Smart Mirror-Based Raspberry PI 4 For Home Automation

1Surya Narayanan CS, 2Priyadharshan C, 3Harshitaa MS
1Research Scholar, 2Research Scholar, 3Research Scholar
1Sona College of Technology,
2Sona College of Technology,
3Sona College of Technology

Abstract - **The Smart Mirror is a two-way mirror with a built-in screen. Smart Mirror's widgets enable multitaskers to keep tabs on the latest news and updates. When you contact the infrared frame, the speech detector that controls this item is triggered. Starting with the Smart Mirror's graphical display, the instrument's system and the procedure are put through its paces by activating its many sensors and components until reaching the instrument's Voice Assistant function as Home Automation for final assessment. hinges on the final exam score. The Smart Mirror's graphical user interface made the sensor, component, and Voice Assistant home automation functions work as intended. However, readings from humidity gauges are sometimes muddled and hard to interpret. The load responds appropriately to commands. The experimental loads can be programmed to respond to commands in under ten seconds. Switch 2 takes the longest to respond, while multicolor LED lighting has the quickest response time.**

keywords - **Smart Mirror, graphical display, Voice Assistant, Home Automation, humidity gauges**

1. INTRODUCTION

The development of technology today creates many tools that can make it easier for humans to carry out various activities. One of the results of this technological development is the creation of a mirror called Smart Mirror. Smart Mirror is a two-way mirror with an electronic display behind the glass [1]. Where this mirror can display various information ranging from the latest news, the development of Covid-19 cases, weather forecasts, and others. In addition, it can also help humans in the use of various electrical equipment that is integrated with an internet connection

Smart Mirror has a Raspberry Pi 4 base of operations by using voice commands to operate the tool [2]. The Raspberry Pi is a credit card-sized computer that is easy to program and use even for people who don't have an IT background [3]. The use of the Raspberry Pi as an operating base is intended to minimize the use of space in the construction of tools. In addition, the use of the Raspberry Pi is also intended to facilitate the use of computer functions in a more complex way in a lighter and simpler system.

A tool setting and various Home Automation activities do not escape the internet integration system. This led to a working system known as the Internet of Things (IoT). The Internet of things (IoT) is the sensors that connect to the internet and behave like the internet by making connections open at all times, as well as sharing data freely and enabling applications that are not available so that computers can understand the world around them and become part of human life [4].

A work system that integrates with an internet connection can have much better work efficiency and effectiveness. This can be demonstrated by taking information data in real-time, controlling the tool with no distance restrictions, communicating without distance restrictions, and various other things. This capability can occur due to the API system.

Application Programming Interface (API) is a collection of program instructions used to build a software application [5]-[7]. The Application Programming Interface (API) facilitates the exchange of information or data between two or more software applications. An Application Programming Interface (API) acts as a messenger sent by the client or user who will then tell a system what the system should do, then the system will respond back according to the client's or user's request. Where the work system implemented here uses the Voice Assistant work system. Voice Assistant is a digital assistant that uses voice recognition, or pun also Natural Language Processing (NLP) to execute commands commanded by the user [8]-[10].

This research was conducted to find out whether the tool can function according to the description and also to see how long it takes for this tool to respond to spoken commands. In addition, this research itself is intended to look at the capabilities of using Smart Mirror and it is hoped that this tool can be applied in various sectors such as housing use (private), commercial, health, education, industry, sports, etc. with adjustments in several ways such as components, programming, widgets, etc. according to the needs of each of these sectors

2. RESEARCH METHODS

The block diagram of the working system of the Raspberry Pi 4-based Smart Mirror for Home Automation itself can be seen in Figure 1. The process of using sound in giving control commands to the tool on the Smart Mirror can be seen in Figure 2. It can be seen that when starting, there are two choices of input types, namely with a voice command or in the form of a touch on the IR Frame to activate the voice detector. After the given voice command is detected by the voice detector, two possibilities will be generated:

1. If the sound is not detected, the process is repeated.
2. If the sound is detected, the process will continue.

When raspberry pi 4 processes the command, two possibilities will be generated:

1. When the given command is incorrect, the input process is repeated.
2. If the command given is correct, the results will be sent to the web server with client-server communication.

In addition, the command is processed on the web service, which will result in two possibilities:

1. If the process fails, it will return to the web server.

2. If the process is successful, then the control command will be sent with the API system, after which the sound output appears on the speaker and the tool will be controlled.

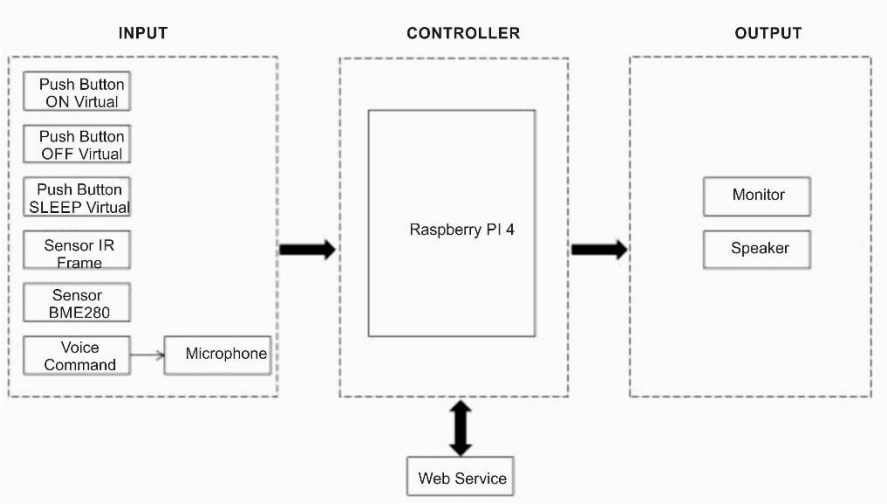

Figure 1 Smart Mirror-Based block diagram Raspberry Pi 4

The steps performed are:

1. Activate the Smart Mirror script with the command cd Magic Mirror start
2. Pay attention to whether there is a crash or system and program error when Smart Mirror is running a program.
3. Enable Voice Detector by mentioning the keyword "Jarvis".
4. Speak voice commands to give instructions against the Voice Assistant module.
5. View Voice Assistant's response to the commands given.
6. View the response of the controlled tool.
7. Record the time and how long the tool responds to a given command.

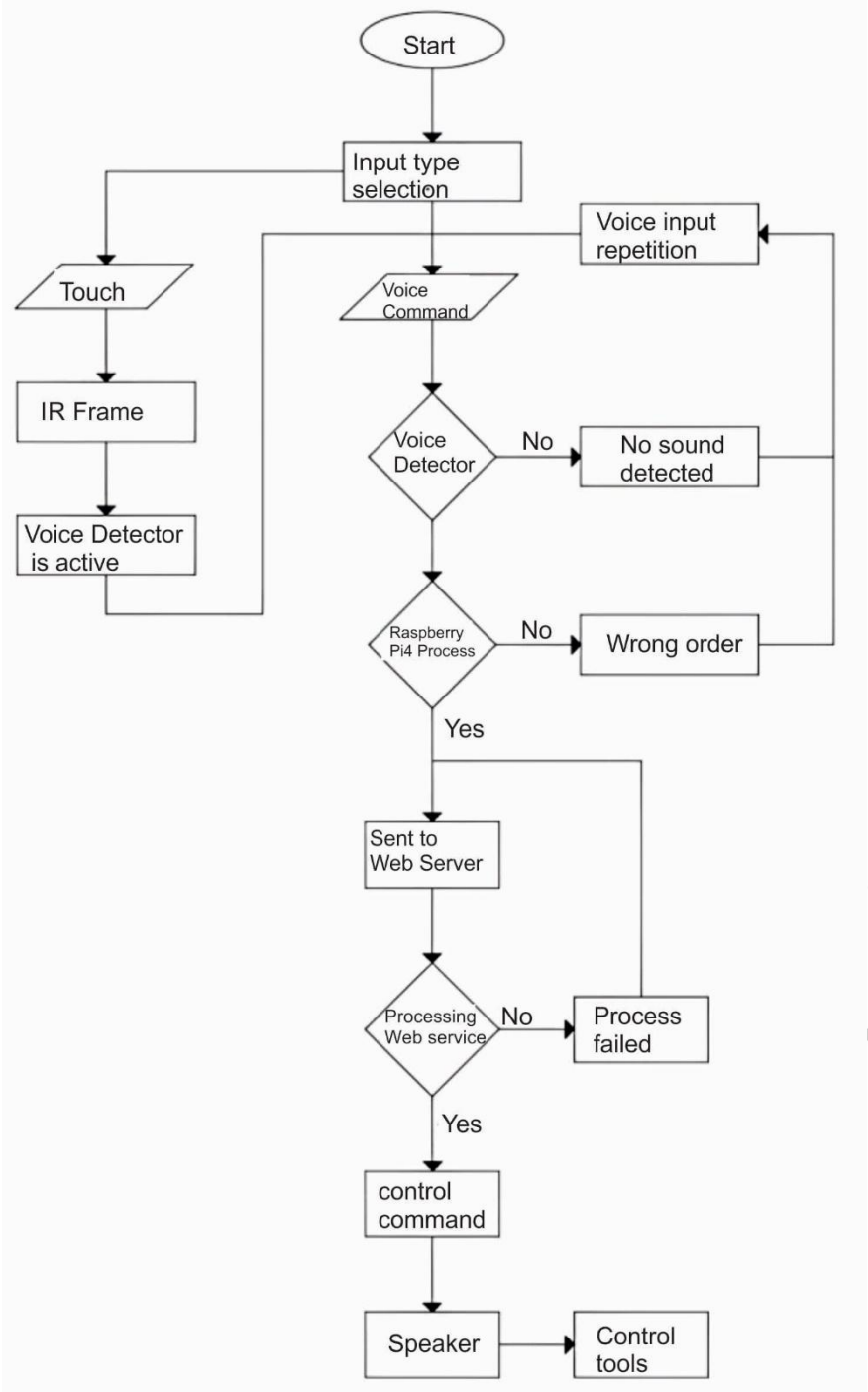

Figure 2 Voice Assistant Flowchart for Home Automation

3. RESULTS and DISCUSSION

A. Test result data

Examining the system and the process as a whole on the tool — beginning with the graphic display on the Smart Mirror and continuing through the supporting sensor functions, component functions, and the Voice Assistant function as Home Automation — is how one arrives at the results of the testing data. Figure 3 shows the results that were displayed when the software was being tested.

B. Smart Mirror graphical display

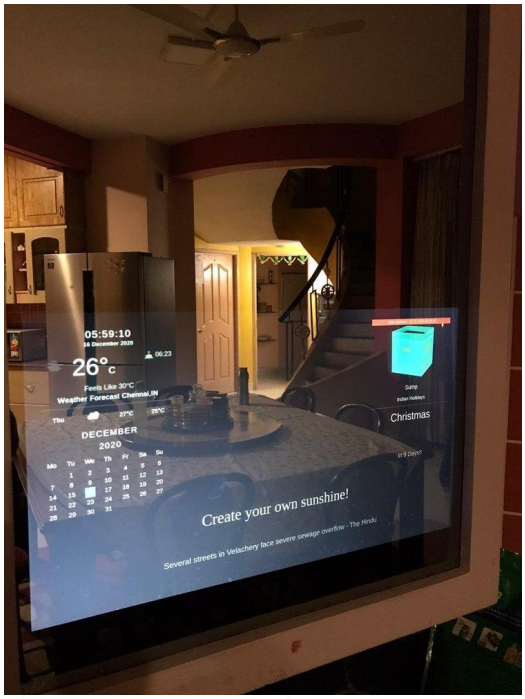

Figure 3. Smart Mirror Display

In testing this graphic display, it indicates that the program created is in accordance with the python grammar.

C. Supporting sensor functions

In testing the function of the supporting sensor, namely the IR Frame, this indicates that the program made is in accordance with the Phyto n grammar.

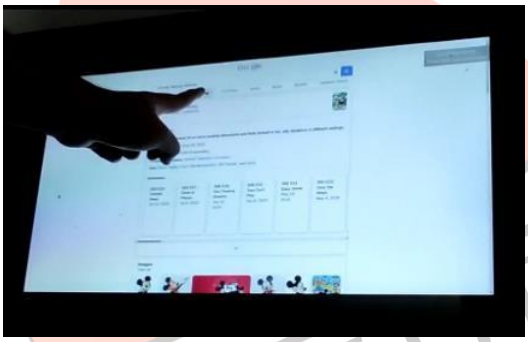

Figure 4. IR Frame

In testing the function of the supporting sensor, namely the BME280 Sensor, this indicates that the program created is in accordance with the python grammar. Then the measurement results of the BME280 Sensor can be seen in Table 1.

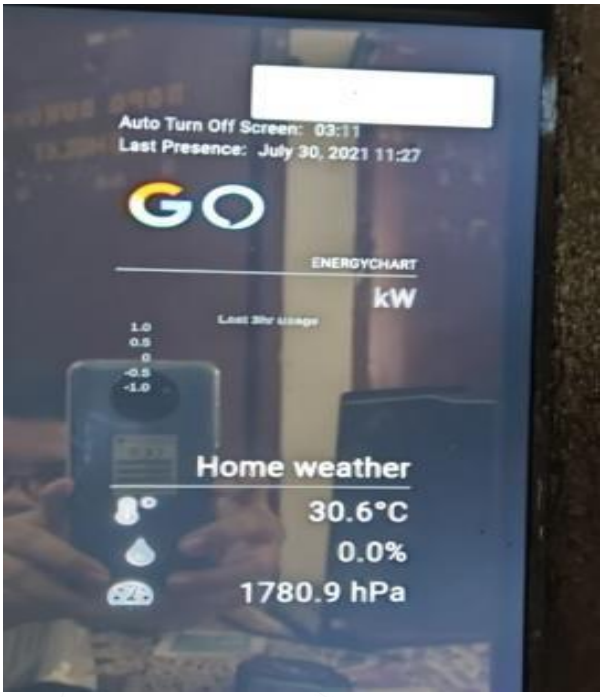

Figure 5. Sensor BME280

Table 1. Results of measuring data by sensors BME280

Date	Humidity in Air (%)	Temperature (C)	Pressure Air
08-01-2023	86%	23°C	1014 mbar
09-01-2023	88%	23°C	1015 mbar
10-01-2023	84%	21°C	1016 mbar
11-01-2023	84%	20°C	1014 mbar

It can be seen from Table 1. that on the temperature measurement data and air pressure, the sensor can work properly. However, there was an error in the air humidity measurement data, wherein the experiment results showed a value of in a row. This error can be caused by an error when connecting the sensor pin out by using solder.

D. Component functions

It can be seen from Table 2. that all components used on the Smart Mirror can function as intended. It can also integrate one with another.

Table 2. Test results of components used in Smart Mirror

No.	Testing	Component Conditions
1	Monitor	Can function properly
2	Raspberry Pi 4	Can function properly
3	Microphones and Loudspeakers	Can function properly
4	USB Extension	Can function properly

E. Voice Assistant Function as Home Automation

For test results on each load can be seen in Table 3. - Table 6.

Table 3. Test results of voice assistant control of Multicolour LED lamps

Order	Response
Power on	The light is on
Turn off	Lights off
Dim 10%	Lamp brightness to 10%
Change color to red	The color of the light changes to red

Can be seen in Table 3. on the Multicolour LED lamps load, seen when the 'Turn on' command, then the light is on when the 'Turn off' command, then the light turns off. In addition, control can also be done on the color of the lamp such as changing the color of the lamp to red with the command 'Change the color of the light to red'.

Table 4. Control Test Results

Order	Response

Turn on Switch 1	Light 1 on
Turn off Switch 1	Light 1 off
Turn on Switch 2	Light 2 on
Turn off Switch 2	Light 2 off

It can be seen from Table 4. that when the 'Power Off' and 'Turn On' commands for switches one or two are detected by Voice Assistant, the lights respond also with the state on and off as commanded.

Table 5. Control Test Results in Fan Load

Order	Response
Turn on fan	turns fan on
Turn off fan	Turns fan off

It can be seen from table 5. that when the 'Power Off' and 'Turn On' commands for the fan are detected by Voice Assistant, the fan will respond with the on and off state as commanded.

Table 6. Response Time

Controlled tools	Length of Time the Tool Response
LED lights	± 5 seconds
Simple installation: Switch 1 Switch 2	 ± 7 seconds ± 8 seconds
Fan	± 6.5 seconds

It can be seen from Table 6. that the tool's response time to tool control ranges from 2 to 5 minutes.

4. CONCLUSIONS

From the research that has been carried out it can be concluded:

1. The Smart Mirror is capable of working as described, including having a graphic display, supporting sensor functions, component functions, and Voice Assistant features that allow for proper operation within Home Automation.
2. There is an error in the air humidity drain, and the data that was measured is illegible due to the fault.
3. The length of time that passes between the presence of a command and the load beginning to respond to that command. The loads that were employed in this research were able to correctly respond to commands that lasted between 5 and 8.5 seconds.
4. The load that can be controlled by instructions the Multicolor LED lamps are the ones that respond to commands the quickest, while switch 2 is the one that takes the longest.

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