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MIRROR MAGIC: REFLECTING INNOVATION FOR EVERYDAY CONVENIENCE USING RASPBERRY PI

MR.K.ASWIN M.E.,[1] , KELLY JOSEPHINE RAJ.A [2] , KIRUBASHINI.S [2] , NAVITHA.R [2] , ROSHINI.M [2]

1. DEPARTMENT OF CSE ASSISTANT PROFESSOR, DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE, PERAMBALUR.

2. FINAL YEAR CSE, DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE, PERAMBALUR.

ABSTRACT:

Smart is not an adjective anymore, Now it is an used for anything that improves functioning in multi-device environment, by simplifying our daily tasks by speeding up the information flow and allowing us to do incredible tasks in the twinkling of an eye. A smart mirror is a two-way with an electronic display behind the glass. The display can show the viewer different kinds of information in the form of widgets, such as weather, time and date and news updates. This project would be useful for busy individuals that want to multitask and stay informed while on the go.The basic design of smart mirror starts with two-way glass is the recommended types as it lets the graphics on the display come through clearer. Upon uploading the code to the device from android studio, all the prototypes and design that we have installed in the design module will be displayed. The electrical component to our project was a simple 19mm Computer monitor mounted to the back of the see through glass. In addition to, installation of PIR on and off sensor to different motion atmospheres is added. And an LED strip around the smart mirror comes with multiple luminosity levels from cool to warm light. The Google voice assistant feature has been implemented to control device with spoken commands. All of this works with Raspberry pi 3 A+ model which is a single board computer. To install the raspbian OS a micro SD card is needed prepared with an OS image all that will be running on the mirror will be coded on the same device at least a keyboard, mouse are required. One mode of interaction with smart is through the microphones. All the coding are written in python which most popular in the Raspberry pi community and it has all the libraries Mirror OS is the software we created for the smart mirror's interface and it runs on the Raspbian (LINUX) ontop if the electron. The device must be connected to the Wi-fi in order to gather the data through online services.When every device such as phone, watch, TV, speaker has their smart versions, it doesn't come as a surprise that mirrors they become smart too.

KEYWORDS: IOT, PIR, RASPBERRY-PI, RASPBIAN OS, LINUX

1. INTRODUCTION

In this world everyone needs a comfort life.Modern man has invented different technology for his purpose. In today's world, people need to be connected and they are willing to access the information easily. Whether it is through the television or internet, people need to be informed and in touch with the current affairs happening around the world. The Internet of Things mean interconnection via the internet of computing devices embedded in everyday objects, enabling them to send and receive data. The Internet of Things with its enormous growth widens its applications to the living environment of the people by changing a home to smart home. Smart home is a connected home that connects all type of digital devices to communicate each other through the

internet. Our lifestyle has evolved in such a way that optimizing time is the most important thing. Our work is based on the idea that we all look at the mirror when we go out, so why wouldn't the mirror become smart. A common approach for building a smart mirror is to use a high quality one-way glass, a LCD monitor, a frame to hold the glass and monitor, and a web browser with python to provide the software features and drive the display. This project has been developed with the idea of making home smart to save time. The Internet transformed our lives by connecting us more easily to information and other people in the virtual world. The state of innovation currently is to provide more information with less interaction to get it. The device that has been researched and designed is called "Smart Mirror". It is a wall mounted mirror which displays relevant items to the user such as weather, time, date, temperature, humidity and news and other fields of interest. IOT emerged the idea of remotely monitoring objects through the Internet. When it comes to our home, security is crucial issue to the general public. For enhancing the security of home this framework is used by owner of the house. Assume you are not at home and a thief enters your home then this framework will give a caution through alert message. When thief enters the home, PIR sensor will detect the movement and gives the owner alert message. Wireless Home security and Home automation are the dual aspects of this project. The currently built prototype of the system sends alerts to the owner over message using the Internet if any sort of human movement is sensed near the mirror.

2. RELATED WORK

[1] Silapasuphakornwong and Uehir (2021) proposed a Smart Mirror for Elderly Emotion Monitoring, which aims to enhance elderly care by integrating emotion recognition technology into a familiar household item. By utilizing facial recognition and emotion analysis algorithms, this system provides valuable insights into the emotional well-being of elderly individuals, enabling timely interventions and support when needed. **[2]** Sahana et al. (2021) conducted a survey on Smart Mirrors using Raspberry Pi, offering a comprehensive overview of existing implementations, functionalities, and potential applications. Their study provides valuable insights for researchers and developers interested in leveraging Raspberry Pi technology to build Smart Mirror systems, highlighting its versatility and ease of integration. **[3]** Safa et al. (2020) explored the integration of human health care perspectives into Smart Mirror technology within an IoT-based environment, emphasizing the potential of such systems to enhance health monitoring and wellness management. By incorporating features like health tracking sensors and personalized health recommendations, this approach aims to empower individuals to take proactive measures towards improving their wellbeing. **[4]** Silapasuphakornwong and Uehira (2020) proposed a novel IoT device cooperation system utilizing Smart Mirror technology and biological information, envisioning a collaborative ecosystem where Smart Mirrors interact with other IoT devices to provide personalized services and support. This innovative approach fosters seamless integration between Smart Mirrors and various IoT devices, enhancing their utility and effectiveness in addressing user needs and preferences. **[5]** Purohit et al. (2019) developed a Computer Vision Based Smart Mirror with a Virtual Assistant, integrating advanced computer vision algorithms to enable interactive experiences. This innovative system employs a virtual assistant to respond to user queries, display relevant information, and perform tasks such as scheduling appointments or providing weather updates, enhancing user convenience and accessibility. **[6]** Kawale and Chaudhari (2019) presented an IoT-based Design of an Intelligent Mirror using Raspberry Pi, showcasing the integration of Raspberry Pi technology with IoT principles to create a versatile and interconnected smart mirror. Their design leverages the capabilities of Raspberry Pi to connect with other IoT devices, enabling functionalities such as home automation control, weather forecasting, and personalized notifications, thus enhancing the overall user experience. **[7]** D'Souza et al. (2019) introduced Ambient Intelligence Using Smart Mirror for

personalized home use, highlighting its potential to adapt to user preferences and behavior patterns. By incorporating ambient intelligence features, such as contextual awareness and adaptive responses, this smart mirror enhances the user's living environment by providing tailored information and services to suit individual needs and preferences. **[8]** Nadaf and Bonal (2019) proposed a Smart Mirror utilizing Raspberry Pi as a Security and Vigilance System, demonstrating its potential for enhancing home security measures. Their system integrates surveillance functionalities with the smart mirror interface, allowing users to monitor their surroundings in real-time and receive alerts for any suspicious activities, thereby bolstering home safety and peace of mind. **[9]** Singh and Singh (2019) introduced a Smart Interactive Mirror Display, offering an engaging and interactive user experience through its integrated display technology. This smart mirror display serves as a versatile platform for showcasing multimedia content, interactive applications, and personalized information, making it suitable for various settings such as retail stores, hospitality venues, and entertainment spaces. **[10]** Wani and Ahire (2019) developed a Real-Time Smart Mirror System Using Internet of Things (IoT), demonstrating its capability to provide real-time updates and information. By leveraging IoT connectivity, this smart mirror system can fetch and display dynamic data such as news feeds,social media updates, and traffic conditions, enhancing its utility as an information hub for users in various contexts.

3. RASPBERRY PI ARCHITECTURE

Design of Raspberry pi 4 Model B The Raspberry Pi 4 Model B, equipped with 4GB of RAM, represents a significant advancement in the popular single-board computer lineup. Boasting a quad-core ARM Cortex-A72 processor running at 1.5GHz, the Pi 4 offers remarkable performance improvements compared to its predecessors. The Raspberry Pi 4 Model B 4GB RAM features a robust configuration suitable for a wide range of computing tasks. At its core lies a quad-core ARM Cortex-A72 processor clocked at 1.5GHz, providing substantial processing power for various applications. Accompanying this CPU is 4GB of LPDDR4 RAM, offering ample memory capacity for multitasking and handling more demanding workloads smoothly. The Pi 4 also boasts enhanced multimedia capabilities with support for 4K video playback and dual micro HDMI ports, enabling users to connect to highresolution displays for immersive multimedia experiences. It provides expanded connectivity options including Gigabit Ethernet, USB 3.0 ports, and dual-band Wi-Fi ensuring seamless connectivity and compatibility with a variety of peripherals.

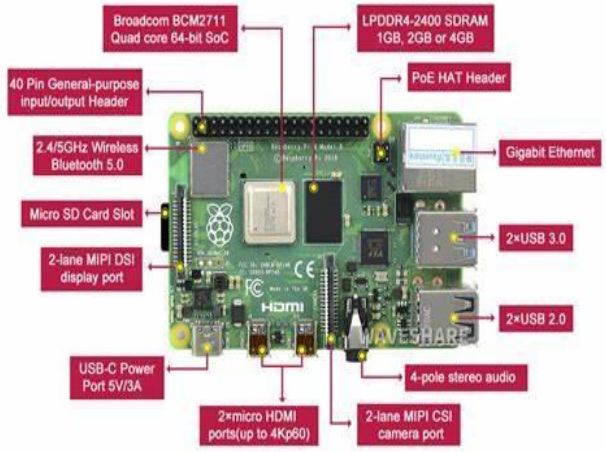

Fig: Raspberry pi 4 model B architecture

4. RASPBERRY PI OS

The choice of operating system for Magic Mirrors, such as Raspbian for Raspberry Pi-based setups, is driven by several key factors that contribute to the overall functionality and performance of these innovative devices. Firstly, Linux distributions are renowned for their open-source nature, which fosters a vibrant community of developers constantly improving and enhancing the system. This collaborative effort ensures that the operating system remains up-to-date, secure, and capable of supporting the latest advancements in Magic Mirror technology. Additionally, the lightweight design of Linux distributions makes them well-suited for running

on the relatively modest hardware configurations often found in Magic Mirrors. This efficiency in resource utilization ensures that the operating system can effectively manage the various tasks required for displaying dynamic content, such as fetching data from online sources, rendering graphics, and responding to user interactions, all while maintaining smooth performance. Furthermore, the flexibility and customizability inherent in Linux distributions empower users to tailor their Magic Mirror's operating environment to suit their specific preferences and requirements, whether it be optimizing performance, implementing security measures, or integrating with other smart home devices. Overall, the choice of a Linux-based operating system like Raspbian lays a solid foundation for the successful deployment and operation of Magic Mirrors, enabling them to deliver a seamless and engaging user experience.

5. PIR-SENSOR SPECIFICATION

Connection of PIR Sensor to Raspberry PI Connecting a Passive Infrared (PIR) sensor to a Raspberry Pi involves a straightforward process that enables motion detection capabilities for various projects. The PIR sensor typically has three pins: VCC (power), GND (ground), and OUT (output). To integrate the sensor with the Raspberry Pi, users first connect the VCC pin to a 5V pin on the Raspberry Pi's GPIO header, providing power. The GND pin is then connected to any ground pin on the GPIO header to complete the circuit. Finally, the OUT pin of the PIR sensor is connected to a GPIO pin on the Raspberry Pi, allowing it to send signals when motion is detected. Through programming in Python or another suitable language, developers can then configure the Raspberry Pi to react to these signals, triggering actions such as turning on lights, capturing images, or sending notifications. This simple yet effective setup enables the Raspberry Pi to incorporate motion sensing capabilities into a wide range of projects, from home automation systems to security applications.

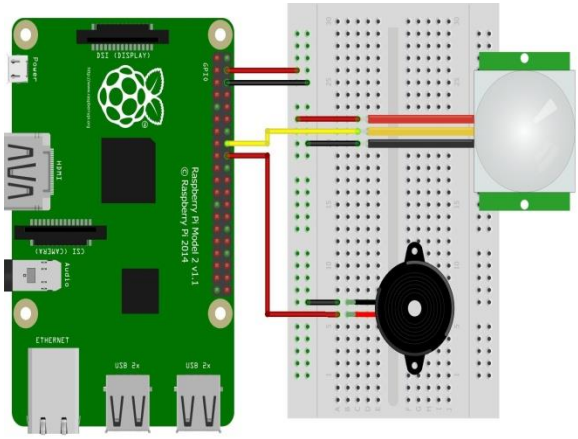

Fig: PIR sensor connected to raspberry pi

6. PROPOSED METHODOLOGIES

6.1. GOOGLE ASSISTANT API

The magic mirror represents a convergence of sophistication and utility, where technology seamlessly integrates into everyday life. At its core lies Google Assistant, a digital companion that transforms the mirror into a hub of productivity and convenience. With just a voice command, users can effortlessly manage their schedules, set reminders, and access a wealth of information. Whether checking the weather forecast, searching for recipes, or controlling smart home devices, Google Assistant empowers users to navigate their day with ease. Its intuitive interface and seamless integration make the magic mirror not just a reflective surface, but a dynamic tool that enhances efficiency and connectivity in the modern home. **Implementation Steps:**

To integrate the Google Assistant functionality into your magic mirror, you'll need a Raspberry Pi or similar platform equipped with a microphone and speaker for voice input and output. The software requirements include setting up the Google Assistant SDK and obtaining API credentials through the Google Cloud Platform. Once authenticated, you'll develop a Python script to manage voice input, process requests using the Google Assistant API, and generate responses. Finally, seamlessly integrate this functionality into your magic

mirror software, enabling users to interact with the Assistant through voice commands. This integration enhances the mirror's interactivity, allowing users to access a wide range of information and services hands-free.

6.2. SPOTIFY API

Within the sleek frame of the magic mirror lies an immersive audio experience, courtesy of Spotify. This innovative integration transforms mundane moments into melodious escapes, as users indulge in their favorite tunes while going about their daily routines. With Spotify seamlessly integrated into the mirror's interface, users can curate personalized playlists, explore new genres, or simply hit shuffle for a serendipitous soundtrack to accompany their reflections. Whether preparing for the day ahead or unwinding in the evening, the magic mirror becomes more than just a reflective surface; it becomes a portal to a world of endless musical possibility, elevating the ambiance of any space with its harmonious accompaniment. **Implementation Steps:**

For integrating Spotify functionality into your magic mirror, specific hardware requirements are not necessary. However, you'll need access to the Spotify API for controlling playback and accessing user data, along with an OAuth2 library for authentication. Development can be done using Python or JavaScript. The implementation process begins with registering your application with the Spotify Developer Dashboard to obtain API credentials. Next, implement OAuth2 authentication to enable users to log in to their Spotify accounts securely. Utilize the Spotify API to control playback, access playlists, and retrieve track information. Finally, seamlessly integrate the Spotify functionality into your magic mirror software, empowering users to play music directly from their Spotify accounts, enhancing their experience with personalized audio entertainment.

6.3. FACIAL RECOGNITION

The magic mirror stands as a testament to the fusion of cutting-edge technology and personalized convenience, boasting an advanced facial recognition system. This innovative feature adds a layer of sophistication to the mirror's functionality, allowing it to greet users by name as they approach and customize their experience based on individual preferences. With a quick glance, the mirror seamlessly identifies users, unlocking a tailored interface that may include personalized reminders, favorite music playlists, or even skincare recommendations based on previous interactions. Beyond its practical applications, facial recognition imbues the mirror with a sense of intimacy, creating a truly personalized and immersive experience that blurs the lines between technology and everyday life.

Fig: raspberry pi camera module

Implementation Steps:

To incorporate facial recognition capability into your magic mirror, you'll require specific hardware components including a compatible camera for your Raspberry Pi or chosen computing platform, with an optional IR illuminator for enhanced performance in low light conditions. On the software side, you'll utilize OpenCV, a widely-used computer vision library, along with a facial recognition algorithm such as Haar cascades or deep learning-based methods. Development will typically be carried out in Python or another suitable programming language. The implementation process involves setting up the camera, installing necessary drivers, and developing a Python script using OpenCV to

capture video frames and perform facial recognition. Following this, you'll train the facial recognition model using a dataset of known faces, allowing the system to recognize individuals. Finally, seamlessly integrate the facial recognition script with your magic mirror software, enabling it to take actions or display personalized information based on recognized faces, thereby enhancing user experience and interaction.

7. OUTPUT

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