e-ISBN: 978-93-6252-360-0
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SMART HOME PRACTICAL AND INNOVATIVE APPLICATIONS USING IOT AND IOT NETWORKS

Abstract

The main aim of this paper is to explore the impact and usage of the Internet of Things Based Smart Home Technology in this generation. The Internet of Things (IOT) has revolutionized the concept of smart homes, enabling automation, connectivity, and control of various devices and systems We present a comprehensive analysis of how IOT technology can enhance smart homes, including increased energy efficiency, improved security and safety, optimized resource management, and enhanced user experience. Furthermore, we propose innovative ideas for future development, such as intelligent appliances, augmented reality interfaces, and personalized AI assistants. The appliances can be controlled through android platform. This method is used to provide help for the elder people and who are disabled in home. Through this exploration, we aim to inspire further advancements and innovations in the field of IOT-enabled smart home. In this paper, we explore the applications of IOT and IOT networks in smart homes, focusing on their current state, potential improvements, and invention ideas.

Keywords: Internet of things (IOT), Node MCU, Raspberry Pi, Python.

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I. INTRODUCTION

The Internet of Things (IOT) has revolutionized the concept of smart homes by enabling the interconnectivity of various devices and appliances through internet-enabled sensors, actuators, and network infrastructure. Home automation can also be used to manage and communication between all the nearby devices in the home. This interconnectedness facilitates automation, remote control, and monitoring of household activities, leading to increased comfort, convenience, energy efficiency, and safety. It involves basic feature that take care the user luxury and satisfaction. In this paper, we will explore some practical and innovative applications of IOT and IOT networks in the context of smart homes.

1. **Home Automation**: IOT technology allows homeowners to automate various tasks and processes within their homes. For instance, using smart lighting systems, residents can remotely control and schedule the operation of lights, adjusting brightness and colour to suit their preferences. Similarly, IOT-enabled thermostats enable the automatic adjustment of temperature settings based on occupancy patterns, weather conditions, or pre-set preferences, optimizing energy consumption and enhancing comfort.

2. **Energy Management:** IOT networks offer significant opportunities for efficient energy management in smart homes. Smart meters integrated with IOT capabilities can monitor energy consumption in real-time and provide detailed insights to homeowners. This empowers residents to identify energy-intensive appliances, track usage patterns, and make informed decisions to reduce energy waste. Additionally, IOT-enabled smart plugs can remotely control and schedule the operation of devices, ensuring they are not left in standby mode unnecessarily.

3. **Security and Surveillance:** IOT-based security systems have transformed home security by providing enhanced monitoring and control features. Smart cameras equipped with motion sensors and facial recognition capabilities can detect intrusions and send real-time alerts to homeowners via their smartphones. Integration with IOT networks allows homeowners to remotely access live video feeds and control the security system, including locking doors and windows or arming/disarming alarms.

4. **Health and Wellness Monitoring:** IOT devices are increasingly being used to monitor the health and well-being of individuals within smart homes. For instance, wearable fitness trackers can collect biometric data such as heart rate, sleep patterns, and activity levels. This information can be transmitted to IOT platforms, which can then provide personalized health recommendations, reminders, or alerts to both users and healthcare providers. Furthermore, IOT-enabled home health monitoring systems can track vital signs, medication adherence, and detect emergencies, enabling proactive healthcare interventions.

5. **Appliance and Resource Management**: IOT networks enable seamless integration and coordination between various smart appliances and devices within a home. For example, a smart refrigerator can monitor its contents, detect expiration dates, and even place orders for grocery replenishment. Similarly, IOT-enabled washing machines can optimize water and detergent usage based on load size and fabric type, while smart irrigation

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systems can adjust watering schedules based on weather conditions and soil moisture levels, conserving water resources**.**

II. PROBLEM TO BE SOLVED

1. **Burglary and Break-Ins**: Home security breaches, such as burglaries and break-ins, pose a significant threat to the safety of homes and residents. Intruders can cause property damage by break and miss placing the things, steal valuable belongings, and even harm the human beings and animals.

2. **Carbon Monoxide Poisoning**: Carbon monoxide (CO) is a colourless, odourless gas that can be produced by faulty gas appliances, fireplaces, and vehicles in enclosed spaces. Inhaling CO can lead to poisoning and, in severe cases, be fatal. Ensuring proper ventilation and having carbon monoxide detectors can help mitigate this risk. Common cases are busting of the gas cylinders.

3. **Fire Hazards:** Fire hazards are potential sources or conditions that increase the risk of fires, posing a threat to life, property, and the environment, requiring proactive measures to prevent and mitigate such risks.

4. **Electrical issues**: Faulty wiring, overloaded circuits, damaged electrical cords.

5. **Cooking accidents:** Unattended cooking is leading cause of home fires.

6. **Smoking:** careless smoking practices: Fires can quickly escalate and cause extensive damage to homes, leading to property loss, injuries, and even fatalities. Common fire hazards include faulty electrical wiring, unattended cooking, flammable materials, and malfunctioning appliances.

7. **Poisoning and chemical exposure:** Improper storage of the any toxic substances, pesticides. Inhaling fumes can result in poisoning and health complications.

III. BENIFITS IN INTERNET OF THINGS

1. **Data Sharing and connectivity**: Data sharing and connectivity refer to the ability to exchange information between devices or systems, enabling seamless communication and access to shared resources.

2. **Smart and sustainable city**: A smart and sustainable city incorporates advanced technologies and data-driven solutions to enhance efficiency, liability, and environmental responsibility, creating a harmonious urban environment for its residents.

3. **Improved Decision Making**: Improved decision-making involves utilizing data, insights, and critical thinking to make more informed and effective choices, leading to better outcomes and problem-solving in various contexts.

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4. **New revenue streams**: New revenue streams refer to additional sources of income or ways to generate money for a business or individual, often resulting from exploring untapped markets, innovative products/services, or novel business models.

5. **Cost saving**: Cost saving refers to the practice of reducing expenses or expenditures within an organization, leading to increased efficiency and profitability by optimizing resources and processes.

6. **Productivity improvement**: Productivity improvement involves enhancing the output or efficiency of tasks, processes, or individuals, resulting in increased output with the same or reduced resources, contributing to overall growth and success.

7. **Improved safety**: Improved safety entails implementing measures and technologies to mitigate risks, prevent accidents, and safeguard individuals and assets, creating a secure and protected environment.

8. **Rapid response**: Rapid response refers to the quick and timely reaction to emerging situations or challenges, allowing for immediate action and effective resolution of issues.

9. **Innovation and New business models**: Innovation and new business models involve creating novel ideas, products, or services, coupled with fresh approaches to conducting business, leading to competitive advantages and growth opportunities in the market.

10. **Remote monitoring and control**: Remote monitoring and control enable the supervision and management of devices, systems, or processes from a distance, offering flexibility, efficiency, and accessibility in various industries and applications.

11. **New capabilities to predict and act**: New capabilities to predict and act refer to leveraging advanced technologies and data analytics to anticipate future events and make proactive decisions, enabling organizations to respond swiftly and effectively to changing circumstances.

12. **Predictive analysis**: Predictive analysis involves using historical data and statistical algorithms to forecast future trends and outcomes, providing valuable insights to make informed decisions and optimize strategies.

IV. LIST OF SOME SMART HOME ASSISTANT DEVICES AND ITS APPROACHES

1. **Amazon Alexa and Echo**: Perform various tasks like playing music, providing weather updates, controlling smart home devices.

2. **Samsung Smart Things Hub**: This allows to control them through a smartphone app or voice commands.

3. **Nest Cam**:This is a range of indoor and outdoor security cameras that provide live video streaming and can send alerts to your smartphone when motion or sound is detected.

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4. **Ecobee Smart Thermostat**: This is a smart thermostat that can be controlled using voice commands or a smartphone app. It can adjust temperature settings based on occupancy, weather conditions, and user preferences.

5. **Philips Hue**:This is a popular smart lighting system that allows users to control their lights using a smartphone app or voice commands. It offers various lighting options, including colour-changing bulbs.

6. **Ring Video Doorbell**:This smart doorbell comes with a built-in camera that allows users to see and speak to visitors through their smartphones. It also provides motion detection and can integrate with other smart home devices.

7. **Gas leakage and fire Detection using Raspberry Pi**: This system is used to detect of fire and detection of the gas. MQ2 sensor is present which detect various type of gases, fire sensor detect fire. GSM module is used for sending notification to user. Python code and sensor libraries are used for executive of entire system model.

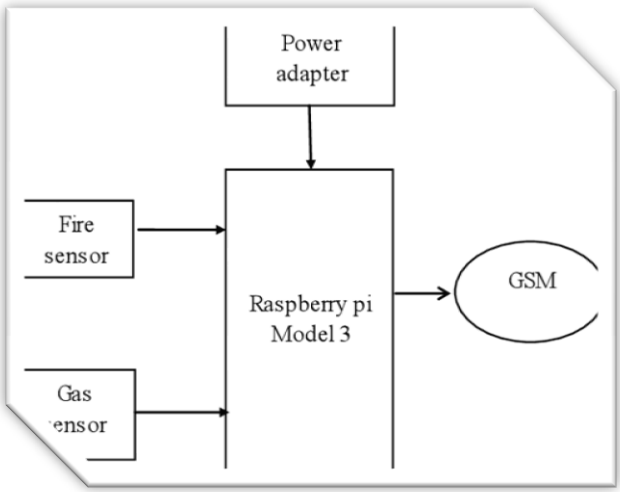

Figure 1: Block diagram of designed system for Gas leakage and fire Detection using Raspberry Pi

8. **Internet of Things (IOT) for building Smart Home System:** The system consists of four application modules they are smoke /gas, lighting, appliances, intrusion detector. In this FLIP device is used for connecting the different sensors for camera, windows, controlling lights, air conditioner, 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. The show smart home FLIP shield. To increase the functionality of the board FLIP shield is assembled over base board. Smart home shield built in such a way that it contains various sensors like, PIR, various gas sensor that is light intensity (LDR), air quality sensor, sound sensor, temperature humidity, PIR and many more sensors. All these sensors are attached to it and it can used for home automation.

9. **Brainy streets- An automatic lighting system:** Automatic switching ON/OFF of street lights based on the intensity of sunlight, using the Arduino UNO micro-controller, PIR

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sensor, LDR and LED street light When there is no movement, the lights are turned off. This method can be used in house to automatically control the lighting system.

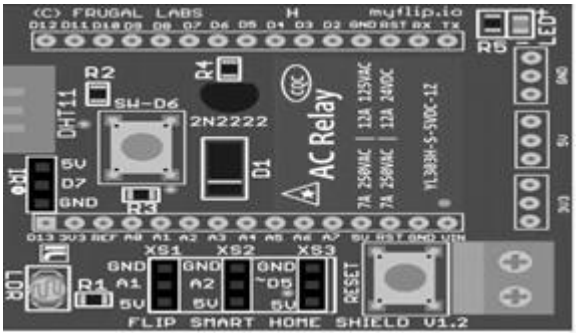

Figure 2: Smart Home Flip shield

Smart Home Energy Management System Exploration of IOT use cases.

- **Wink Hub 2:** The Wink Hub is a smart home automation hub that acts as a central control system, allowing users to connect and manage various smart devices from different brands through a single interface. It enables users to control lights, thermostats, cameras, and more, creating a cohesive and interconnected smart home experience.

- **TP- Link HS200:** The TP-Link HS200 is a Wi-Fi smart switch that allows users to remotely control their lights from anywhere using the Kasa app or voice commands through Amazon Alexa or Google Assistant. It offers scheduling, dimming, and energy monitoring features, making it an efficient and convenient addition to any smart home setup.

- **Net Gear Arlo Q:** The Net gear Arlo Q is a high-definition indoor security camera that offers 24/7 live video streaming, motion detection, and two-way audio communication. It provides reliable monitoring and surveillance for homes and businesses, accessible remotely through the Arlo app.

- **LG smart TV:**LG Smart TV is a line of televisions that come equipped with internet connectivity and pre-installed apps, offering users access to streaming services, web browsing, and various smart features for an enhanced entertainment experience.

- **Logitech Harmony Elite:** The Logitech Harmony Elite is a universal remote control that can manage multiple entertainment and smart home devices, providing seamless control through a single interface, including touch screen and voice commands, simplifying home entertainment and automation.

- **iRobot Roomba (robotic vaccum cleaner):**The iRobot Roomba is a robotic vacuum cleaner designed to autonomously navigate and clean floors, using advanced sensors and intelligent algorithms to efficiently cover various surfaces and remove dirt, making household cleaning more convenient and effortless.

- **Arlo Pro (wireless security cameras):**The Arlo Pro is a wireless security camera that offers high-definition video recording, two-way audio, and motion detection, providing reliable surveillance for both indoor and outdoor settings with convenient mobile app access and cloud storage options.

10. **Based Smart Emergency Respond System for Fire Hazards:** This system consists of ESP32, MQ gas sensors, flame sensor, GPS module and MQTT protocol for sending message. This are capable of providing the location of the hazard to the fire department. MQ-5 is used to detect the gases like LPG/LNG, methane, H2, CO. These sensors are connected to a MQTT broker and with the help of the internet, the fire hazard alerts are sent to the fire organization which is found nearby.

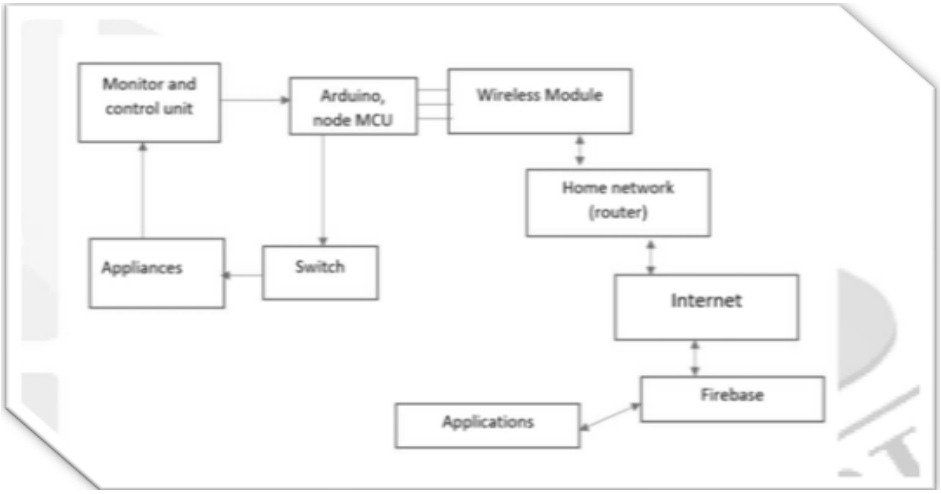

Figure 3: Energy Management system

11. **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. The microcontroller continuously monitors the elements that can be controlled. When any changes are observed in the elements, the microcontroller can take appropriate actions. It is also possible to get the readings of total energy consumed by an electrical outlet in the present month.

12. **Water Management in Housing Societies using IOT**: This methodology can be used in the houses to monitor the water level and the quality of the water in the tank. This system consists of many sensors like relay switch, turbidity sensor, cloud platform, Raspberry Pi, and ultrasonic sensor. The ultrasonic sensor can be used to monitored the water level in the tank and share the data based with the owner. 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. For water tank relays can act as the switch.

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V. AIM AND OBJECTIVE

- By giving voice command it can turn on / off the LED lights. Even it can be done without using voice we can use our smartphone, smart watch, etc and turn off.
- IR sensors helps to see if the entryways are shut or open advised through email if the entry is left open.
- Smart water tank level monitoring system based on IOT.
- Can be control the observation of vehicle from anyplace to screen.
- Sending massages when there is any fire, smoke and gas leakage.
- Cloud enabled smart firefighting drone using IOT.
- Home appliances control and uses based on IOT.

VI. NEED FOR SMART-HOME

1. **Increased energy efficiency:** Increased energy efficiency refers to using less energy to accomplish the same tasks, reducing energy waste and environmental impact while saving costs and promoting sustainable practices.

2. **Home managements insights:** Home management insights involve leveraging data and analytics to gain valuable information and trends about household activities, enabling informed decisions and effective optimization of resources for a more organized and efficient living space.

3. **Maximizing home securities:** Maximizing home security involves implementing a combination of advanced technologies, surveillance systems, and precautionary measures to create a safe and protected living environment, deterring potential threats and ensuring peace of mind for homeowners.

4. **Remote controls of our home functions:** Remote controls of our home function refer to using smart devices, such as smartphones or smart assistants, to manage various home functions like lighting, temperature, security, and entertainment systems from a distance, providing convenience and control at your fingertips.

5. **Personalization and adaptability:** Personalization and adaptability entail tailoring products, services, or experiences to individual preferences and adjusting to changing circumstances, enhancing user satisfaction and relevance in a dynamic environment.

6. **Home automation:** Home automation is the integration of smart devices and technologies that allow homeowners to control and manage various household functions, such as lighting, security, climate, and entertainment, remotely and automatically for enhanced comfort and efficiency.

VII. ADVANTAGES AND DISADVANTAGES FOR SMART HOME

1. Advantages:

- **Security and privacy risk:** Security and privacy risks in IOT smart homes arise from potential data breaches and unauthorized access due to the interconnected nature of

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devices and the collection of personal information, requiring robust security measures and user vigilance**.**

- **Sedentary Lifestyle**: A sedentary lifestyle refers to a way of living with little physical activity or exercise, which can lead to various health issues, including obesity, cardiovascular problems, and musculoskeletal disorders. Regular physical activity is crucial to maintain overall health and well-being.
- **Accessibility:** IOT technology can benefit individuals with disabilities, providing easier access and control of home devices.
- **Remote Monitoring**: IOT devices allow you to monitor your home while away, giving you peace of mind and the ability to respond to emergencies or issues promptly.
- **Convenience**: IOT devices allow you to control various aspects of your home remotely, making tasks like adjusting thermostats, turning on lights, or locking doors more convenient.

2. Disadvantages

- **Reliance on internet connectivity:** Reliance on internet connectivity refers to the dependence of various devices, services, and activities on a stable internet connection for proper functioning, which can lead to disruptions or limitations when there are connectivity issues or outages. Many aspects of modern life, including communication, smart devices, and online services, heavily rely on a consistent internet connection to operate effectively**.**
- **Dependency on Technology**: Smart homes heavily rely on technology, and any technical issues or outages could disrupt regular home functions until resolved.
- **Cost:** Smart home technology can be expensive, especially when outfitting an entire home with various IOT devices, which may not be affordable for everyone.
- **Power Consumption:** While some devices are energy-efficient, others may consume more power due to constant connectivity and data processing.
- **Interoperability Challenges:** Different manufacturers may use various communication protocols for their devices, leading to interoperability challenges and limited options for integration.
- **Obsolescence:** The rapid pace of technological advancements may result in some IOT devices becoming obsolete quickly, requiring users to replace them to maintain compatibility and functionality.

VIII. CONCLUSIONS

Smart Home technology as we know it today, began in 1975 with the invention of X10.X10 is a communication between devices and control modules installed in the home / office. Most embedded IOT devices are programmed in the C language. There are an estimated 300million smart homes in the world. The latest smart home statistics from a survey shows that as many as 63.43 million households in the US are actively using smart home devices in 2023. This is 10.2% more than in 2022. Because of the IOT devices rapid growth, benefits and concerns are increasing. Even if the Wi-Fi is not available. we can use the 3G or 4G services during emergency. Web of things has various applications in different zones.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

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cloud, databases and applications. r. 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. There are a couple of issues found in IOT and Smart home. whether to welcome the guest after receiving the captured ul to picture of the guest or intruder, (IOT) and its application to make sharp homes to give getting, comfort and to improve the individual satisfaction. whether to welcome the guest after receiving the captured ul to picture of the guest or intruder, These moved improvements offer the two prospects and dangers, an IOT-based Smart Home is especially powerless against various security dangers both from inside and outside the home, if security in a shrewd home or astonishing gadget was undercut, and the client's security which holds there, solitary data, real time data and regardless, success of the occupants will be at high risk. Avoiding any fire accidents , waste of water can be reduced, time can be saved as it as voice command or manual control using smart phones , conforming who is ringing door bell, auto open of the door , capture the photo of the person who rings the door ,auto sensing lights, overcoming the fire hazards, waring system, smart automation using internet of things, smart fire fighter drone , distance and intensity of the light can be controlled and monitored remotely and electric energy can be conserved etc Thus , this system helps the society to effectively utilize the energy.

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