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A Review on: Smart Integrated Group Measurable Automation Home

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Abstract:

This research presents a comprehensive approach to home automation by integrating advanced sensor technologies to enhance environmental monitoring and safety within residential spaces. The system incorporates three key features: room air filtration using a dust sensor, water management through an ultrasonic sensor, and smoke detection for kitchen fire prevention, and rain detection sensor for automatic window operation, and temperature sensor for home ventilation operation. The proposed smart home automation system integrates seamlessly with existing home infrastructure, providing a user-friendly interface for control and monitoring through centralized control.

INTRODUCTION

In the rapidly evolving landscape of smart home technologies, the integration of advanced sensors has emerged as a pivotal aspect in enhancing the functionality and efficiency of residential spaces. This project delves into the realm of comprehensive home automation, aiming to provide homeowners with a sophisticated system that not only optimizes daily tasks but also prioritizes environmental monitoring and safety. As the demand for smart living solutions grows, there is an increasing need for systems that go beyond mere convenience. This research focuses on a multi-faceted approach,

incorporating three distinct yet interconnected features: room air filtration using a dust sensor, water management via ultrasonic sensors, and a state-of-the-art smoke detection system for kitchen safety. [12]

Nowadays there is a growing social concern about energy efficiency. Whether motivated by the requirements imposed by governmental entities or simply by common sense, more and more people's habits, practices and decisions reflect this concern; the construction industry is no exception. There is a growing demand to find solutions capable of improving the buildings thermal insulation, in order to improve energy efficiency. However, there is a significant drawback with this approach because using better insulation materials and reducing air leakage, reduces the air renewal. So, if the building has no HVAC system installed, the IAQ is worsened leading to potential harmful consequences for human health. [6]

The microclimate and ventilation control system in particular occupies a special place in a smart home, because it directly affects the health of residents. The possibility of integrating ventilation into the "Smart Home" system expand the variations in monitoring the state of the indoor microclimate and improve its quality. An analysis of existing solutions and approaches was carried out before starting the design of an intelligent microclimate control system.[2]

Gas spillage and fire accidents in houses are causing various losses and property harms. For instance, the flammable gas leaks, which is significantly burnable, increase the danger of fire and can even instigate impact. These days, sensor based different project are broadly utilized. Every year lots of people died for fire that's because of gas leakage. So, most significant thing is to distinguish gas spillage and recognize fire. Each private home should have an alarm framework to remain protected from fire. The proposed point "IoT (Internet of Things) based smart gas management system" manages significant issues, fire discovery and auto ventilation. [3]

Dust is one of the most important health and safety risks in various operations such as construction, cement plants and mining industry. In particular, dust particles under 10 μm in size (respirable) are a source of nuisance and able to enter the lower zone of the lung. Thus, a robust and reliable dust monitoring system is essential in any surface to maintain the health and safety of workers and operations. [4]

A smart home system, includes very smart features to make life easy. In smart home automation you can control home appliances. Main motto behind the idea of smart home system is to reduce human efforts, electricity consumption, and to help old aged people and children. As wireless communication technique growing, it allows us to access or handle home appliances remotely. Another risky major issue is gas leakage in home. LPG gas is a flammable gas. So in this case also system will raise an alarm and notify user. [5]

The Intelligent Window and Temperature controlling system is an investigation to provide suitable temperature with supportable features. It aims to provide a suitable temperature for a closed environment like rooms in hospitals, old age

homes, and even in houses, etc. Because of the inability of the old aged people and disabled people to open their room windows for maintaining the room temperature, this project will be helpful for them to automatically maintain their room temperature. This Smart Window and Temperature controlling System is a simple and real-time project that can be very useful for people to maintain their room temperature. This Project is aimed to reduce the stress level or workload for disabled and old aged people. [1]

Smart home system and home safety are vital issues for our modern life. Electronic advancement moves us to this development. But in most of the smart home system, the presence of people is ignored or the residents need to turn on/off electric appliances used in their home. The smart home system is an automated home with control devices associated with lighting, heating, air conditioning, ventilation, and security system. Sensor and microcontroller are the main parts of the smart home system. In this case, sensors collect data from the surroundings and send electric signals to the microcontroller. The microcontroller processes this signal, and depending on the installed program in the microcontroller, necessary actions are taken to control the utilities connected to it. So, we can say that microcontrollers are the central axis of this system, and are sometimes called "gateways". The microcontrollers are usually interfaced with a tablet, mobile phone, or computer; and the network connectivity of the systems is managed by IoT. Using this system, the controlling of all the electric appliances is possible which makes a home automation system. [7]

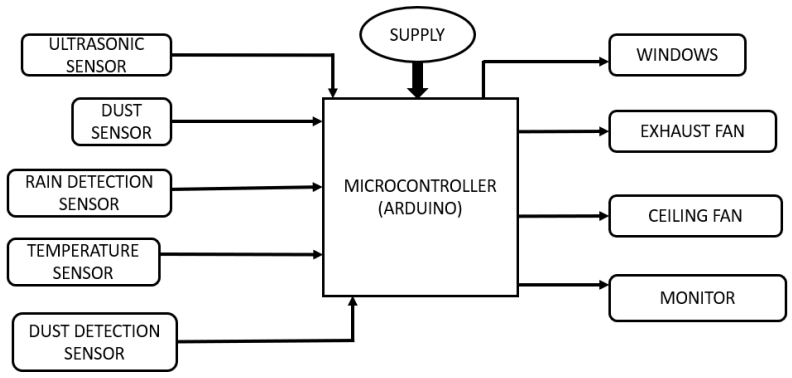

Fig1: Block diagram

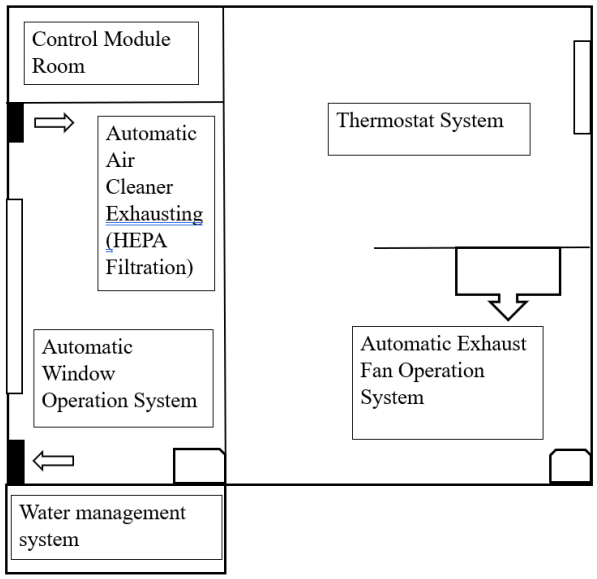

Fig2: Home Layout

DESIGN

LM35 sensor is used to measure the indoor temperature. The operating temperature range is from -55 °C to 150 °C. The output voltage varies by steps of 10mV in response to every one-degree Celsius rise in temperature. Dc motor is currently very popular. Compared to AC motors, they only use about half of the electrical energy and therefore represent a real breakthrough in terms of energy efficiency. In addition to their low power consumption, DC motors offer additional more efficient regulation of rotation speeds. It used as a DC fan for ventilation according to temperature value in living room of the house. Output part consists of the relays and buzzer. Buzzer serves as a warning alarm when there is a suspicious movement. Relays connected with lamps and socket. A relay is a simple electromechanical device made up of electromagnet which can be operated by relatively small electric current to turn OFF or turn ON large electric current. Relays are using in many applications because of its long life, simplicity and high reliability. In this study solid-state relay has been used. The proposed home automation consists of Arduino mega microcontroller, ultrasonic sensor, dust sensor, rain detection sensor, temperature sensor, motor, buzzer, exhaust fan, display, and keyboard devices. [8]

NEED OF THE STUDY:

The study on the proposed home automation system is essential to address contemporary challenges and advance the field of smart home technologies. Indoor air quality significantly impacts residents' health, and this project aims to mitigate risks by introducing an integrated system for air filtration and purification. Kitchen safety is a paramount concern, with cooking-related smoke and pollutants posing health hazards and fire risks.

The incorporation of smoke detection and immediate purification measures in the kitchen enhances safety. The need for energy-efficient climate control is emphasized, and the study presents an automated ventilation system that optimizes energy consumption based on temperature variations.

Additionally, the project addresses the necessity for adaptive window operations in response to external factors such as rain, enhancing both convenience and energy efficiency. The growing importance of water conservation is acknowledged, with a comprehensive water management system proposed to monitor usage and detect leaks.

The study contributes to the broader field of smart home research by showcasing the integration of Internet of Things (IoT) technologies and considering user-centric design principles. By sharing insights and methodologies, this research aims to foster advancements in smart homes, providing a foundation for future studies and improvements in home automation systems.

METHODOLOGY:

Integrate microcontrollers (e.g., Arduino, Raspberry Pi) with the selected sensors (dust sensor, ultrasonic sensors, smoke detection sensor) and actuators. Ensure proper wiring and compatibility to facilitate seamless communication. Connect the dust sensor to each room for air quality monitoring. Link ultrasonic sensors strategically to water storage tanks for water level measurement. Position the smoke detection sensor in the kitchen area for fire hazard detection. Establishing communication channels between microcontrollers and central processing units. Developing algorithms for real-time data processing on the microcontrollers. Implement intelligent decision-making processes to activate air filtration, monitor water levels, and detect smoke. Optimize algorithms for system responsiveness. Implementing features for real-time data visualization, system status updates, and user-configurable settings. Ensure seamless interaction between the user interface and microcontrollers. [9]

Programing the system to continuously monitor dust levels using the dust sensor. When elevated levels are detected, activate the corresponding room's air filtration system. Integrate feedback mechanisms to inform users about the system's actions. Enable ultrasonic sensors to measure water levels in storage tanks. Calculating the percentage of water usage based on real-time data. Display this information on the user interface, allowing homeowners to monitor and optimize water consumption. Programing the smoke detection sensor to identify potential fire hazards in the kitchen. In the event of smoke detection, trigger immediate response mechanisms, such as sounding alarms and sending notifications to users. Ensure the activation of safety protocols. [10]

Microcontroller processes the data collected from sensors using predefined algorithms. For example, the microcontroller analyzes dust levels, water levels, and smoke presence to make intelligent decisions, such as activating air filtration, monitoring water usage, or triggering emergency responses. Based on the processed data, the microcontroller makes decisions about system operations. For instance, it decides when to activate the air filtration system, how to manage water resources efficiently, and when to initiate safety protocols in response to smoke detection. The microcontroller controls actuators and devices within the system. It can activate and deactivate air filtration systems, communicate with water pumps to manage water levels, and trigger alarms or notifications in response to smoke detection and acting as a communication hub, the microcontroller facilitates data exchange between sensors, actuators, and the user interface. It ensures seamless communication to provide real-time updates and alerts to users through the user interface or notifications. [11]

RESULTS AND DISCUSSION:

The implementation and testing of the integrated home automation system demonstrated successful performance across multiple functionalities. The room air filtration system effectively reduced particulate matter and allergens, leading to a noticeable improvement in indoor air quality. The kitchen safety features, including smoke detection and rapid purification, exhibited reliable and timely responses to potential hazards during cooking activities. The automated ventilation system, governed by temperature variations, showcased an efficient mechanism for maintaining optimal indoor climate conditions while minimizing energy consumption.

The window automation system, designed to respond to rain detection, functioned seamlessly, preventing unnecessary window openings during adverse weather conditions. The water management system successfully monitored water usage patterns and promptly identified and addressed leaks, contributing to more sustainable and efficient household water practices.

The positive results affirm the practicality and effectiveness of the proposed home automation system in addressing critical aspects of residential living. The enhanced indoor air quality achieved through the air filtration system aligns with the growing awareness of the impact of air pollutants on health. The integrated kitchen safety measures not only mitigate potential fire risks but also contribute to a secure cooking environment.

The automated ventilation system's adaptive response to temperature variations not only ensures occupant comfort but also aligns with energy-efficient practices, a crucial aspect in contemporary smart homes. The responsive window automation system adds an extra layer of convenience and energy conservation by preventing unnecessary heat loss or gain during adverse weather conditions.

The water management system not only addresses the global concern of water scarcity but also provides homeowners with an intelligent tool to monitor and conserve water resources effectively.

While the results are promising, it's essential to acknowledge potential limitations, such as system robustness under various environmental conditions and the need for ongoing maintenance. The discussion also opens avenues for future improvements, potentially incorporating machine learning algorithms for predictive actions and expanding compatibility with emerging technologies.

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