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INTEGRATED IOT SMART HOME AUTOMATION AND ENERGY MANAGEMENT SYSTEM WITH INFRARED REMOTE INTERFACE

Kalpana Koppolu[1]
koppolukalpana@gmail.com

Sandeep Namamula[2]
namamulasandeep88248@gmail.com

Divya Sri kundrapu[3]
Kundrapudivyasri@gmail.com

Ashra Farheen Mohammad[4]
Ashrafarheen.md456@gmail.com

Siva Lakshman Kumar Gurram[5]
Sivakumar.gurram2002@gmail.com

Ajith Kota[6]
reddyahith3@gmail.com

[1] *Assistant Professor,* [2 3, 4, 5,6] *UG Students*
[1, 2, 3, 4, 5, 6] Dept. of ECE, Bapatla Engineering College, Bapatla
Andhra Pradesh, India

Abstract :
An inventive project called "Integrated IOT smart home automation and energy management System with infrared remote interface Using Mobile App" uses an Arduino board, a NodeMCU, and a number of sensors to create an intelligent home management system. With the integration of temperature, fire, and gas sensors, this system enables real-time monitoring and prompt notifications. In order to improve security and energy efficiency, also manage door access, fans, and lighting. The project offers remote control and accessibility using an intuitive mobile app interface. The significance of real-time current sensing in energy monitoring applications, highlighting its function in pattern recognition and usage optimisation. This project illustrates a flexible and scalable method of updating home automation for increased convenience, safety, and security by leveraging cloud-based communication via ThingSpeak.

Keywords: Arduino, mobile app, internet of things.

1 INTRODUCTION :

The dynamic nature of technology has ushered in a period of increased intelligence and interconnectivity in homes. The convergence of home automation systems and the Internet of Things (IoT) has led to the development of creative solutions that improve energy efficiency, safety, and convenience. An innovative initiative called " Integrated IOT smart home automation and energy management System with infrared remote interface Using Mobile App " aims to make conventional homes into responsive and intelligent places to live[1].
This project uses the Arduino and NodeMCU platforms to create an intelligent environment that smoothly integrates several sensors and control mechanisms. Critical components of environmental and safety monitoring are addressed by the use of temperature, fire, and gas sensors[1],[2]. Moreover, servo motor integration makes it possible to regulate the lights, fans, and even the house's entrance.

The core of this system is the mobile app interface, which gives customers the opportunity to remotely monitor and manage their home environment. A wide range of users can utilize the software because of its intuitive design, which guarantees user-friendly interaction. Moreover, the scalability and real-time responsiveness of the system are improved by ThingSpeak's cloud-based communication[3].

We'll probe the hardware configuration, data collection procedures, and mobile app interface creation as we delve into the complexities of this project. Since the Internet of Things and smart home technologies are always evolving, the system's modular architecture facilitates future additions and modifications, reflecting the flexibility needed[4].

This concept fits in with the larger trend of building intelligent homes that adjust to the requirements and tastes of their occupants. It not only covers the essentials of energy conservation and security, but it also sets itself up to be a foundation for future advancements in the field of home automation[4],[5].

A glimpse of the future is shown as we delve into the specifics of the "IoT-Based Home Monitoring and Controlling System and energy management with infrared remote interface," where our homes actively adapt to our preferences and help us live a safer and more efficient lifestyle[6].

1.1 Internet of Things:

The Internet of Things is known as IoT. IoT is difficult to define accurately. Expert in digital innovation, Kevin Ashton,

has exploited the theme of IoT. And then it was reallywell-liked.

The Internet of Things (IoT) is a network of interconnected devices that can exchange and collect data. Our essential appliances are integrated into a large number of digital devices via the Internet of Things.

With the advent of the Internet of Things, home automation systems are gaining popularity in current research. The majority of devices are managed and observed by people. Appliances in homes can be controlled and observed via the internet of things. The physical world is merging with the internet of things to build one massive information system. IoT technology generates fresh concepts that improve the quality of our lives.

2 OUR PROPOSED METHOD :

Safeguarding your home, keeping it secure, saving energy, and providing convenience for you are all addressed by the suggested system. This project presents itself as an innovative approach to contemporary smart home solutions by utilizing cloud-based connectivity and IoT capabilities.

By using adaptive algorithms, the system is guaranteed to fulfill customers' immediate demands while also adapting to their changing lifestyles. The methodological and implementation details of the suggested system will be covered in full in the upcoming parts, along with an explanation of how each part fits into the overall functionality.

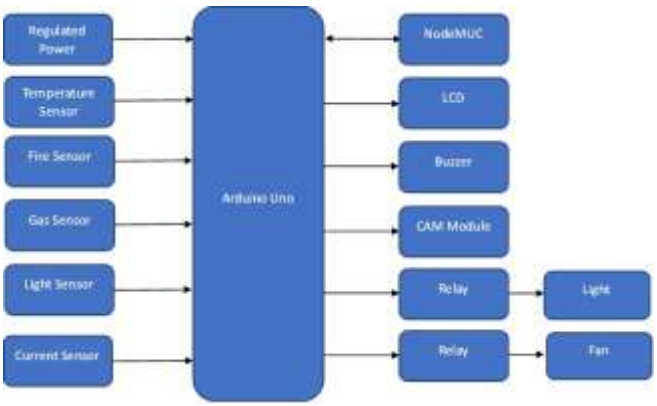

Fig 1. Block diagram

3 SYSTEM DESIGN:

3.1 Arduino:

Based on a microcontroller board with an integrated development environment for programming the board, Arduino is an open source physical processing system. A few inputs, like switches or sensors, are fed into the Arduino, which then controls a few different outputs, like lights, an engine, and other things. Unlike most microcontroller frameworks, which are limited to functioning on Windows, the Arduino application is compatible with Windows, Macintosh, and Linux operating systems.

Arduino is an instrument used to build a better version of a computer which can control, interact and sense more than a normal desktop computer. It's an open-source physical processing stage focused around a straightforward microcontroller board, and an environment for composing programs for the board. Arduino can be utilized to create interactive items, taking inputs from a diverse collection of switches or sensors, and controlling an assortment of lights, engines, and other physical outputs.

Fig 2. Arduino symbol

3.2 Sensors Monitoring and Controlling System:

Integrated gas, humidity, temperature, and fire sensors as well as a buzzer for instant notifications provide a sensor monitoring and alarm system that guarantees complete safety in a variety of settings. The technology identifies possible risks like leaks or fires by continuously monitoring vital parameters like gas levels and environmental circumstances. After the buzzer promptly sounds, everyone within are alerted and can take immediate action to mitigate the situation. Safeguarding homes, workplaces, and industrial environments is made easier and safer with this integrated method that effectively counters many threats. The technology offers proactive security measures for enhanced security and peace of mind, along with real-time monitoring and prompt alarms.

3.3 Door Locking System with Camera Interfacing:

IoT-powered door locks offer a modern and effective solution for safeguarding homes, giving users control, flexibility, and heightened security in a connected world. Enhanced security features like activity logs and tamper alerts ensure vigilant monitoring, and integration with home automation systems enables a cohesive smart home experience. Remote access, customizable access control, and seamless integration with other smart devices are just a few of the ways that a door locking system using IoT revolutionizes home security.

3.4 Power Monitoring and Controlling System:

Accurate monitoring and control of electrical usage in a variety of applications is made possible by energy management that makes use of the ACS712 module for IoT. The technology facilitates informed decision-making for efficiency improvements by enabling real-time assessment of energy usage through accurate measurement of current flow. By enabling remote monitoring and control through integration with IoT systems, customers may optimize energy consumption by taking demand and usage trends into account. Proactive energy management tactics are made possible by the precision and dependability of the ACS712

module, which guarantees accurate data collecting. All things considered, this solution provides a simplified method of energy optimization, encouraging cost-effectiveness, sustainability, and environmental stewardship in both commercial and residential settings.

4 IMPLEMENTATION:

A prototype of our suggested method has been created and is tested in our lab to look at its architecture. There are primarily two sections to the implementation phase. The hardware component is one, while the software component is another. The following is a detailed description of the implementation phase:

4.1 Hardware Implementation:

In conclusion, modern homeowners can benefit from a comprehensive and user-friendly solution provided by the hardware implementation of an IoT-based smart home automation and energy management system with an infrared remote interface. This system allows for easy management and monitoring of household gadgets and energy consumption by integrating sensors, actuators, an IR receiver, and IoT connectivity. With the help of smartphone apps, or IR remote controls, users can easily regulate their home environment and optimize energy consumption.
This creative strategy enhances sustainability and lowers energy expenses while promoting efficiency, comfort, and convenience. In terms of building smarter, more connected, and energy-efficient houses, this hardware implementation is a major
Advancement.

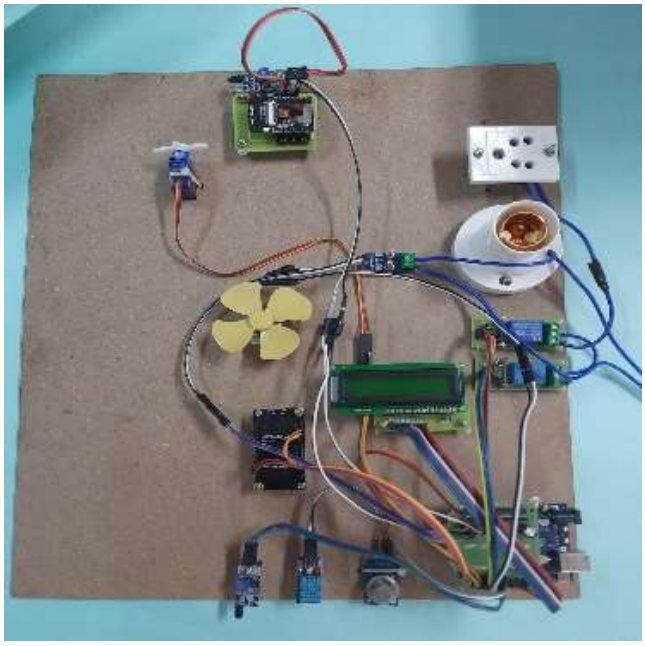

Fig 2. Circuit schematic for many sensor interfaces.

4.2 Software Implementation:

Arduino IDE is a comprehensive software tool designed for programming Arduino microcontroller boards. Its key features cater to both beginners and experienced developers, offering a user-friendly environment for writing, compiling, and uploading code its primary features include a user-friendly environment for creating, developing, and submitting code, catering to both novice and seasoned developers.
Key elements that improve the coding experience are provided via the IDE's code editor, including syntax highlighting, code completion, and auto-indentation. The pre-written code for different sensors, actuators, and communication modules may be easily integrated with the built-in Library Manager, drastically cutting down on development time.
Multiple sketches can be arranged within projects by users, making code file organization more effective. To help with debugging and sensor data monitoring, the Serial Monitor enables real-time communication between the Arduino board and the PC.
To ensure compatibility with a range of hardware configurations, users can install and configure support for different Arduino-compatible boards using the Board Manager. Furthermore, deployment is made easier by the IDE's streamlined procedure for uploading compiled code to Arduino boards via USB connection.

The Arduino IDE promotes a collaborative development environment by being cross-platform compatible and open-source. It is a vital tool for effectively developing, testing, and implementing embedded programs because of its adaptability and strong community support.

5 CONTROL VIA MOBILE APP:

Fig 4. Managing the app's home screen, the appliances list, and the option

Use the IP addresses that your IoT devices have been issued to effortlessly control them using a mobile app. The software eliminates the requirement for a centralized hub by allowing users to remotely operate and monitor their smart devices from any location via direct connectivity. All it takes to modify settings, enable features, and get real-time updates is for users to enter the IP address of the device into the app.
With the flexibility and scalability this solution provides, users may manage a wide variety of IoT devices without depending on cloud services or proprietary protocols. Users can feel secure in the privacy and integrity of their control interactions since security mechanisms like authentication and encryption are in place.

6 SECURITIES:

With the help of ESP32 and IoT, the camera module recognizes objects and sends images to Telegram when it

does. The ESP32 prompts the camera to take a picture when it detects an object. After processing the image, the object is transmitted as a Telegram photo message if it can be identified. Real-time warnings to users are made possible by this smooth integration, which makes remote monitoring and action easier. The integration of ESP32's connectivity with Telegram's messaging platform allows for prompt notifications, which improves security and facilitates prompt replies to detected events. This solution promotes improved automation and monitoring in a variety of applications by providing effective object detection and notification capabilities.

Fig 5. Telegram Photo

7 THINGSPEAK:

Establish a ThingSpeak channel to create a real-time monitoring system. Data gathering from IoT devices, sensors, and other sources is made possible via ThingSpeak. Start by setting up an IoT device to send data to the channel, defining fields to gather data, and creating a channel.

Fig 6. Channel creation in thingspeak

Utilize ThingSpeak's integrated capabilities to visualize and analyze data in real-time as it streams into the channel, or link it with other platforms. ThingSpeak enables users to continuously monitor a variety of characteristics, such as location, humidity, and temperature. This allows for automated processes and well-informed decision-making based on real-time information. Robust monitoring capabilities for many IoT applications are provided by this seamless integration.

8 RESULTS:

Fig 6.Gas Measurement

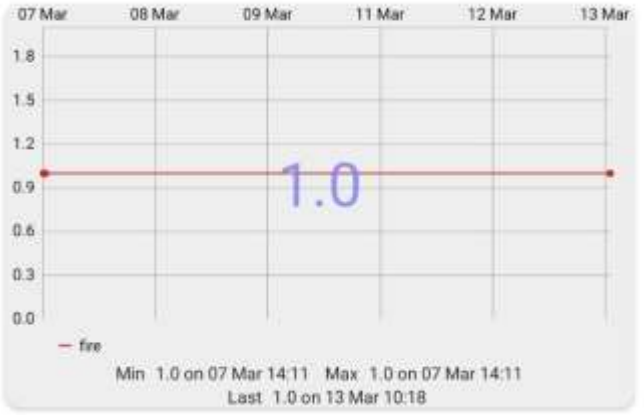

Fig 7.Fire Measurement

Fig 8.Load Measurement

Fig 9.Temperature Measurement

Fig 10.Humidity Measurement

Fig 11.Results Monitoring on Mobile

CONCLUSION

All a home computerized system is a controller mechanism that allows us to operate our devices from anywhere at any time. It serves a special purpose in our daily lives because it is an automatic controller. It is also well recognized that it allows users to remotely control various device types from anywhere in the continent. Cell phones, computers, and tablets are the technologies that are employed in this framework. This document claims that there are several options available for customizing their security system. Researching home automation has several benefits and increases support across all domains for several individuals, including employees and those with physical disabilities, enabling them to perform tasks independently.

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