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Development of a Canny House Security via IoT

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Abstract

With the rise of smart homes, security has become a top priority. However, many traditional security systems are limited in their capabilities and often require manual intervention. This project aims to address this issue by developing a smart security system that utilizes IoT technology to provide more efficient and effective security measures. The purpose of this investigation is to address this issue by designing a smart security system that employs IoT technology to deliver more efficient and effective security measures. To allow the door to be opened, the system is improved with a keypad and an ESP32-CAM. This system also employs gas sensors to ensure that the house is constantly in a safe state. Additionally, a notification system is in place to keep homeowners informed about home security via Blynk. The Internet of Things (IoT) plays a significant role in enabling the functioning of the system. The paper illustrates the hardware and software requirements, the methodology used for implementation, and the result and discussions based on testing the system components. The results indicate that the system works well and successfully detects the faces, controls the smart door lock and detects the gasses in the house. The camera detection demonstrates accurate detection with a range of 4 seconds for registered persons, while for the solenoid, the detection for the door opens within a range of 1 second. Based on the result, the ESP32-CAM performs reliably and consistently. The Blynk application is used to provide home security monitoring and control capabilities, whether in monitoring the user's face or the level of gas security at home. Overall, the Development of a Canny Smart House system is very convenient for the owner, and further improvements will be made based on the test result.

1. Introduction

People ultimately come up with inventive ways to upgrade or build specialised technologies as we live in an age when technological breakthroughs occur on a regular basis. With the help of technological breakthroughs and automation, daily jobs become easier.[1] This project focuses on upgrading smart home security that has been frequently used in our neighbourhood called Development of a Canny House Security via IoT. Given the fast-paced and unpredictable nature of today's world, it is becoming increasingly necessary to adopt new

technologies that can provide enhanced security measures and preemptive safeguards for homes and their occupants daily. [2]. Nowadays, the issue of home safety is a major worry. There is a need to enhance the effectiveness of current security systems since there are many unwanted actions, such as theft, that are growing steadily nowadays. This is a feature of this project to efficiently monitor the property when the owner is absent and to alert the owner of the home if there is any smoke inside the house while the fire is on without the owner's realisation.[3] The project's original prototype sends warnings to the owner through SMS over the internet if any movement is detected near his home's entry or if a false password is entered at the door lock, triggering an urgent alarm [4]. This system includes a door lock with a password, an alarm, a wifi module, and other sensors to look for dangerous situations. People in various groups won't be bothered by the considerable inconvenience and concern of being away from home for extended periods of time thanks to this Canny House Security. Besides, when there is fire, the owner will also be more responsive and likely to act fast [4].

1.1 Accessible Smart System

Accessible smart locked door systems are designed to provide reminders and easy access to people of varied abilities. This is accomplished by utilizing LED lights, which improves accessibility. LED lights strategically placed on the lock serve as visual indicators, communicating the state of the lock by glowing or changing color to show whether the door is locked or open. Individuals may effortlessly move around their surroundings and successfully limit access to their premises because of this inclusive design strategy. In this project, this conveniently accessible smart door system can be utilized in conjunction with MQ-6 gas detectors to boost dependability and security. The MQ-6 gas detector can detect the presence of dangerous gasses such as LPG, butane, and propane in a household or business setting [4]. Individuals with varying skills can receive visual and audible alerts if the gas detector detects the presence of harmful gas near the entrance by combining the detector's capabilities with a smart door system that uses LED lights. This connection adds an extra degree of protection by allowing for prompt action to ensure occupant safety and well-being. This approach to inclusive design ensures that all individuals, regardless of ability, may engage with the smart door system in a way that is comfortable and intuitive for them.

1.2 Convenient Technology

The conveniently accessible smart locked door idea employs a notification system to provide users and their family members with timely information and cautions. Blynk is the primary mode of communication in this project. By linking a smart door lock system to a smartphone, notifications can be delivered to their devices to notify them of upcoming meetings or actions that must be taken, such as locking or unlocking the door and identifying the presence of an unexpected guest. To convey information to users on a predetermined schedule, the system also uses a combination of phone notifications and visual signals [5]. This guarantees that the user is properly taught on how to interact with the smart secured door system, which increases comfort and convenience of use. The implementation of this simple technology in a smart locked door project simplifies the user experience and allows individuals and their family members to have seamless access control. This basic technique can be utilized in a gas detector project employing the MQ-6 to send messages to users and their family members about the presence of harmful gas around the door. If the presence of harmful gas is detected by the detector, the notification system incorporated with the MQ-6 can send the user visual and auditory notifications. As a result, people of all abilities can receive timely alerts and take the required precautions to ensure their safety and security.

1.3 Internet of Things

Some examples of how your references should be listed are given at the end of this template in the ‘References’ section, which will allow you to assemble your reference list according to the correct format and font size. The Internet of Things (IoT) is a rapidly growing technology that connects various devices and appliances to the internet, enabling them to communicate with each other and be controlled remotely. This technology has the potential to revolutionize the way we interact with our daily surroundings, including the way we interact with our homes. The smart door lock and gas sensor project is a prime example of how IoT technology can be utilized to enhance home security and safety. Blynk is an IoT platform that allows users to create custom smartphone applications to control their devices. By integrating Blynk into the smart door lock and gas sensor project, users can remotely monitor and control their smart locks and gas sensors using their smartphones. This could potentially make it easy for homeowners to stay vigilant about their homes being always secure.

Multidisciplinary Applied Research and Innovation Vol. 5 No. 1 (2024) p. 315-322

2. Materials and Methods

2.1 Materials

Table 1 *Hardware Requirement*

Name	Function
NodeMCU ESP32-CAM	The ESP32-CAM is a small size, low power consumption camera module based on ESP32. It comes with an OV2640 camera and an ESP32-CAM-MB micro usb to serial port adapter. The ESP32-CAM can be widely used in intelligent IoT applications such as wireless video monitoring, WiFi image upload, QR identification, and so on.
NodeMCU ESP8266	Provide a Wi-Fi connection to the device it is integrated into, allowing the device to connect to the internet and communicate with other devices.
Arduino UNO	A flexible and easy-to-use platform that can be used for a wide range of applications, including IoT projects.
Keypad	A keypad is an input device that is commonly used in electronic circuits to provide a simple and intuitive way for users to enter data or commands.
Relay 5V	A 5V relay is an electromechanical device that is designed to switch a circuit on or off when an electrical signal is applied.
Solenoid	An electromechanical device that converts electrical energy into mechanical motion.
Gas Sensor (MQ6)	Detect the presence of a specific gas and generate an electrical signal that can be used to trigger an alarm or other alert.
Light-Emitting Diodes (LED)	Convert electrical energy directly into light. Used as an indicator or status light.
Buzzer	An electronic device that is designed to produce a loud and distinctive sound when an electrical signal is applied.
Blynk (IoT)	To control via the Internet.

Table 1 shows the hardware and software requirements for this project. The function of the hardware and software are explained in the table.

2.2 Methods

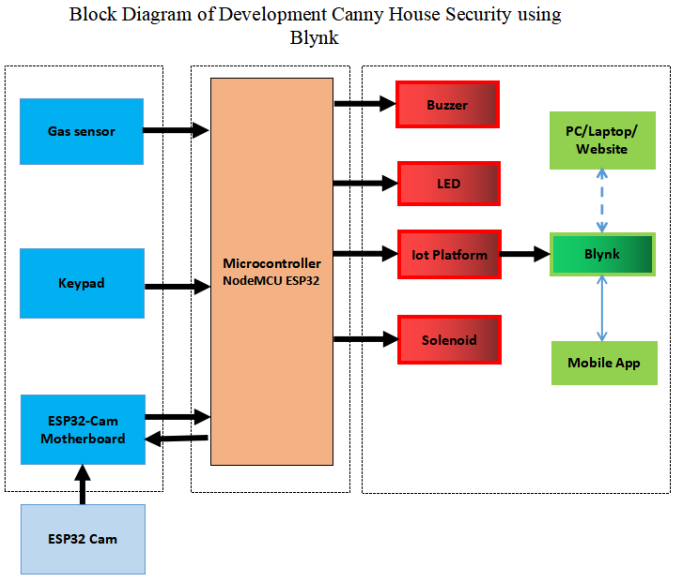


Fig. 1 *Block Diagram of Canny House Security using IoT*

The block diagram of the system is shown in Figure 1. There are two sections of this system which are outdoor project and indoor project. Next, for the outdoor project, the input uses a keypad, camera and an ESP32-CAM. While, for the indoor project, it uses LPG Gas Sensor (MQ6). Then, the output uses a solenoid door, a buzzer and a led. The controller used in this project is NodeMCU ESP32, a microcontroller board that has 2.4 GHz dual-mode WiFi and a Bluetooth wireless connection [6]. In addition, the data that will be established to the user can be controlled and viewed via the Blynk and web applications.

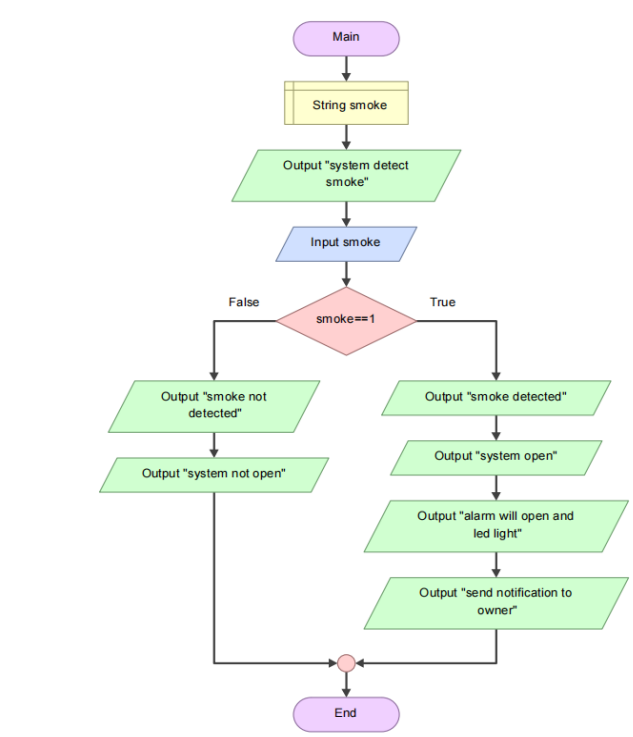
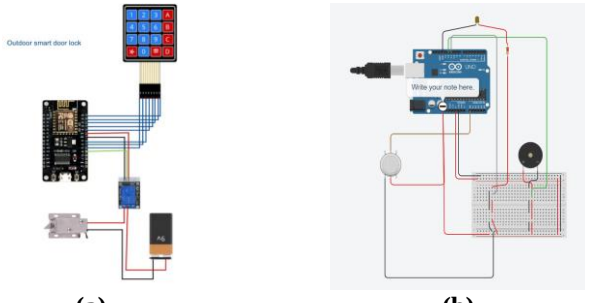


Fig. 2 *Block Flowchart of the Development of a Canny House Security using IoT for Indoor Project*

The flowchart of the system is shown in **Figure 2.** In **Figure 2,** initially, the camera will recognise faces. If the face is correctly detected, the door will open. If the face is not correctly identified, a message will be given to the owner to conduct the action of either allowing the visitor to enter or not using the Blynk application. Visitors can also input the password on the keypad, but the notice will still be sent to the owner and gas is detected by the LPG gas sensor (MQ6). When gas is detected, the system is activated, and the led and buzzer sound. Following that, a notification will be issued to the owner. If no gas is detected, the system is closed and secure.

2.3 Implementation

Please do not change the margins of the template as this can result in the footnote falling outside printing range. The Development of a Canny House Security system will be installed and tested beginning with the circuit. The **Tinker cad** programme will be used to simulate this system. After sketching the circuit diagram, it goes through the process of connecting the circuit connections independently for each component. Furthermore, the following stage involves connecting connections by pairs such as input and output components. **Figure 3** (a) and (b) shows the complete schematic diagram of the system components.



(a) **(b)**

Fig. 3 *Figure description (a) First picture; (b) Second picture*

Multidisciplinary Applied Research and Innovation Vol. 5 No. 1 (2024) p. 315-322

2.4 Testing

After the connections are formed, each component's circuit connections will be checked independently. The next stage will be accomplished by adding components one by one until it is finished. This step will make debugging components easier if they have connectivity issues or do not react when tested.

3. Results and Discussion

For the result and discussion, we have made a few analyses and test based several aspects. For the outdoor project, we have made a few analyses and tests based on this aspect: Configure the person who registers, Limitation of the person who registers, Trial for camera detection of registered persons, solenoid and keypad functionality and detection speed. While for an indoor project, we have made a few analyses and tests based on this aspect Trial for gas sensor functionality.

3.1 Prototype Results

3.1.1 Result 1 : Configuration of person who registers

The student observed the ESP-Cam 32's ability to detect registered individuals and prevent unauthorized access. The experiment involved registering two individuals, Farisah and Fazliana, and testing the system's accuracy in allowing them to pass through a door. After capturing and storing their facial features in the system's database, Farisah and Fazliana approached the door and were successfully granted access. The results demonstrate the ESP-Cam 32's effectiveness in accurately detecting registered individuals and preventing unauthorized entry. This experiment has important implications for developing facial recognition and access control systems and provides valuable insights into their potential applications in various settings.

3.1.2 Result 2 : Trial for camera detection and solenoid functionally

An experiment was conducted to measure the speed at which a camera could detect registered individuals.**Table 2** summarizes the results of five trials, showing that the camera was able to detect registered persons with a delay of either 4 or 5 seconds between each detection. The experiment also measured the speed of the solenoid's functionality and detection, with **Table 2** showing that the solenoid was able to detect each registered person within alternating intervals of 1 and 2 seconds. These findings provide valuable insights into the capabilities of the camera and solenoid systems and can inform the development of more efficient and effective security technologies.

Table 2 *Trial for camera and solenoid functionally*

Trial	Trial for camera detection of registered persons		Trial for solenoid functionally and detection speed	
	Detect	Time (Second)	Detect	Time (Second)
1	√	4.00	√	1.00
2	√	5.00	√	2.00
3	√	4.00	√	1.00
4	√	5.00	√	2.00
5	√	4.00	√	1.00
	Average (second) :	4.40	Average (second) :	1.40

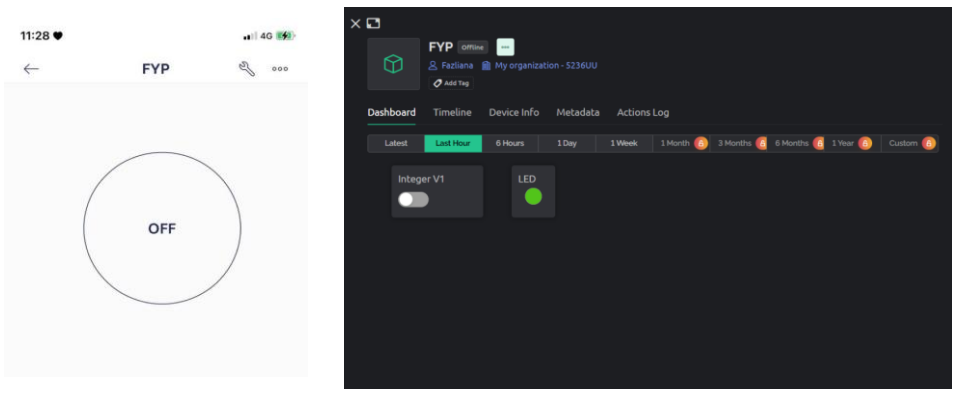
3.1.3 Result 3 : Trial for keypad functionally and detection speed

An experiment was conducted to measure the speed at which a keypad system could detect registered individuals. The experiment involved registering individuals and testing the system's accuracy in identifying and allowing access to registered individuals while preventing unauthorized entry. **Table 3** summarizes the results of five trials, showing that the system was able to detect registered persons within alternating intervals of 1 and 2 seconds for all trials. A test was conducted to determine the functionality of a gas sensor and its ability to detect the presence of gas. The test was performed at least five times, and each trial confirmed the presence of gas. The delay before the gas sensor functioned varied between one and two seconds for each trial. Nevertheless, all five trials were successful, despite the slight differences in delay.

Table 3 *Trial for keypad & Gas sensor functionally and detection speed*

	Keypad functionality		Gas sensor functionality	
Trial	Detect	Time (Second)	Detect	Time (Second)
1	√	1.00	√	1.00
2	√	2.00	√	2.00
3	√	1.00	√	1.00
4	√	2.00	√	2.00
5	√	1.00	√	1.00
	Average (second) :	1.40	Average (second) :	1.40

Figure 4 shows the screenshots of the Blynk UI designed system obtained on the website and Blynk app. As illustrated in (a), the Blynk application interface is utilized for the outdoor project, allowing the user to remotely control the door opening mechanism through the press of a button. This demonstrates the effective use of IoT technology in enabling remote access and control of physical objects. Additionally, the user-friendly and intuitive nature of the Blynk app interface enhances the accessibility and convenience of the system for the user. Then, (b) displays the interface of the indoor system, which makes use of the Blynk application to monitor gas levels. The LED will light up if gas is detected, providing an immediate alert to the user. This implementation showcases the potential of IoT technology in enhancing safety and security measures in various settings, including homes and workplaces. The real-time monitoring and alert system can help prevent accidents and ensure prompt action is taken in the event of a gas leak.



(a) **(b)**

Fig. 4 *(a)Blynk application interface; (b) Display for indoor system*

The smart door lock and gas sensor projects present innovative solutions that cater to the evolving needs of individuals seeking enhanced security and safety measures in their homes. These projects offer advanced functionalities and

convenience through the integration of intelligent technologies. The smart door lock project utilizes the ESP32-CAM microcontroller, which combines a camera module and Wi-Fi connectivity, to create a versatile platform for controlling and managing the components of a smart lock system. With features such as LED indicators, visual and auditory cues, and remote access via smartphone applications, the project ensures seamless and secure access to the user's premises. The Arduino programming framework enhances the system's customization capabilities, providing a user-friendly environment for developers.

On the other hand, the gas sensor project focuses on detecting and monitoring gas levels within the environment, ensuring the safety of occupants. The project enables real-time gas monitoring by leveraging gas sensors and a microcontroller, alerting users to potential hazards. The integration of Wi-Fi connectivity enables remote monitoring and control, allowing users to receive notifications and take necessary precautions when gas levels exceed safe thresholds. Both projects have undergone rigorous testing, demonstrating their accuracy, reliability, and effectiveness. The intelligent door lock project enhances security measures, providing visual and auditory feedback to users, while the gas sensor project ensures prompt detection and alerting of hazardous gas levels.

Conclusion

In conclusion, the smart door lock and gas sensor projects offer practical and technologically advanced solutions to address security and safety concerns in residential settings. These projects showcase the potential of intelligent systems and connectivity in creating convenient, efficient, and secure living environments. Continued advancements and further research in these areas promise even more sophisticated and user-friendly solutions for the future.

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Author Contribution

The authors confirm contribution to the paper as follows: **study conception and design:** Siti Farisah Nadiah Amer, Wan Nur Fazliana Alyaa Abd Rahman, Nur Azliza Ahmad; **data collection:** Siti Farisah Nadiah Amer; **analysis and interpretation of results:** Wan Nur Fazliana Alyaa Abd Rahman; **draft manuscript preparation:** Siti Farisah Nadiah Amer, Wan Nur Fazliana Alyaa Abd Rahman. All authors reviewed the results and approved the final version of the manuscript.

References

[1] 2010d (forthcoming). Job for Youth: Synthesis Report, Paris. United Nations Environment Programme (UNEP), ILO, International Organization of Employers (IOE) and International Trade Union Confederation (ITUC). 2008. Green jobs: Towards decent work in a sustainable, low-carbon world (Geneva).

[2] GA. Adriansyah and A. W. Dani, "Design of small smart home system based on arduino, "in Proc. Electr. Power, Electron., Commun., Control Informat. Seminar (EECCIS), Aug. 2014, pp.121-125 https://ieeexplore.ieee.org/document/9138408

[3] L. Ophir, "802.11 Over Coax - A Hybrid Coax - Wireless Home Network Using 802.11Technology", Consumer Communications and Networking Conference, (2004) January, pp.13-18 https://www.researchgate.net/publication/289348900_A_multilevel_home_security_system_MHSS

[4] Krishna Prasad K and Sai ran susheel 2014 Intrusion detection system for smart home using laser rays International Journal for Scientific Research & Development (IJSRD) 2 176-78 https://zenodo.org/record/2709387/files/Smart%20Home%20Security%20System%20using%20IoT.pdf

[5] Sudhir Chitnis1, Neha Deshpande2, Arvind Shaligram3 An Investigative Study for Smart Home Security: Issues, Challenges and Countermeasures

[6] https://joy-it.net/en/products/SBC-NodeMCU-ESP32

[7] Maria Latif2, Jazzba Asad3, Faiza Nawaz4, Noman Mazher SMS Based Gas Leakage and Fire Detection Alert System to attempt as Firewall against Cybersecurity https://www.atlantis-press.com/proceedings/iccmcee-15/25839647

[8] Liu Shengwu, FanHong and Cai Weifeng: Smart Home Burglar Alarm Subsystem Based on ARM+Zigbee. Computer System & Applications Vol.24 No.2 (2015), p.257-p.260 https://www.researchgate.net/publication/288833560_The_Online_Home_Security_System_Ways_to_Protect_Home_from_Intruders_Thefts

[9] Takako Nonaka, Masato Shimano, Yuta Uesugi and Tomohiro. Embedded Server and Client System for Home Appliances on Real-Time Operating Systems.IEEE (2010).Static Analysis Tools For. NET. https://www.mdpi.com/1424-8220/17/7/1631

[10] Gburzynski, P.; Olesinski, W.; Vooren, J.V. A WSN-based, Rss-driven, real-time location tracking system for independent living facilities. In Proceedings of the 13th International Joint Conference on e-Business and Telecommunications (ICETE), Lisbon, Portugal, 26-28 July 2016; pp.64-71 https://www.mdpi.com/2571-5577/1/4/42

[11] Zhang, Z.; Lei, Z.; Li, S.Z. Regularized Transfer Boosting for Face Detection Across Spectrum. IEEE Signal Process. Lett. 2012, 19, 131-134 http://eprints.utar.edu.my/2668/1/CT-2017-1404211-2.pdf

[12] Hamid Hussain Hadwan, Y. P. Reddy M.E. Student, Mech. Mechatronics, SCOE, Pune, India Professor in Mech, SCOE, Pune, India, April 2016, Smart Home Control by using Raspberry Pi & Arduino UNO, International Journal of Advanced Research in Computer and Communication Engineering Vol.5, Issue 4 http://eprints.uthm.edu.my/402/1/24p%20MUHAMED%20OBED%20ABD%20OUN.pdf

[13] C. Paul, A. Ganesh and C. Sunitha, "An overview of IoT based smart homes, "International Conference on Inventive Systems and Control (ICISC), Coimbatore, India, 2018, pp.43-46 https://airccse.com/eeij/papers/4317eeij01.pdf