Journal of Advances in Developmental Research (IJAIDR)
E-ISSN: 0976-4844 ● Website: www.ijaidr.com ● Email: editor@ijaidr.com

A Tranquil Smart Robot for Home Security Using Arduino

K. Sravani[1], M. Veda Vathi[2], D. Jahnavi[3], G. Umesh Kumar[4], B. Viswanath[5]

Department Of ECE, Tadipatri Engineering College, Tadipatri

Abstract

This project introduces an Internet of Things (IoT)-based home security robot that uses a number of sensors to identify different security and environmental concerns. The system includes a temperature sensor to keep an eye on fire threats, a vibration sensor to detect attempts at forced entry, an accelerometer sensor to detect odd motions or tampering, and a gas sensor to detect dangerous gas leaks. An IoT-enabled microcontroller that is integrated with these sensors continuously gathers and examines data. The technology instantly sends out an alert notification through a mobile application when it detects any unusual activity, enabling real-time monitoring and reaction. Through an interactive interface, the mobile app enables users to examine sensor readings, receive alerts, and remotely take necessary actions. By offering an economical and effective solution for real-time monitoring and threat detection, this smart home security robot improves safety. IoT integration makes it a dependable option for contemporary home security applications by guaranteeing data logging, remote access, and intelligent decision-making.

Keywords: Internet of Things, Robot, Arduino, Control Systems

INTRODUCTION

Through the ability to remotely monitor and manage things, the Internet of Things (IoT) has completely changed how we interact with our environment in recent years. Home automation, which allows devices and systems like lighting, fans, security, and climate control to be controlled wirelessly with smartphones, voice commands, or automation rules, is one of the most exciting uses of the Internet of Things. In addition to providing convenience, IoT-based home automation solutions seek to enhance security, energy efficiency, and quality of life. Cloud platforms, smart sensors, and microcontrollers like NodeMCU/ESP8266 can be combined to create scalable, reasonably priced, and easily navigable home automation solutions.An emerging technology known as the "internet of things" uses the internet to operate or monitor mechanical or electronic devices, automobiles, and other physical devices connected to the internet. The use of mechanical, electronic, and computer-based frameworks in the job and control of generation is what is meant by the term "mechanization." Apply autonomy is a multidisciplinary aspect of science and construction that includes software engineering, hardware design, mechanical design, and other fields.

Mechanical autonomy oversees the design, development, deployment, and use of robots as well as computer systems for data processing, control, and clear feedback. Nowadays, the majority of robots are used to perform repetitive tasks or jobs that are deemed too dangerous for humans. They served as post

artists earlier in the year. In fact, robots were already performing a great deal of labor and maintenance at that time. The idea behind the home security system is to protect the house from any outsiders without the owner's presence. These days, robots are making their way into modern life.

Additionally, robots are used in manufacturing facilities to build hardware, automobiles, and confections. A clever robot with speech, vision, and environmental awareness is called a "savvy robot." A robot is a machine, particularly one that can be programmed by a computer and is set up to carry out a challenging exercise regimen. Robots can be operated by an external control device or by an internal control system. Even though they can be made to resemble humans, most robots are devices designed to perform a task regardless of their appearance. There have been several records of client-configurable mechanical gadgets and even automata that resemble people and animals, arranged essentially as preoccupations, dating back to the era of ancient human advances. With the development of mechanical processes in the modern era, new convenient uses appeared, such as remote control and computerized machinery. People may need assistance in their houses to reduce manual labor; this is necessary essentially in the event that someone is physically tested.

From now on, this paper will be divided into expressive sections. The Arduino Uno microcontroller, the robot's central component, is part of the device. A selection of the work and research in this discipline is shown in the accompanying section. Such as programming requirements, segments, and the process of association formation. Once a robot is positioned in the entryway, sensors installed in its body are activated whenever a person or object approaches it. The robot instantly responds to this and emails the home's owner.

OBJECTIVES

The primary goals of the suggested home automation system are to: Offer an affordable and easy-to-use way to automate household equipment. To use Android apps to provide remote control of household equipment. To incorporate Bluetooth and other connectivity technologies for smooth device operation. To increase energy efficiency by automating device operations according to environmental conditions and user preferences. To improve home security by making it possible to remotely monitor and manage security equipment like alarms and cameras.

LITERATURESURVEY

Numerous research articles have already been written that discuss various robot kinds in various domains. In [1], a six-degree-of-opportunity mechanical arm was described that could precisely and accurately follow a predetermined path. Additionally, the automated arm was designed for tasks like weightlifting, characterization of shading, acknowledgment of discourse, and so forth [2]. In order to function as a discourse-to-compose converter, a mechanical arm that could recognize human speech and translate it into content was created [3].Up until 1961, when Unimation Inc. (another name for "Widespread Automation") installed its first robot in a General Motors facility in Ternstedt, New Jersey, to automate bite-the-dust flinging, robots were still considered science fiction [4].Due to the vast array of service areas, service robots come in many forms and are designed for a wide range of tasks and environments—unlike their traditional industrial counterparts, whose workplaces and task scopes are quite limited. Examples of commonly used service robots include autonomous floor cleaning robots [5][6][7], polishers [8], window cleaners [9], and aircraft [10]; construction robots for tall buildings [11], tunnels [12], and roads [13]; crop harvesting [14] and lawn mowing robots [15]; surgical assistance robots [16]; as well as security patrollers [17] and mail delivery robots [18].

Previous literature has seen numerous researchers explore the field of security and service robots. The primary and foremost advantage of having robots in workplaces is their cost. Robots are significantly less expensive than humans and their prices are continuously decreasing. Currently, many companies are developing security robots that are expensive. This paper demonstrates that a security robot can be created at a low cost. It is built with Arduino since Arduino components are more affordable. The robot can grasp small objects requiring minimal mechanisms to move its arm. The body is constructed from cardboard, which is simple, although its circuitry is complex. It can only respond to the commands issued to it. It can perform functions like seeing, speaking, and holding. Because it is made with Arduino, it lacks advanced features. The board pins are insufficient for locomotion. The robot is designed to see objects and react according to programmed instructions. It responds when a specific eye or chest sensor is activated. Future developments could include the ability to detect the smell and taste of objects. A robot can be developed using Arduino. Libraries are essential, such as Servotimer2. h, which is useful for operating the robot.

EXISTINGSYSTEM:

Existing systems frequently have functional and security flaws. Strong face detection for security may be lacking in current home automation systems, making houses open to unwanted entry. Furthermore, a lot of IoT configurations have poor integration and control, which results in ineffective device management and a constrained operational range. These flaws can lead to inconsistent performance and decreased convenience, underscoring the need for more sophisticated systems with enhanced security measures, better IoT integration, and more control options.

Disadvantages:

- Inadequate facial detection and low security.
- Performance problems are caused by inadequate IoT integration.
- Limited range of operation.
- Intricate setup procedure.
- Absence of notifications and monitoring in real time.

PROPOSEDSYSTEM

Multiple sensors are integrated into the suggested IoT-based home security robot to improve security and real-time monitoring. It makes use of an esp32 camera for real-time video and an ultrasonic sensor for obstacle detection. An IoT-enabled microcontroller, which is linked to these sensors, continuously gathers and analyzes data. The robot automatically sounds an alarm and provides real-time notifications to a smartphone application when it detects any unusual behavior, allowing owners to remotely monitor their home security. Users can take prompt action if necessary thanks to the mobile app's interactive dashboard that shows real-time sensor data. The system also has analytics and data tracking to monitor security trends and increase the precision of threat detection. The system is an effective and dependable home security solution because of its IoT connection, which guarantees improved security, automation, and remote accessibility.

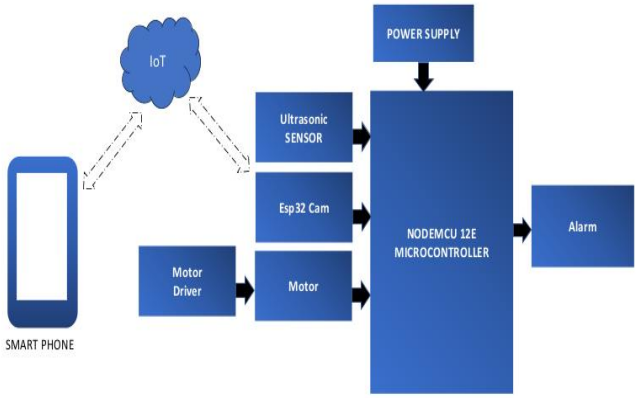
Advantages:

- Enables immediate notifications and real-time monitoring for prompt threat action.

- Allows for remote control and access through a mobile app. improves security by detecting different threats using several sensors.
- Uses automated threat detection and response to minimize manual interaction.
- Provides data analysis and logging for better security insights.

BLOCKDIAGRAM

The description of the software's general features is closely related to the device's order and requirements. The architectural design process includes the description and design of numerous web pages and their interactions. Key software components are recognized, deconstructed into conceptual processing modules and records systems, and their relationships are described. The proposed system defines the following modules.



HARDWAREEXPLANTION

Node MCU esp8266:

There are open source prototyping board designs available for the NodeMCU firmware. "NodeMCU" is a combination of the terms "node" and "MCU" (micro-controller unit). The firmware, not the related development kits, is technically referred to as the "NodeMCU" in this context. Built around the ESP8266 Wi-Fi System-on-a-Chip (SoC), NodeMCU is an open-source, low-cost IoT platform and development environment that is mostly used for Internet of Things (IoT) project prototype and development.Designed as a standalone system-in-a-chp, this Wi-Fi module includes a TCP/IP protocol

stack, 4MB of reminiscence, and a multitude of additional hardware (regulators, amplifiers, and so forth.). This will allow any microcontroller, consisting of an Arduino board, to access your Wi-Fi community connected in the project.Its small size in no way compromises its development abilities thanks to the GPIO ports. Caution: You want to installation a common sense degree converter to use with a 5V microcontroller.

RELAY

There need to be no electrically operated switch. Current flowing via the relay coil creates a magnetic discipline that attracts the bar and changes the transfer contact. The coil present day can be turned on or off, so the slider position has two positions and is a double function (toggle) transfer. Allow one circuit to bypass via the second, which may be completely separate from the primary. For instance, an excessive-voltage battery circuit can use an AC 230 V circuit: internal there is no electrical connection among the two circuits; the relationship is magnetic and mechanical. The coil present day incorporates a high inner present day, normally 30mA for 12V devices, but can be as high as 100mA for devices designed to function at lower voltages. Most ICs (eu) can't provide this present day, and the transistor to a larger fee is used to increase the small IC cutting-edge for the larger coil required. The popular 555 chip has a most modern of 2 hundred mA, so those gadgets can directly power any circuits without amplification.

ULTRASONIC SENSOR

An ultrasonic sensor is an electronic device that emits sound waves and measures the time it takes for the reflected sound waves to return. Ultrasonic waves are sound waves that are above the human auditory range and are used to measure distance or detect objects without physical touch. The Arduino Ultrasonic Sensor is a gadget that estimates an object's distance using the ultrasonic sensing technique. Since it must be configured to detect reflected rays from objects and display the distance in the appropriate manner, an Arduino is utilized to create this sensor.

FUTURE SCOPE

These days, a growing number of robots are starting to be used for everything. They have an endless amount of jobs for their reality in both fiction and reality. According to its capabilities, a "robot" is usually defined as a machine that can carry out a complex series of tasks, especially one that can be programmed by a computer. As far back as the 1950s, when research on artificial intelligence (AI) first began, predictions about how humans will behave in the ensuing decades and how AI will alter our daily lives have been notoriously inaccurate.AI-powered robots are also feasible. Robotics is where the open-plan development offers the subject's tangible artifacts. This area of robotics uses free and open-source software that provides source code, schematics, and blueprints, as well as open-source hardware. The word often suggests that information about the equipment is easily identifiable so that others can create it using common item segments and apparatuses, connecting it to open science and the maker movement. Making a robot walk is challenging since Arduino has limited pins.

CONCLUSION

By combining several sensors for real-time threat detection, the suggested Internet of Things (IoT)-based home security robot improves safety. Instant alerts are sent to users through a mobile app for remote monitoring, guaranteeing prompt action. It is a dependable, economical, and effective solution for contemporary home security requirements because of its automation, data logging, and intelligent analytics.

REFERENCES

1. D. T, J. J. Shirley, R. Prajapati, P. Singh, A. Biswas and U. Soni, "An IoT-based Home Automation System using NodeMCU and Blynk IoT App," 2023 International Conference on System, Computation, Automation and Networking (ICSCAN), PUDUCHERRY, India, 2023, pp. 1-7, doi: 10.1109/ICSCAN58655.2023.10394759.

2. R. Sivapriyan, S. V. Sushmitha, K. Pooja and N. Sakshi, "Analysis of Security Challenges and Issues in IoT Enabled Smart Homes," 2021 IEEE International Conference on Computation System and Information Technology for Sustainable Solutions (CSITSS), Bangalore, India, 2021, pp. 1-6, doi: 10.1109/CSITSS54238.2021.9683324.

3. S. Tiwari, A. Bhushan, A. K. Singh and R. K. Yadav, "Unleashing the Potential of IoT Integration for Energy Optimization in Smart Homes," 2024 3rd International conference on Power Electronics and IoT Applications in Renewable Energy and its Control (PARC), Mathura, India, 2024, pp. 82-85, doi: 10.1109/PARC59193.2024.10486624.

4. P. M R and B. Bhowmik, "Development of IoT-Based Smart Home Application with Energy Management," 2023 International Conference on Sustainable Communication Networks and Application (ICSCNA), Theni, India, 2023, pp. 367-373, doi: 10.1109/ICSCNA58489.2023.10370276.

5. K. Singh, A. Jain and P. Thiyagarajan, "Design and implementation of integrated control system for IoT enabled home automation," 2022 4th International Conference on Advances in Computing, Communication Control and Networking (ICAC3N), Greater Noida, India, 2022, pp. 1433-1437, doi: 10.1109/ICAC3N56670.2022.10074496.

[6] Wong Guan Hao, Y. Y. Leck and Lim Chot Hun, ―6-DOF PC-Based Robotic Arm PCROBOARM with efficient trajectory planning and speed control‖, in Proc. 4th International Conference Mechatronics (ICOM),Kuala Lumpur, pp. 1-7, April 2011, ISBN:978-1-61284-435-0

[7] Rong-Jyue Wang, Jun-Wei Zhang, Jia-Ming Xu andHsin-Yu Liu, ―The Multiple-function Intelligent Robotic Arms‖, in Proc. IEEE International Conference on Fuzzy Systems, FUZZIEEE, Jeju Island, pp. 1995 - 2000, August 2009, ISSN:1098-7584.

[8] M. Wongphati, Y. Matsuda, H. Osawa and M. Imai, "Where do you want to use a robotic arm? And what do you want from the robot?", IEEE RO-MAN, Paris, pp. 322-327, September 2012, ISSN:1944-9445.

[9] J. F. Engelberger, Robotics in Practice: Management and Applications of Industrial Robots. London, U.K.: Kogan Page, 1980.

[10] H. Endres, W. Feiten, and G. Lawitzky, "Field test of a navigation system: Autonomous cleaning in supermarkets," in Proc. IEEE Int. Conf. Robotics and Automation (ICRA 1998), vol. 2, pp. 1779–1784.

[11] World's first automatic vacuum cleaner soon on the market—Will be exported.Electrolux. [Online].Available:http://trilobite.electrolux.com

[12] iRobot introduces Roomba intelligent floorvac—The first automatic floor cleaner in the U.S. (2002). [Online]. Available: http://www.roombavac.com

[13] F. Miller, "Sky-high cleaning robot," Fraunhofer Mag., vol. 1, pp. 24–25, 2000.

[14] IPA (2002): Haushaltsrobotik: RACCOON—AutonomerFensterreinigungsroboter (in German), Produktblatt, 2002.

[15] R. D. Schraft, M.-C. Wanner, and T. F. Herkommer, "SKYWASH—Aircraft cleaning by robots" (in German), in Proc. 25th Int.Symp. Industrial Robots, 1994, pp. 273–280.

[16] Obayashi at a glance (1999). [Online]. Available: http://www.obayashi.co.jp/E_page/annual/report/1999/11.pdf

[17] M. Honegger, G. Schweitzer, O. Tschumi, and F. Amberg, "Vision supported operation of a concrete spraying robot for tunnelling work," in Proc. 4th Conf. Mechatronics and Machine Vision in Practice, 1997, pp. 230–233.

[18] J. P. Pimentão, R. Gonçalves, T. Gonçalves, H. Silva, M. Vital, P. Sousa, and A. Steiger-Garção, "The RoadRobot project: From theory to practice in systems integration," in Balanced Automation Systems II—Implementation Challenges for Anthropocentric Manufacturing, L. M. C. Matos and H. Afsarmanesh, Eds. London, U.K.: Chapman & Hall, 1996, pp. 126–133.

[19] M. Ollis and A. Stentz, "Vision-based perception for an autonomous harvester," in Proc. IEEE/RSJ Int. Conf. Intelligent Robotsand Systems (IROS 1997), vol. 3, pp. 1838–1844.

[20] Robomower owner operating and safety manual (2003). [Online]. Available: http://www.friendlyrobotics.com

[21] Integrated Surgical Systems announces the sale of Robodoc surgical assistant system (2001). [Online]. Available: http://www. robodoc.com/eng/ press_release.html

[22] CyberGuard SR3/ESP Datasheet (2003). [Online]. Available: http://www.cybermotion.com

[23] N. Tschichold, S. Vestli, and G. Schweitzer, "The service robot MOPS: First operating experiences," Robot. Auton. Syst., vol. 34, pp. 165–173, 2001