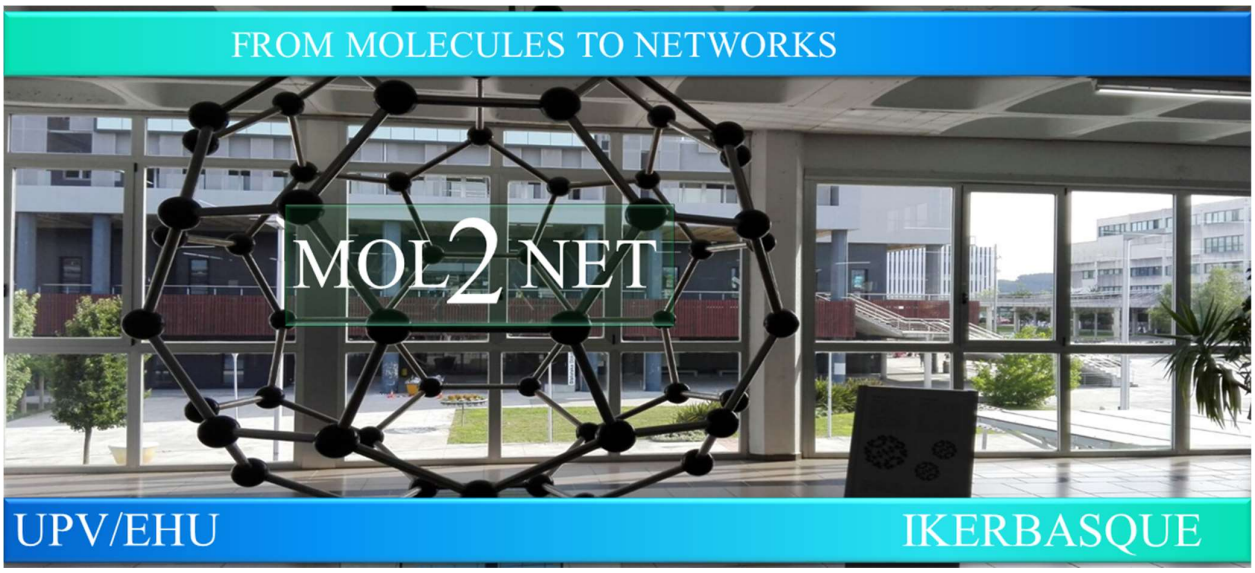
MDPI sciforum

MOL2NET'22, Conference on Molecular, Biomedical & Computational Sciences and Engineering, 8th ed.



IoT-Based Smart Mirror

Aliya Batool [a], Baqir Nadeem Hashmi [b], Aqib Ali [, c], Samreen Naeem [c], & Sania Anam [d]*

[a] Department Computer Science, The Islamia University of Bahawalpur, Pakistan
[b] Faculty of Technology Management and Business Universiti Tun Hussein Onn Malaysia
[c] College of Automation, Southeast University, Nanjing, China.
[d] Department of Computer Sci., Govt Associate College for Women Ahmadpur East, Bahawalpur, Pakistan.

*. * Corresponding author: aqibcsit@gmail.com*

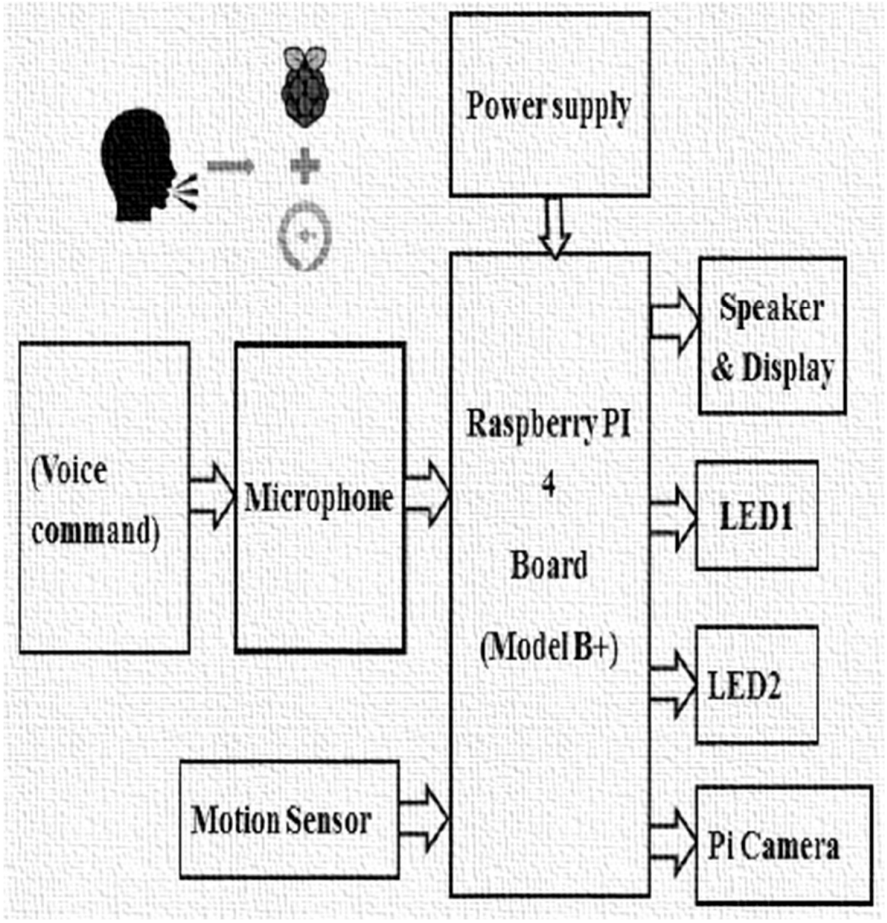
Abstract.

Preparing in front of the mirror in the morning takes time. This Smart Mirror can solve several business issues simultaneously. This voice service system analyzes customer inquiries and instructions using "ALEXA". Smart Mirror, based on the Raspberry Pi 4, is the newest design to replace our mirrors with high-tech and inventive applications. We have all seen various things that help the country and world thrive in this modern era. Multitasking is required since it is hard to fit everything into a day. The challenge is controlling everything that might impact a person to prepare for each day and accomplish all the critical chores in front of the mirror more efficiently. This project aims to construct a smart mirror that provides general information like news, time,

weather, and other valuable data to the general public. This mirror collects this information throughout morning preparation to make it easier. Our items can incorporate music, control techniques, and other entertainment to make this mirror more fascinating. Smart glass can improve a modern lifestyle. Face recognition will enhance mirror use.

Keywords: Smart Mirror, IoT, ALEXA, Voice services, Amazon.

Graphical Abstract



Introduction

The Internet of Things (IoT) is currently the most significant concept in all goods and projects. You can see individuals using the internet wherever you turn. The "Internet of Things" is predicted to link up to 21 billion devices by 2020. Each individual can carry between seven and ten IoT devices that are always connected to the internet. Because it is now present in almost every element of our way of life, accessing the internet has become a must for human existence [1]. As the Internet of Things grows, specialized data will be gathered, which will then need to be processed and looked at. The Internet of Things offers countless opportunities for better data interchange and device connection, but the same feature that makes these improvements possible also leaves it incredibly susceptible regarding security.

It is a mirror that hangs on the wall, and its display displays information pertinent to our needs, such as the news, the weather, the calendar, and other items [2].

High-quality one-way glass, an LCD monitor, a frame to support the glass and monitor, a motion sensor to identify people, and a web browser called flash combined with python to offer the software capabilities like "Alexa" and drive the display further are frequently goals when building a smart mirror. There may also be additional elements. In this post, the design of a smart mirror will be covered. One such is the Amazon ALEXA program, a voice service that responds to our questions and comes with smart mirrors. The smart mirror can also detect faces thanks to its built-in Pi camera [2].

The smart mirror comprises a monitor display with two-way glass mirror film, a USB microphone, a Raspberry Pi 4 board, two led strips, a Pi camera for face detection, a speaker, and the components listed above. The purpose of LEDs 1 and 2 is to act as indicators. One of the LEDs will start to light up after the word "Alexa" has been said into the microphone, signaling that Alexa is in listening mode. When Alexa is speaking or answering, the other led will start to glow. An LED monitor is connected to a reflecting mirror and a see-through mirror that might also function as a see-through mirror [3]. This fulfills the dual function of mimicking a traditional mirror and serving as a display for real-time data updates. These are the two primary purposes that this gadget fulfills. iii) Personalized data and information services: Anyone using this mirror will have access to real-time updates on traffic, stocks, news, and weather, as well as other reports tailored to their interests and areas of concern. iv) Voice Instructions: The Raspberry Pi 4 will be connected to a microphone, which the user will use to issue voice commands to the mirror. The user instructions control what information is shown on the Magic Mirror [3].

The block diagram for the proposed project may be seen in the figure. The Raspberry Pi 4 board's USB microphone, which is attached, picks up the spoken instruction and executes it. A power source is necessary for the Raspberry Pi to run. The Smart Mirror will turn on automatically when motion is sensed. On the other side, it will not turn ON if you do the opposite [4].

The second incident occurred when the mirror was instructed to switch on and off the light, fan, and other devices. As a result, it is used as a smart home device to manage the numerous appliances in the house. The motion sensor acts as a limit switch by recognizing a person in front of the screen and showing the information when they are present. Every time the sensor detects a human, this occurs [4].

Materials and Methods

The Raspberry Pi 4B: The Raspberry Pi 4 Model B was released in June 2019. It features a 1.5 GHz 64-bit quad-core ARM Cortex-A72 processor, on-board 802.11ac Wi-Fi, Bluetooth 5, full gigabit Ethernet

(throughput not limited), two USB 2.0 ports, two USB 3.0 ports, dual-monitor support via a pair of micro-HDMI (HDMI Type D) ports, and support for up to 4K resolution. When combined with the proper power supply unit (PSU), the Raspberry Pi 4 may also be powered through its USB-C connector, which enables an extra power supply to be sent to any peripherals connected downstream. The original board for the Raspberry Pi 4 contains a design defect that causes it to be mistakenly identified by third-party e-marked USB cables, such as those used on Apple MacBooks. As a result, the board does not receive power from these connections. Late in 2019, iteration 1.2 of the board was made available, and a patch for the design issue came with it [5].

One-Way Mirror Image in a Film: A *one-way mirror* is a reciprocal mirror that is partially transparent and partially reflective. It is sometimes referred to as a two-way mirror, two-way glass, semi-transparent mirror, or one-way mirror. The spectator may believe that the mirror is conveying information just in one way when one side of a mirror is brightly lit and the other is dark. The mirror's design aims to offer a natural user interface in the ambient home environment for accessing various services, including voice services and location-based weather, time, and calendar information. This served as the mirror's main inspiration throughout creation. The Raspbian operating system, based on Debian, must be downloaded to complete the project. The card must then be placed into the SD card port on the Raspberry Pi before the operations can be completed [6].

LCD Display: An output device that displays data as pictures is a liquid crystal display sometimes called an LCD panel. The monitor's construction includes electronics, power supply units, and display components. The user's chosen interface is shown on a concealed LCD panel behind the mirror. In order to communicate with the user, this panel is used. An array of light-emitting diodes organized into pixels on an LED monitor is used to display video. Flat-panel displays are what LED monitors are. They can be used in outdoor advertising, like billboards and shop signage, because they are bright enough to be seen even in direct sunshine [7].

Microphone with USB functionality: In every way, this microphone functions incredibly well with the Raspberry Pi. Users can converse using Alexa's voice assistance. Compared to our ordinary microphone, its accuracy is significantly better. It is effortlessly connected to the Raspberry Pi's USB port. It is much easier to store on the Raspberry Pi and has a much more reasonable size [8].

Pi Camera: Lightweight and portable, the Raspberry Pi camera module is compatible with the Raspberry Pi. It connects to the Raspberry Pi via the MIPI camera serial interface protocol. Applications for using it often include image processing, machine learning, and different surveillance-related tasks. The camera is widely used in drones for security due to its small payload. Regular USB cameras, the same sort used with PCs, may also be utilized by the Raspberry Pi in addition to these modules. This

project made face recognition possible using a Raspberry Pi camera. This element is located just at the top of the mirror glass [8].

Results and Discussion

Operating System Raspbian: In all respects, Raspbian is the best operating system. Most users will start their Pi experiences using Raspbian because it is considered the "official" operating system for the Raspberry Pi. Raspbian is a version of Linux created explicitly with the Raspberry Pi in mind. Descended from Debian, Raspbian is a free operating system designed especially for Raspberry Pi's hardware. An operating system is a collective term for the essential programs and tools that make your Raspberry Pi work [6]. To set up this Smart Mirror using a Raspberry Pi, a few steps must be followed. Launch the Raspberry Pi first, then carry out the Raspbian Jessie installation. Place the SD card in your Pi after removing it from it mounting on your PC. After you have attached your keyboard, mouse, and HDMI cable to the Raspberry Pi, connect the power wire. You should now be able to see the Raspbian Pixel desktop (GUI). For this "Smart Mirror" to be able to connect to the internet and for us to be able to remotely access it using VNC Viewer in order to modify the settings, Wi-Fi must be enabled. Select the network symbol in the top right corner of your screen to connect to a network. After selecting your network and entering your Wi-Fi connection's password, click OK [4]. After that, get the machine's IP address so you can connect to it from any standard computer and continue the installation from there. Last but not least, we launch our "Smart Mirror" as the system starts up, bringing up all of its features.

Configuration and Installation of ALEXA Voice Services: One of the Amazon services is ALEXA Voice Services (AVS), an artificial intelligence (AI) voice-controlled assistant for a variety of things, including system demands and system Smart Home Smart Mirror as "Smart Mirror." Smart Mirror is another service provided by Amazon. The intelligent speaker company, Echo, developed by AVS and ALEXA, was the first to offer two-way voice communication with various devices, both offline and online. Many other gadgets, including smartphones, tablets, and remote controllers, can now use ALEXA, a speech service Amazon offers. The name ALEXA for this voice service was influenced by the legendary ancient Library of Alexandria, known as the "keeper of all knowledge." The name of this voice service is ALEXA [6].

Viewing VNC: The term "Virtual Network Computing" (abbreviated as "VNC") refers to a program created by remote console consoles for use by penetration and hacker testers. The IP address already available in the Raspberry Pi to monitor the "Smart Mirror" is used in this procedure. VNC uses RFB protocols to exchange screen pixel data between devices such as PCs, laptops, or smartphones via the internet network. It was Real VNC that created this user-friendly and reliable protocol [9].

Thanks to a service offered by VNC Viewer, users may remotely control their desktop PCs using a range of electronic devices, such as cell phones. Real-time desktop computer captures and transmission to VNC Viewer are the responsibilities of the VNC Server. The VNC Viewer collects the input (mouse, keyboard, or touch), which is then transferred to the VNC Server so that it may be injected and used to establish remote control fully [10].

Conclusions

The Flask micro web framework was created using the Python programming language. Since it does not require particular tools or libraries, it is referred to as a micro-framework. It lacks a database abstraction layer, a layer for form validation, and any other elements typically offered by already-built third-party libraries to do the same functions. Contrarily, Flask supports extensions, enabling developers to add features to their applications as if they had been included in the framework. For object-relational mappers, form validation, upload handling, several open authentication protocols, and other utilities linked to common frameworks, extensions are readily accessible. Updates to extensions happen far more often than to the Flask program itself. We utilized the flask web framework to display the mirror information. The Python language has a library under the name Flask. We must import the library into Python before we can utilize it.

The information on the screen is presented following the algorithms and functions specified while programming in Python. The flask web framework is used to generate the widgets. The information on the screen the smart mirror will display the news feed and other information in the manner indicated in the picture. There will be a motion sensor at the very top of the screen. On display, Alexa was shown operating on a Raspberry Pi 4. With the least resources possible, the mirror has been put in place. Future project versions could incorporate voice recognition functionality by using a microphone. If a touch screen is more practical, a monitor screen can also be used in place of it. This endeavor, therefore, has enough ramifications for the future.

References

[1]. Alboaneen, D. A., Alsaffar, D., Alateeq, A., Alqahtani, A., Alfahhad, A., Alqahtani, B., ... & Alamri, L. (2020, March). Internet of things based smart mirrors: a literature review. In 2020 3rd International Conference on Computer Applications & Information Security (ICCAIS) (pp. 1-6). IEEE.

[2]. Uddin, K. M. M., Dey, S. K., Parvez, G. U., Mukta, A. S., & Acharjee, U. K. (2021). MirrorME: implementation of an IoT based smart mirror through facial recognition and personalized information recommendation algorithm. International Journal of Information Technology, 13(6), 2313-2322.

[3]. Silapasuphakornwong, P., & Uehira, K. (2021, March). Smart Mirror for Elderly Emotion Monitoring. In 2021 IEEE 3rd Global Conference on Life Sciences and Technologies (LifeTech) (pp. 356-359). IEEE.

[4]. Muneer, A., Fati, S. M., & Fuddah, S. (2020). Smart health monitoring system using IoT based smart fitness mirror. TELKOMNIKA (Telecommunication Computing Electronics and Control), 18(1), 317-331.

[5]. Sahana, S., Shraddha, M., Phalguni, M. P., Shashank, R. K., Aditya, C. R., & Lavanya, M. C. (2021, April). Smart Mirror using Raspberry Pi: A Survey. In 2021 5th International Conference on Computing Methodologies and Communication (ICCMC) (pp. 634-637). IEEE.

[6]. Tater, L., Pranjale, S., Lade, S., Nimbalkar, A., & Mahalle, P. (2020). IoT based Assistive Smart Mirror with Human Emotion Recognition System. Int. J. Eng. Res. Technol.(IJERT), 9, 381-385.

[7]. Lin, Z. M., & Kim, C. W. (2021). Development of Smart Mirror System based on the Raspberry Pi. The Journal of the Korea institute of electronic communication sciences, 16(2), 379-384.

[8]. Ikeuchi, N., Sakai, E., & Suzuki, H. (2020, October). A proposal of iot device cooperation system using smart mirror and biological information. In 2020 IEEE 9th Global Conference on Consumer Electronics (GCCE) (pp. 246-247). IEEE.

[9]. Patil, T., Pawar, A., Yadav, S., & Palleri, A. (2020). Research and Analysis of Smart Mirror. International Research Journal of Engineering and Technology (IRJET), 7(2), 2609-2612.

[10]. Puthran, R., Patil, A., Kadam, M., & Patil, N. (2020). Iot Based Smart Mirror using Raspberry Pi. SAMRIDDHI: A Journal of Physical Sciences, Engineering and Technology, 12(SUP 1), 137-141.