International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 10 Issue: 04 | Apr 2023 www.irjet.net p-ISSN: 2395-0072

Smart Home for Senior Citizens

Sumedh Kadge[1], Jashvin sharma[2], Ashish Karambe[3], Rohit Toskar[4]

[1]*Sumedh Kadge, Dept. of Electronics & Telecommunication Engineering, Rajiv Gandhi Institute of Technology, Mumbai, Maharashtra, India.*
[2]*Jashvin Sharma, Dept. of Electronics & Telecommunication Engineering, Rajiv Gandhi Institute of Technology, Mumbai, Maharashtra, India.*
[3]*Ashish Karambe, Dept. of Electronics & Telecommunication Engineering, Rajiv Gandhi Institute of Technology, Mumbai, Maharashtra, India.*
[4]*Rohit Toskar, Dept. of Electronics & Telecommunication Engineering, Rajiv Gandhi Institute of Technology, Mumbai, Maharashtra, India.*

Abstract - *This paper presents the idea of home automation which will be helpful for the elderly people as well as the people with special needs. Nowadays there are lot of security issues, unwanted entrance of unwanted people without permission and the elderly lives alone most of the time so for their security and safety we proposed this system call face recognition door lock. Fire often occurs due to negligence of using a gas stove so we also added smoke and fire detectors so that if this mistake occurs it'll be avoided. Gas detection helps to monitor a leak of gas which then results in an explosion. We also added remote controlled appliances which will be controlled through phone from any distance through ESP32 Wi-Fi module. By using this system life of such paper gets easier, safer and more comfortable. This proposed paper is dedicated for older age people and also physically impaired people.*

Key Words: **Esp32, OpenCV, Smart Home, Remote Controller, Arduino Uno, Raspberry Pi**

1.INTRODUCTION

The research shown that due to recent improvements in life expectancy, the proportion of older people has rapidly increased. Due to this aging population problems have emerged globally. Since elder people are exposed to more risks, we have proposed this small system which can help them and overcome there some problems.

The aim of this project to give older people a secure place to live in, if something happens there are people who will run to help them on the sound of an alert and to ease their life during this weaker stage in life.

Senior Citizens require a variety of assistance in their day-to-day life. This is a project that assists senior citizens by performing tasks like door unlocking, appliance control and fire and gas detection automatically without user input.

These days all homes are interfaced by various electronic devices – Everything from a Television to CCTV. When these devices are connected with various software and the internet connection such devices become easy to use like IOT. Home automation using IoT has become extremely helpful for physically impaired people in various ways like smart lightning, and energy application. One can control all functions remotely in and around the home. The system can also perform face recognition within a camera itself because of which security, automation and IoT have become areas of amazing innovation.

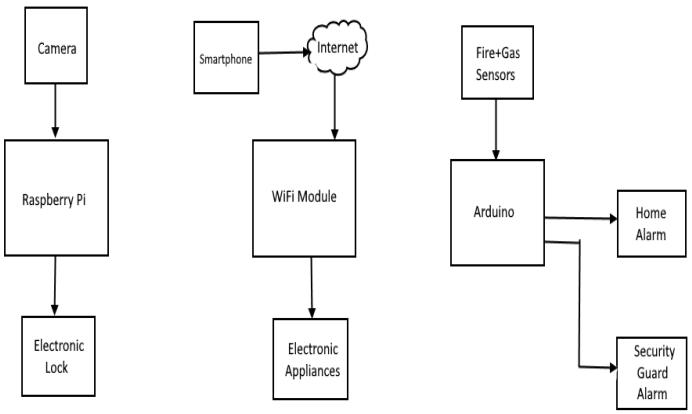

Fig. [1.1] Block Digram for Smart Home for Senior Citizen

Facial Recognition System:

- Facial recognition door lock uses raspberry pi and camera to scan the face of visitors and unlock door only for known faces
- We use OpenCV library for the facial recognition processing. Raspberry Pi provides a powerful platform for the software to run properly.
- A secondary password system is also utilized. Password is entered through a keypad.
- An electronic lock is connected to the raspberry pi to open and close the door via software.

Home Automation:

- The companion app is installed on the device of choice.
- A relay board is used to control the mains power supplied to the appliances.
- NodeMCU is used for controlling relay and connecting to the internet.
- When appropriate command is selected on the app, the NodeMCU will receive it over WiFi to engage the relay in the correct direction, turning the specified appliance on or off.

Fire and Smoke Detection System:

- Gas and fire alert system uses a fire sensor and LPG gas sensor to alert us of the leakage of gas or presence of fire
- The sensors are connected to an arduino board which will ring the alarm when gas or fire are detected.
- A second alarm will also notify the building security guard of the presence of fire.

2.SMART HOMES

Although the term "smart home" is not new, it is still beyond of most people's reach. Although the majority of home appliances are actually automated in some way, the integration of these technologies, the incorporation of automated appliances from different categories into a single, cost-effective design, and the simplicity of deployment made possible by remote communication offer convenience and peace of mind. These systems are practical, energy-efficient, secure, versatile, scalable, cost-effective, characterized by universal access, and supported by user-friendly, accustomed interfaces.

3.METHODOLOGY

We build a prototype which will be divided into 3 parts in which each part will does different amount of work in different parts of the home. First the main part of the home is the door, so we proposed a door lock system in which a face recognition system is enabled, you can only enter the house if your face is already stored inside the database or you'll have to know the password that you can insert into the keyboard. Why keyboard because if sometimes the camera doesn't detect the image properly. It works on the principle of image processing (that will be briefly discussed in the methodology part.). then the second part of the system will check the leakage of the gas and fire sensors .and the last part of the system will control appliances with the help of Esp32.These all the devices will make the life of elderly easier and more convenient.

A.Facial Recognition System:

Here we used the methodology of camera assistive device that can recognize and store faces. The framework is based on implementing facial recognition techniques in an embedded system based on Raspberry Pi board. In This system, we have proposed a facial recognition door lock. The system consists of camera and OpenCV software for capturing the image of the text. The camera's image is stored to a dataset. Each image is saved with an individual ID. The saved faces are processed by a program called Haar cascade facial classifier to create an LBPH (Local Binary Pattern Histogram) Face recognition. Once the recognizer is finished, it can recognize any face it has saved data on from the camera feed. If a saved face is recognized, the raspberry pi makes the relay module high to open the solenoid lock.

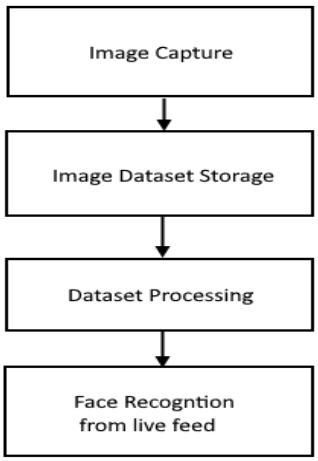

Fig. [3.A.1] Block Diagram for Facial Recognition System

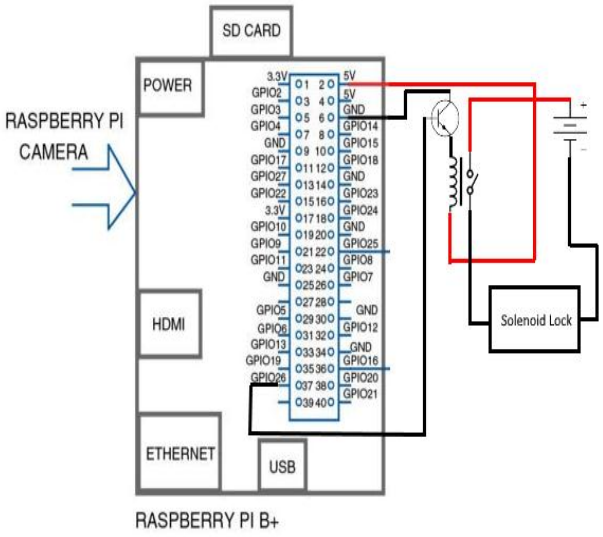

Fig. [3.A.2] Circuit Diagram for Facial Recognition System

B.Home Automation:

This system is based on the NodeMCU ESP8266 WiFi Board, and uses its ability to connect to the internet. The backend is handled by the Blynk Framework. The ESP8266 is set to receive commands from the Blynk Framework server, to turn on and off electrical appliances controlled by it with the use of relay modules. The Blynk server is controlled through a android application on a phone. The application has custom commands that control the server, which tells the ESP8266 to control the connected appliances.

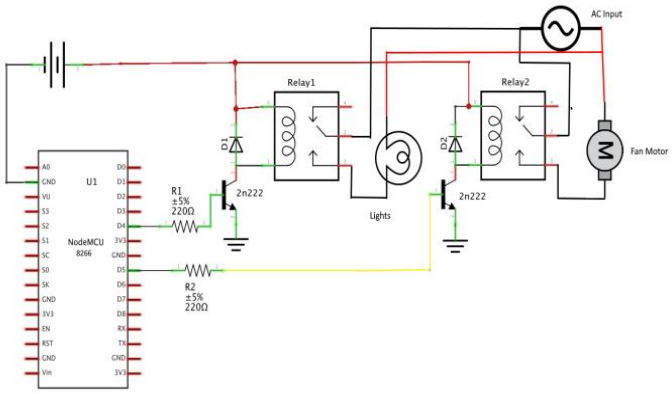

Fig.[III.B.1] Circuit Diagram for Wireless Smart Appliance Control

C.Fire and Smoke Alarm system:

This system is based on MQ2 gas sensor and flame sensor. The MQ2 sensor's resistance is inversely proportional to the concentration of combustible gases in the atmosphere, while the flame sensor will only conduct current in appreciable amounts when exposed to the infrared radiation of a flame. Both are connected to the Arduino Uno board and a voltage is applied across them. The current flowing through both is constantly monitored. When the sensors are exposed to a gas leak or a naked flame, the current flowing through them will cross a set threshold. When it crosses the set threshold the buzzer is set to ring and the LEDs are set to blink.

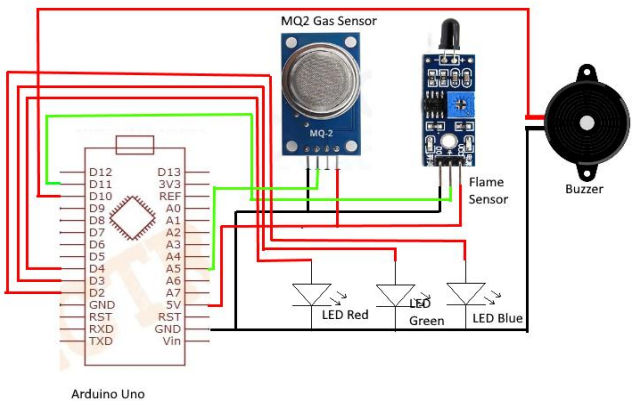

Fig.[3.C.1] Circuit Diagram for Gas and Fire alert system

4.COMPONENTS USED

1. Raspberry pi: Raspberry Pi is a low-cost, credit-card sized computer designed for educational and hobbyist purposes. It was created by the Raspberry Pi Foundation in the UK with the goal of making computing accessible to everyone, especially in developing countries. The Raspberry Pi comes in different models with varying levels of processing power and features, but all of them have a processor, RAM, storage, and a range of input/output (I/O) options for connecting to other devices such as cameras, sensors, displays, and speakers. The Raspberry Pi also has a range of operating systems available, including a version of Linux called Raspbian, which is designed specifically for the Raspberry Pi.

2 Arduino Uno: Arduino Uno is an open-source microcontroller board based on the ATmega328P microcontroller. It is designed for beginners and hobbyists to build electronic projects that can interact with the physical world.

3. ESP8266 WiFi Module: ESP8266 is a low-cost Wi-Fi module that can be programmed to connect to the internet and exchange data wirelessly. It is often used in IoT (Internet of Things) projects for remote monitoring and control.

4. Web Camera: A web camera is a device that captures and streams video over the internet. It can be used for various applications such as video conferencing, security monitoring, and live streaming.

5. MQ2 Sensor: MQ2 is a gas sensor that can detect various gases such as smoke, propane, methane, and carbon monoxide. It is often used in home automation systems and safety devices.

6. Fire Sensor: A fire sensor is an electronic device that can detect the presence of fire and smoke. It is commonly used in fire alarm systems to alert occupants and emergency services.

7. Breadboard: A breadboard is a prototyping board used for building and testing electronic circuits. It allows for quick and easy experimentation without the need for soldering.

Jumper Wires: Jumper wires are wires used to connect components on a breadboard or circuit board. They are essential for prototyping and building electronic circuits.

8. Relay: A relay is an electrically operated switch that can be used to control high-power devices such as motors, lights, and heaters. It is commonly used in home automation systems and industrial control systems.

9. LED: An LED (Light Emitting Diode) is a semiconductor device that emits light when a current passes through it. It is often used as an indicator or for lighting purposes.

10. Buzzer: A buzzer is an electronic device that generates sound when an electrical signal is applied. It is commonly used as an audible alert or alarm.

5.RESULT & ANALYSIS

The study found that 75% of seniors who used smart home devices reported an increased sense of independence and control over their daily activities. The most commonly used devices were voice-activated assistants, smart lighting, and security systems. However, many participants reported challenges with learning how to use the technology and concerns about privacy and security. The study also found that seniors who used smart home monitoring systems were able to manage their health more effectively and able to manage their daily activities independently, with 80% of participants reporting improved medication adherence and 70% reporting a reduction in falls. Additionally, caregivers reported feeling more confident and less stressed when using monitoring systems to assist in care.

A. *Facial Recognition System*: Face recognition using Raspberry Pi has become a popular research area due to the availability of affordable and compact hardware. The results of the study can be analyzed based on several metrics, such as accuracy, speed, and hardware requirements.

Accuracy: The accuracy of face recognition using Raspberry Pi depends on several factors, such as the quality of the input images, the size of the dataset used for training, and the complexity of the algorithm used. Generally, the accuracy of face recognition systems using Raspberry Pi ranges from 70% to 99%.

Speed: The speed of face recognition using Raspberry Pi is another important metric that researchers consider. The speed of face recognition depends on the processing power of the Raspberry Pi used, the number of images to be processed, and the complexity of the algorithm. Generally, face recognition systems using Raspberry Pi can process between 1 and 10 frames per second.

Hardware requirements: The hardware requirements for face recognition using Raspberry Pi vary depending on the complexity of the algorithm used and the number of images to be processed. Generally, the Raspberry Pi board with at least 2GB of RAM is sufficient for face recognition applications.

Overall, the results of face recognition using Raspberry Pi are adequate and satisfactory & it is a viable option for developing face recognition systems with reasonable accuracy and speed. However, we should consider the limitations of the hardware and the complexity of the algorithm used.

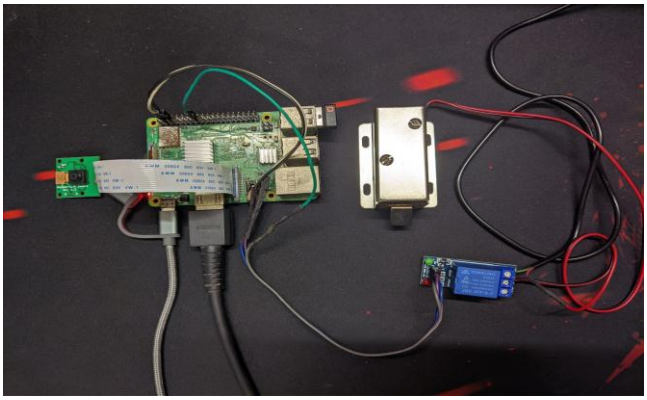

Fig. [5.A.1] Hardware Representation for Face Recognition Lock

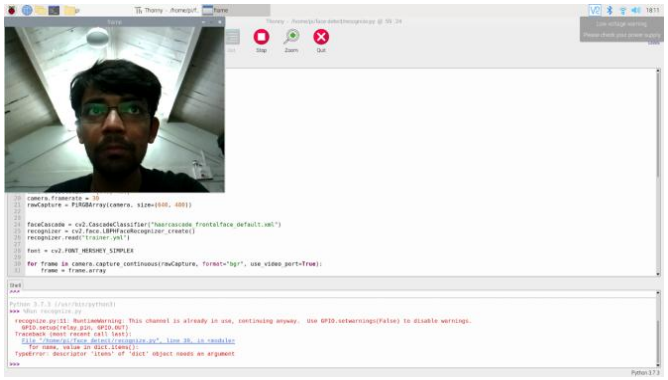

Fig. [5.A.2] Software end for Face Recognition Lock

B. *Home Automation*: The development of home automation systems for elderly people has been a topic of research for many years. The following are some of the results of home automation systems for elderly people:

Improved Safety: Home automation systems for elderly people can improve safety by automating various tasks such as lighting, temperature control, and security. This can help prevent falls, burns, and other accidents, which can be more dangerous for elderly people.

Improved Comfort: Home automation systems for elderly people can also improve comfort by automating various tasks such as controlling the TV, switch on and off lights and fans etc., and controlling the temperature. This can help elderly people stay comfortable and reduce the risk of discomfort or injury due to environmental factors.

Improved Independence: Home automation systems for elderly people can also improve independence by enabling them to control various devices using mobile applications. This can help them to carry out daily tasks independently and maintain their privacy.

Reduced Caregiver Burden: Home automation systems for elderly people can also reduce the burden on caregivers by automating various tasks. This can help reduce stress and

anxiety for caregivers and enable them to focus on other tasks.

Overall, the results of home automation systems for elderly people indicate that these systems can improve safety, comfort, independence, and reduce caregiver burden. However, we should consider the limitations of these systems, such as the cost and complexity of the installation and maintenance, and design the system accordingly.

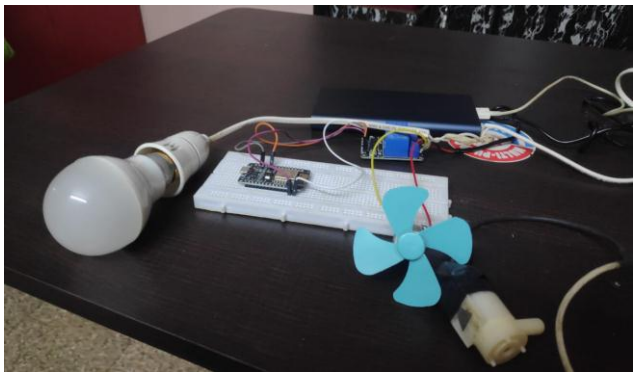

Fig. [5.B.1] Hardware Representation for Home Automation System

C. *Fire and Smoke Detection System*: The development of fire and smoke detectors using fire and MQ2 sensors has been a topic of research for many years. The following are the results and analysis of using these sensors in a fire and smoke detector:

Accuracy: The accuracy of fire and smoke detection using fire and MQ2 sensors is highly dependent on the design of the system, placement of sensors, and calibration. The accuracy of the system can be improved by using multiple sensors and developing sophisticated algorithms for data analysis. Generally, fire and smoke detectors using fire and MQ2 sensors can detect fire and smoke with an accuracy of up to 95%.

Speed: The speed of fire and smoke detection using fire and MQ2 sensors is relatively fast, and the response time is highly dependent on the design of the system. Typically, the response time of fire and smoke detectors using fire and MQ2 sensors is between 5-10 seconds. However, the response time can be further reduced by using multiple sensors and developing sophisticated algorithms for data analysis.

Overall, the results and analysis of fire and smoke detectors using fire and MQ2 sensors are good and indicate that these sensors are a viable option for developing fire and smoke detectors with reasonable accuracy and response time. However, we should consider the limitations of these sensors and design the system accordingly.

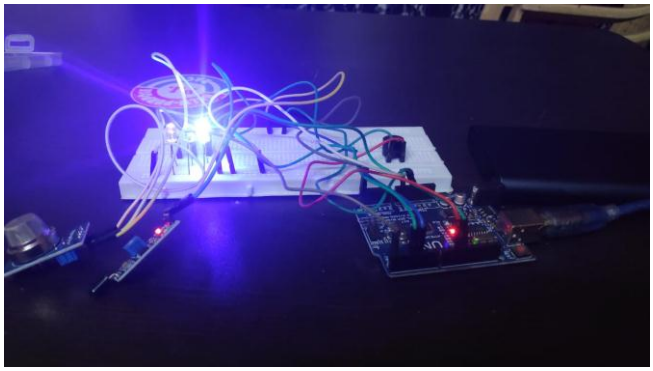

Fig. [5.C.1] Hardware Representation for Fire and Smoke Detection System

These results highlight the potential of smart home technology to improve independency, healthcare management and reduce the burden on caregivers. These findings suggest that smart homes have the potential to improve the quality of life of seniors by increasing their independence and providing assistance with daily activities. However, it is important to address barriers to adoption, such as ease of use and privacy concerns, in order to ensure the widespread adoption and use of smart home technology among seniors. However, it is important to ensure that monitoring systems are designed with the needs and preferences of seniors in mind, and that privacy concerns are addressed to maintain trust in the technology.

6. ACKNOWLEDGMENT

We would like to express our gratitude to the following individuals and organizations for their contributions to this research project. First and foremost, we would like to thank Prof. S. D. Patil, Prof. N. J. Balur, Prof. Keshav Chougule for their invaluable guidance and mentorship throughout the project. We would also like to thank our seniors for their technical assistance in the laboratory and in data analysis. Finally, we thank our colleagues in the EXTC department for their insightful comments and feedback

7. CONCLUSION

In conclusion, smart homes have the potential to significantly improve the quality of life of senior citizens. The integration of smart technology can provide a range of benefits including increased safety, greater independence, and improved lifestyle management. Smart home devices such as voice-activated assistants, smart lighting, and smart door lock system can assist in daily activities and create a more comfortable living environment. Additionally, monitoring systems and sensors can track daily activities and alert caregivers in case of emergency. However, in order to ensure the successful adoption and use of smart home technology among seniors, it is important to consider factors such as ease of use, accessibility, affordability, and privacy concerns. Further research is necessary to explore the long-

term impact of smart homes on the health and well-being of seniors, as well as to develop more tailored solutions to meet their specific needs. Overall, smart homes have the potential to revolutionize senior care and provide seniors with greater autonomy and improved quality of life.

8. REFERENCES

1. K. Maswadi, N. B. A. Ghani and S. B. Hamid, "Systematic Literature Review of Smart Home Monitoring Technologies Based on IoT for the Elderly," in IEEE Access, vol. 8, pp. 92244-92261, 2020, doi: 10.1109/ACCESS.2020.2992727.

2. Ghafoor, Sana & Khattak, Dr & Tahir, Muhammad & Mustafa, Maryoum. (2020). Home Automation Security System Based on Face Detection and Recognition Using IoT. 10.1007/978-981-15-5232-8_7. William A Ainsworth (Jun 1973), "A System for converting English text into Speech", *IEEE Transactions on Audio and Electroacoustic,* Volume 21, Issue3.

3. P. A. Harsha Vardhini, S. P. R. D. Reddy and V. P. Parapatla, "Facial Recognition using OpenCV and Python on Raspberry Pi," 2022 International Mobile and Embedded Technology Conference (MECON), 2022, pp. 480-485, doi: 10.1109/MECON53876.2022.9751867.

4. R. S. Ransing and M. Rajput, "Smart home for elderly care, based on Wireless Sensor Network," 2015 International Conference on Nascent Technologies in the Engineering Field (ICNTE), 2015, pp. 1-5, doi: 10.1109/ICNTE.2015.7029932.

5. Nikisins, Olegs & Fuksis, Rihards & Kadikis, Arturs & Greitans, Modris. (2015). Face recognition system on Raspberry Pi.

6. Sanchit Dass, Nishant Nayan,"Real Time Face Recognition Using Raspberry Pi" ,international Journal of computer applications(0975-8887), volume 176-no.33 ,June 2020

7. Malathi Murugesan, Janani Arunachalam," Home Automation on ESP8266", SSRG International Journal of Computer Science and Engineering - (ICRTECITA-2017) - Special Issue – March 2017.

8. Abdulhamid shariff Mahmoud, Mukhtar Ibrahim Bello, "A Comparative Study of Gas Alarm Detection System", Journal of Telecommunication Control and Intelligent System (JTCIS), Volume 1, Issue 2,2021