart home is an advanced technology that makes the lives of people smart. The devices present in the home are made smart using the technologies like Internet of Things, Machine Learning, Big data, cloud computing and others. There is a necessity to control the home and the appliances present in the home remotely when people are not present. This can be achieved using the applications. The detection of hazards in the kitchen like fire can be detected using the sensors and people can be alerted. The water level in the tank can be monitored and the supply can be cut down upon water exceeding the certain level in the tank. Similarly, switching off the unnecessary lights and other tasks that require the humans to be involved can be automated using the technology. As people cannot always be involved in conserving energy, technology can be used at its best to conserve energy.

Keywords: Internet of Things (IoT), Smart House, Node MCU, Arduino, FLIP architecture, microcontroller, sensors, android application, web application, monitor, control.

I. INTRODUCTION:

IoT (Internet of Things) refers to the rapidly growing network of connected objects that can connect with each other and exchange data in the real time. This network of objects contains the sensors embedded into the objects, containing the Wi-Fi connectivity, Bluetooth and other networking elements. This helps to connect with other objects and share the data among themselves. The range of these objects varies from the household devices to sophisticated industrial devices. There are billions of devices connected to the internet at present. This count is increasing year by year.

IoT has become the rapidly growing technology of this century. Connecting the devices to the internet and analyzing the data thus obtained can be taken as input for the machine learning algorithm. Using this algorithm, predictions can be made. This helps to make intelligent decisions in the businesses. Using these technologies, many day-to-day activities can be automated, requiring less human intervention. In this way, the physical world meets the digital world and they cooperate.

fig.1 smart home monitoring using IoT

The smart home is a best example of IoT in action. Internet-enabled lighting systems, fire detection systems and water tanks are monitored and controlled using applications. From smart blackboards in school classrooms to medical devices that can detect diseases, IoT is rapidly making the world smarter by connecting the physical objects. Devices have hardware like sensors to collect data. The data collected by the sensors is then shared to the cloud then accessed using application.

Smart House is defined as a residence that uses a control system to integrate various automation systems in the house. A house should be smart and secure and it must contribute to the energy and water conservation. Using IoT, a house can be made smart. Tasks which require human intervention can be automated using IoT devices and various sensor units can be controlled remotely as shown in fig 1.

Around the world, people are gradually moving towards smart home practices security control systems. As shown in the fig 2, Lighting system, temperature control, energy management can be integrated, thus monitoring and controlling home appliances become easier than ever before.

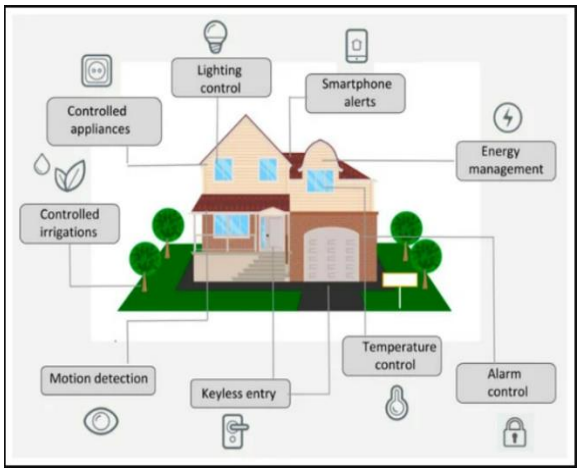

fig. 2 use of applications in the smart home

II. SMART HOME APPROACHES

This section describes the various approaches to make the home smarter.

2.1 Gas Leakage and Fire Detection using Raspberry Pi:

The proposed system is used to detect leakage of gas and detection of fire. The system consists of gas sensor MQ2 which detect various types of gases, fire sensor detects fire and GSM module is used for sending SMS to user. The components are connected to Raspberry Pi as shown in figure 3.

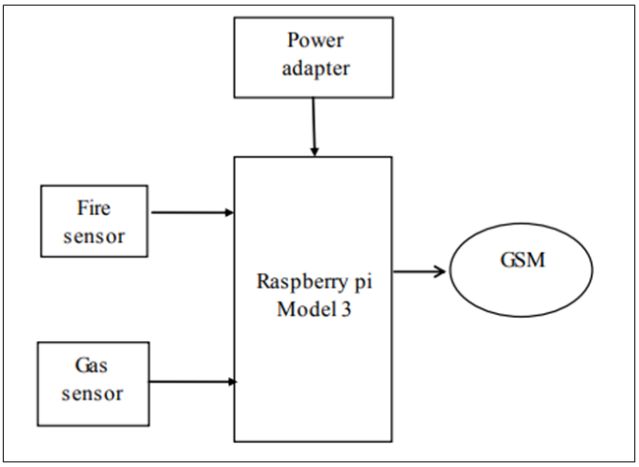

fig.3. block diagram of designed system

A voltage is generated when sensor detects fire and leakage of gas. Raspberry pi will take these values as input then it sends message to users. Python code and sensor libraries are used for execution of entire system model [1].

2.2 Internet of Things (IoT) for building Smart Home System:

The proposed system describes features of smart house with its applications and also introduces FLIP architecture with implementation of smart house service as shown in figure 4.

The system consists of four application modules they are lighting, appliances, intrusion detection, and smoke/gas detection [2].

The FLIP device is used for connecting the different sensors for controlling lights, air conditioner, camera, windows and door system, and various appliances. Internet is used for connecting the Flip device and it works by uploading code to the Flip device. The application modules were monitored and windows, doors can be controlled.

fig.4 FLIP architecture

The figure shows smart home FLIP shield. To increase the functionality of the board FLIP shield is assembled over base board. Smart home shield is designed in such a way that it contains various sensors like temperature humidity, (LDR) that is light intensity, PIR, various gas sensor, air quality sensor, sound sensor and many more. All these sensors are attached to it and it can used for home automation.

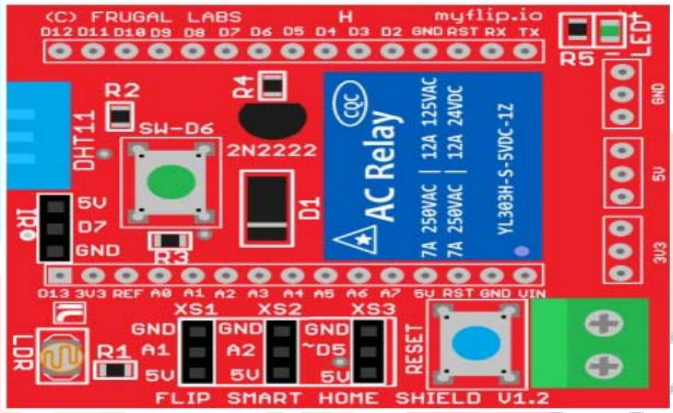

fig.5 smart home FLIP shield

2.3 Implementation of Cost-Effective Smart Home Controller with Android Application using Node MCU and Internet of Things (IOT)

The proposed system discusses about how smart home is controlled and implemented using android application and IoT. The application was designed using android studio software and the Node MCU was connected to in home Wi-Fi and relay board.

General Purpose Input Output (GPIO) pin state considers the relay operation, that is if the output of GPIO pin is low then relay will be in open circuit condition and if it is high then relay closes the circuit and turn ON the device. Arduino software is used for coding and also for the working of Node MCU [3]. The paper presents low-cost controller which controls home appliances through web application.

2.4 IoT based Monitoring and Control System for Home Automation:

The system presents an efficient implementation with the help of IoT (Internet of Things) for monitoring and controlling the home appliances through web. The system consists of IR sensors and Passive Infrared (PIR) sensors which are used to detect infrared light and human presence or an animal arrives in their proximity respectively, it helps to turn ON/OFF of lights.

The fire detection module consists of a Light Dependent Resistor (LDR) and flame sensor which gets sensed when fire is detected and LDR helps for detecting fire by using light intensity. A camera is installed in system and it takes picture of the fire and accident and then sends it to mobile, the Raspberry Pi is used in the system. The overall connection of the system is shown in the figure 6. [4]

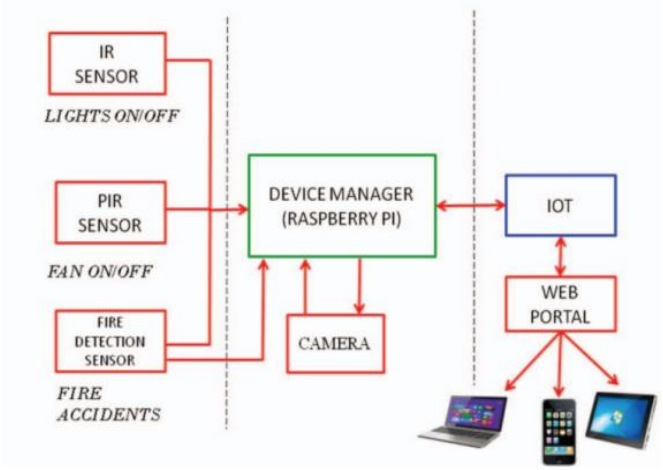

fig.6 home automation architecture

2.5 Smart Home Energy Management System An exploration of IoT use cases

In the proposed methodology, every electric outlet contains the current sensors. The sensor data is sent to the microcontroller which then analyses the data and sends it to the web server. In the server, the data is stored in the JSON format.

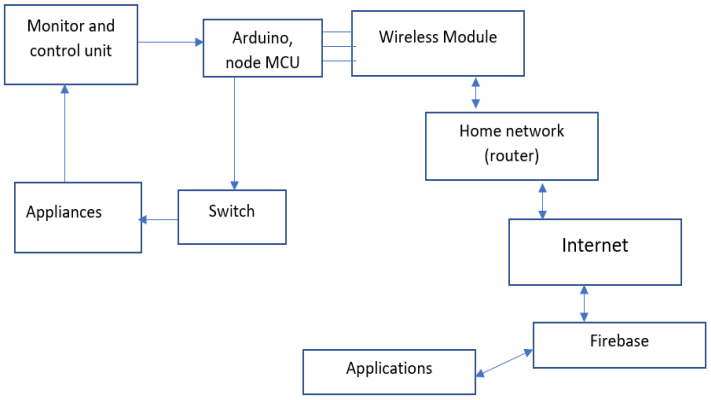

fig.7 energy management system

The mobile application gathers the data from the web server and displays it to the user. The user can send the control commands to the web server. The microcontroller continuously monitors the elements that can be controlled. When any changes are observed in the elements, the microcontroller can take appropriate actions [5]. It is also possible to get the readings of total energy consumed by an electrical outlet in the present month.

This is shown in Fig.7. This methodology can be used for controlling the appliances in the house with the help of mobile applications remotely.

2.6 Brainy Streets - An automatic lighting system

The proposed model deals with the automatic switching ON/OFF of street lights based on the intensity of sunlight, using the Arduino UNO micro-controller, LED- Street Lights, LDR and PIR Sensors.

The Light Dependent Resistor offers high resistance during the daytime when the intensity of sunlight is high and low resistance during night time when there is absence of light.

Based on the value of LDR resistance, PIR motion sensor is used. During night time, when movement of any object is detected within the user defined limit, PIR sensor detects the movement and with the signal to the microcontroller, the LED lights which are treated as street lights in this model are turned on. This is shown in figure 8 [6].

When there is absence of movement, the lights are turned off. This method can be used in houses to automatically control the lighting system.

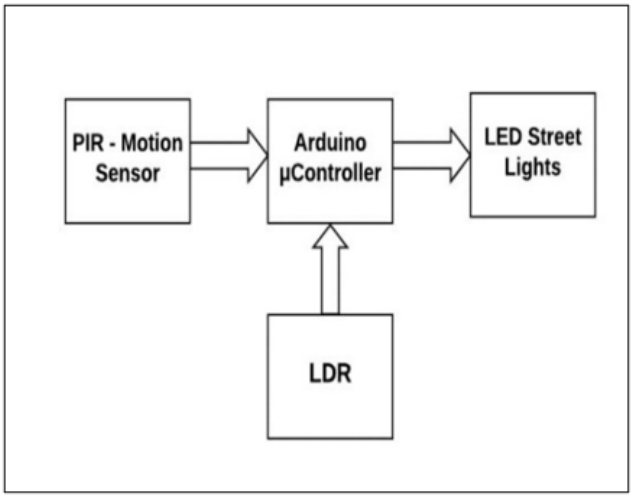

fig.8 automatic lighting system

2.7 IoT Based Smart Emergency Response System for Fire Hazards

The proposed system consists of ESP32, flame sensor, MQ gas sensors, GPS module and MQTT protocol for message transmission. Smoke, flammable gases and fire can be detected using this system. It is also capable of providing the location of the hazard to the fire department [7].

MQ2 is used to detect the smoke, the Flame sensor is used to sense the flame, MQ-5 is used to detect the gases like LPG/LNG, methane, CO, H2 and the GPS module is used to obtain device location. These sensors are connected to a MQTT broker. With the help of the internet, the fire hazard alerts are sent to the nearest fire organization. This is shown in fig.9. This methodology can be used in the houses to detect the leakage of LPG gas or fire in the kitchen and alert the concerned people instantaneously.

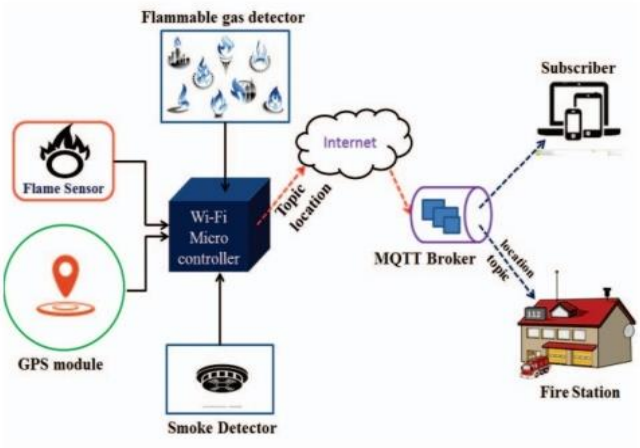

fig.9 fire emergency response system

2.8 Smart Water Management in Housing Societies using IoT

The proposed system consists of Raspberry Pi, ultrasonic sensor, turbidity sensor, cloud platform and relay switch.

The water level in the tank is monitored constantly by the ultrasonic sensor and this data is shared to the people. When the water in the tank goes down below certain level, proper arrangements can be made to fill the water. Turbidity sensor monitors the quality of water in the tank by measuring the amounts of impurities present in the water.

To monitor and control the data received from the sensors and controllers, cloud platform is used. Raspberry Pi is used to analyses the signals that are received from the smart objects. Relay acts like a switch for the water tank [8]. This methodology can be used in the houses to monitor the water level and the quality of the water in the tank.

2.9 IoT based Smart Water Tank with Android application

The proposed system deals with monitoring and controlling of water level in the water tank. Smart home automation system consists of ESP8266 and it is used as microcontroller. The ultrasonic sensor is used to obtain the current level of water in the tank and ESP is used to obtain the values of minimum and maximum levels from cloud. The maximum and minimum level values are set from the application and depending on these values the motor is switched ON/OFF.

If the level of water below minimum level, then the motor automatically switches ON. If the water level equal to or greater than maximum level then the motor automatically switches OFF. If the level of water is in between both the minimum and maximum level then the motor can be controlled by the user from android application. For user controlling of water level the start and stop buttons are provided [9].

2.10 IoT-mobile enabled smart water level controlling system to regulate water wastage

The proposed model deals with monitoring and controlling of water wastage. The water level sensor provides the information with the Arduino about the level of water in the water tank. Arduino updates database in the server about the level of water through HTTP (Hypertext transport protocol) and the information is stored in the server and that information is displayed on the registered phone number [10].

If the level of water in the water tank is below minimum level, then the server sends notification to the registered mobile phone indicating the user to turn ON the motor, then the water is filled in the tank. If the level of water above maximum level, then the server sends another notification to the user to turn OFF the motor. To switch ON/OFF two buttons are provided in the mobile phone of mobile interface and user can check the level of water in the tank at any time.

2.11 Home Based Fire Monitoring and Warning System

The proposed system is used for monitoring of fire. It is implemented using Arduino Uno. This system consists of Buzzer, GSM and Arduino board. LM35 temperature sensor is used to detect fire based on temperature. To detect fire, lighter is used as a fire source. Once lighter is lighted it will be sensed by the sensor and then it will generate signals which are sent to microcontroller (Arduino_uno) and trigger the incident. The fire detection module is used to send results to the registered mobile phone using GSM module. LM-35 flame sensor is used to detect the flame and it is taken as physical input [11].

The flame sensor converts physical input to the digital signal. This digital signal is received by the Arduino and sensor detects the flame based on temperature. When flame is detected, the buzzer produces alarming sound and notification is sent to the registered user through mobile phone immediately to avoid huge loss of properties.

2.12 IoT Based Home Appliances Control

The proposed model deals with the automatic switching ON/OFF of lights. This system uses Arduino board and android mobile phone. ESP8266 WI-FI module is connected with mobile phone then the module is connected with hotspot. The automation board consist of eight leds it will be configured when user touch relay ON then automation board one led is starts blinking. If user touch OFF then it will not blink. In the same way all the leds are controlled by android application. Relay is used to control all the devices and microcontroller is used to control whole system.

If the automation board configured with devices, then we can easily turn ON or OFF device. People can login to smart home monitoring system by entering login credentials that is user password and name. After login, the user can see different rooms with different devices and also user can see the status of all the home appliances in the room whether they are switched ON/OFF and also, we can choose the rooms to control the status of home appliances from anywhere [12].

2.13 Smart Home Automation System Using Internet of Things

The designed system has the ability to control different home appliances with the help of ESP8266 Wi-Fi technology.

Different sensors like flame sensors, PIR sensors, Temperature and humidity sensors modules are used for home safety which can sense the accidental fires, short circuits, motion etc. Along with this, alert messages are sent to user with the help of GPS and GSM module. It is shown in figure 10. [13]

The system has integrated development environment that is IDE which is open-source software used for writing the program and also for uploading program code into Arduino

.

System hardware part is divided into three cases. ESP8266 Wi-Fi module is used for home automation which is done in first case. Reading the values of temperature and humidity with the help of IoT is done in the second case. Alerting the user with GPS if fire is detected or in case of short circuit and overvoltage is done in third case.

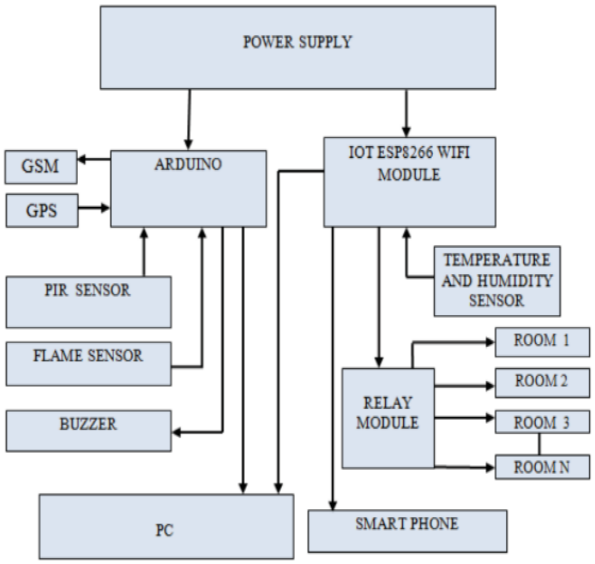

fig.10 block diagram of smart home automation system

2.14 IoT based Smart Water Quality Monitoring System

The system has microcontroller where sensors are connected to it and it helps for taking the readings of water samples and also for analyzing them to predict water quality by using machine learning algorithm. System is designed where it includes four different sensors which is connected to the controller for measuring four different physical parameters that is temperature, pH, turbidity and conductivity of water samples. The pH sensor SEN0161 is used to measure the presence of acidity in water sample.

The DFR0198 temperature sensor is used which provides reading of temperature between –55 to 125ºC and the analog sensor DFR0300 is used which helps to measure the electrical conductivity of water sample [14].

The SEN0189 is used in the system for detecting the presence of suspended particles with the help light which is a turbidity sensor. The data that is values which is extracted from these sensors are accessed by the Arduino-uno controller then that transfers data to the developed application. For checking the quality of water based on the measured data backend is included where it is implemented by using machine learning algorithm. Since the system will verify whether the tested water sample is drinkable or not, an algorithm is employed it is called as fast forest binary classifier algorithm. Then by comparing with collected water samples of nearby tap, filter, soft drinks and other sources with experimented data the accuracy of designed system can be calculated.

2.15 Home Automation Using Internet of Things

The system module uses two main controlling unit that is raspberry pi and a relay board which is used in order to monitor a system by a different low-high power signal. The system includes different sensors in which temperature and humidity sensors is used to read environmental temperature and humidity and also the system has four mechanical limit switches for four individual doors for door security [15].

If doors are opened by an unauthorized person, then it will be activated. For more security purpose, the system uses two PIR sensors and from two PIR sensors one of the them is used as automatic light controller for controlling the garden light depending upon the environmental light condition and other one is used for motion detection. The blue-tooth module is installed in the system which it is used for connecting application and other devices.

2.16 Cloud Enabled Smart Firefighting Drone Using Internet of Things

The system contains operation which will help to send the information of fire location to the drone flight planning unit, the condition of the drone and flight plane is continuously monitored by the drone specialist.

If any emergencies, the flight controller is used by the specialist for monitoring the drone and also it can be called off from the mid-way of operation as shown in figure 11 [16].

Once the drone reaches the desired fire location then the specialist who controls the drone will find a way for drone to enter into area where fire is present and that drone contains the fire extinguisher ball and that fire ball is dropped into fire, as soon as the fire ball is dropped from the drone into fire area then drone will move back to its controlling unit.

Then the fire ball which act as extinguisher once comes in contact with fire, within minute that fire ball will explode and it releases the Non-toxic material into the fire area. So, the system helps to make the fire to get extinguish eventually.

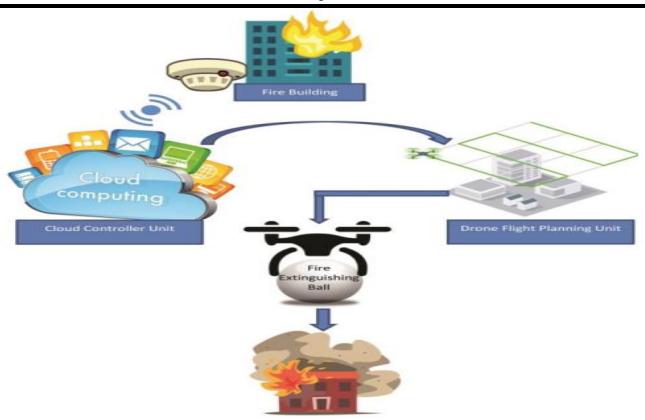

fig.11 drone firefighting architecture

Then the fire ball which act as extinguisher once comes in contact with fire, within minute that fire ball will explode and it releases the Non-toxic material into the fire area. So, the system helps to make the fire to get extinguish eventually.

CONCLUSION: Research papers have discussed about use of IoT in house monitoring and controlling. Using variety of sensors and IoT devices, various parameters like temperature, distance and intensity of light can be controlled and monitored remotely, with the help of cloud, databases and applications. The idea proposed in this paper helps in the monitoring and controlling of the house in smarter way. Smart water tank helps to use water effectively, reducing the unnecessary usage of water. This helps in the conservation of water. Fire detection sensor helps to save many appliances from getting burnt or damaged by operating in the real time. Using PIR motion detection sensors, electrical energy can be conserved. Thus, the conserved fresh water and electricity can be utilized by the people who are deprived of it. Thus, this system helps the society to effectively utilize the energy.

REFERENCES:

[1] Sourabh Jamadagni, Priyanka Sankpal, Shwetali Patil, Nikita Chougule and Shailesh Gurav," Gas Leakage and Fire Detection using Raspberry Pi", Proceedings of the Third International Conference on Computing Methodologies and Communication (ICCMC 2019) IEEE Xplore Part Number: CFP19K25-ART; ISBN: 978-1-5386-7808-4.

[2] Timothy Malche and PritiMaheshwary, "Internet of Things (IoT) for building Smart Home System" 2017 International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC).

[3] Madhu G M and C.Vyjayanthi, "Implementation of Cost Effective Smart Home Controller with Android Application using Node MCU and Internet of Things (IOT)".

[4] Pavithra D and Ranjith Balakrishnan, "IoT based Monitoring and Control System for Home Automation", Proceedings of 2015 Global Conference on Communication Technologies (GCCT 2015).

[5] Mulham B. Soudan, Homam M. Al Rifaie, Taha M. Asmar and SohaibMajzoub, "Smart Home Energy Management System An exploration of IoT use cases".

[6] Dev V. Savla, Heet R. Savla , Krishna B. Kansara, "Brainy Streets-An automatic lighting system ", Proceedings of the Second International Conference on Inventive Systems and Control (ICISC 2018) IEEE Xplore Compliant - Part Number: CFP18J06-ART, ISBN:978-1-5386-0807-4; DVD Part Number: CFP18J06DVD, ISBN:978-1-5386-0806-7.

[7] Ravi Kishore Kodali and Subbachary Yerroju, "IoT Based Smart Emergency Response System for Fire Hazards", International Conference on Applied and Theoretical Computing and Communication Technology-2017, ISBN: 978-1-5386-1144-9.

[8] Kaushik Gupta, Mandar Kulkarni, Manas Magdum, Yash Baldawa and Prof. Shivprasad Patil, "Smart Water Management in Housing Societies using IoT", Proceedings of the 2nd International Conference on Inventive Communication and Computational Technologies (ICICCT 2018) IEEE Xplore Compliant - Part Number: CFP18BAC-ART; ISBN:978-1-5386-1974-2.

[9] Priyen P. Shah, Anjali A. Patil, Subodh S. Ingleshwar, "IoT based Smart Water Tank with Android application", International conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC 2017)

[10] Siddartha Shankar and Dr M Dakshayini," IoT-Mobile Enabled Smart Water Level Controlling System to Regulate Water Wastage", 2018, 978-1-5386-5314-2

[11] Suresh. S, Yuthika. S and G. Adithya Vardhini, "Home based fire monitoring and warning system", 2016, 978-1-5090-5515-9.

[12] Pooja A. Dhobi and Niraj Tevar, "IoT Based Home Appliances Control", Proceedings of the IEEE 2017 International Conference on Computing Methodologies and Communication (ICCMC), ISBN: 978-1-5090-4890-8.

[13] Urvi Singh and M. A. Ansari, "Smart Home Automation System Using Internet of Things",2019, 2nd International Conference on Power Energy, Environment and Intelligent Control (PEEIC), ISBN: 978-1-7281-1793-5.

[14] Monira Mukta, Samia Islam, Surajit Das Barman, Ahmed Wasif Reza and M Saddam Hossain Khan, "IoT based Smart Water Quality Monitoring System", 2019, IEEE 4th International Conference on Computer and Communication Systems, ISBN: 978-1-7281- 1322-7

[15] Shopan Dey, Ayon Roy and Sandip Das, "Home Automation Using Internet of Things".

[16] N. Jayapandian, "Cloud Enabled Smart Firefighting Drone Using Internet of Things", Second International Conference on Smart Systems and Inventive Technology (ICSSIT 2019) ISBN:978-1-7281-2119-2