

# Artificial Intelligence System for Facial Recognition and Home Automation Applications using A Smart Mirror

Dr. Vijaya Kumar A V<sup>1</sup>, Mr. Roopesh Reddy Sadashiva Reddy<sup>2</sup>, Ramesh Byali<sup>3</sup>

<sup>1</sup> Associate Professor, Department of Computer Science and Engineering, PDIT, Hosapete.

<sup>2</sup> Data Scientist, Oklahoma state University, Miami FL

<sup>3</sup> Assistant Professor, Department of Computer Science and Engineering, PDIT, Hosapete

**Abstract:** In this world everybody keeps running behind the solace and comfort. Present day man has a diverse innovation for a similar purpose. Individuals are willing to access information effectively regardless of whether it is through the TV or web. A Brilliant Mirror is proposed which is an interactive system that makes the user to get updated of the day-to-day happenings. Imagine a scenario in which you can investigate the mirror and could see something more than yourself. It will inform the time and date each time you investigate it. It will be interesting if the Mirror recognizes the user and reminds the important meetings on that day. Imagine a scenario in which the mirror could disclose at it's drizzling outside and prescribes to take an umbrella? Sound fascinating, isn't that so? For this reason an Intuitive Mirror is presented. The smart Mirror gives a close experience that enables the user to simply stroll up and be greeted with information. Unlike the magic mirror in the fairytale story to say the most beautiful lady in the world, the proposed mirror system try to alleviate the home member's bad mood by providing positive statements and music therapy. Thus, in a broad sense, the proposed mirror system provides a social relationship between the viewer and the mirror.

*Index Terms- Emotions, IoT, Reflecta, Natural Language Generation*

## 1. INTRODUCTION

The Smart Mirror system which is based on the concept of Internet of Things (IoT) is developed specifically to allow users to manage and control house appliances through voice recognition. In this case, managing house appliances has been identified as the main problem faced by most people. There are just too many things to be done at one time and at certain point, users are not able to multitask such daunting chores. For example, when a to-do list with a number of house chores has been recorded on a paper, but the paper is lost because it is misplaced. Another example is when users are too busy

managing their daily activities until some trivial-yet-critical things are forgotten such as switching off the lights in a room, which can eventually lead to energy wastage. Users are required to give instructions to the system orally, and the system's sensors will recognize the voice of the consumer to receive instructions and respond to users' needs. Smart Mirror aims at augmenting the basic reflective mirror with embedded intelligence to combine daily routine tasks like reading newspaper, getting stock updates, weather updates etc. and providing all that data to the user while he/she gets ready.

The Smart mirror will help in automating our work and development of smart houses. Along with the development of technology, various information can be found easily and the emergence of the concept of Smart Mirror Smart Home has become increasingly widespread. Day by day all are moving towards a more automated and interconnected world because of various wirelessly connected embedded devices[9]. These are responsible for changing and improving the standards and quality of living. Many devices are being developed which use concepts of multimedia communication, artificial intelligence, internet of things (IoT) to revolutionizing the way we perform our various day to day tasks in our home, offices or even industries. Most of them use mirrors every day to look at themselves; they psychologically interact with the mirror every day to check how they look and how their attire is while getting ready for their work or colleges. So, the idea of having an interactive mirror that can respond.

A Smart Mirror can display the weather, time, date and traffic conditions on the mirror. These all features can be implemented by using the Raspberry Pi and the data from the internet. Raspberry Pi runs with Raspbian Jessie PIXEL Operating System (OS) [14]. The common procedure of building a Smart Mirror is by using an acrylic sheet covered over the LCD monitors. The Web browser and JavaScript or

Python are used for the UI display. The usage of Smart Mirror provides many advantages, it makes life easier i.e. one need not to check mobile for notifications, weather updates etc., This can be advanced by introducing the motion sensor to detect the motion of the objects and can be able to watch the movies, read news and also all our home appliances can be controlled with Smart mirror.

We use the mirror multiple times every day to see if we have dressed well or how our hair looks and even do a lot of grooming in front of it. Reflecta is an advancement effort to develop an embedded intelligence onto a mirror and offer enhanced features such as latest news, headlines, weather, and local time corresponding to the user's location. The Smart Mirror is a stepping stone in development of smart homes with the help of embedded artificial intelligence. It's found its applications in various workspace as well.

This Phase intends to implement an electronic board known as RASPBERRY PI 3 board. Basically, the Smart Mirror consists of a 2-way mirror with a hardware technology including the LCD display and raspberry pi 3 board connected to process the inputs and display the outputs in the LCD screen which tend to appear in the mirror. In this world everybody keeps running behind the solace and comfort[15]. Present day man has a diverse innovation for a similar purpose. Individuals are willing to access information effectively regardless of whether it is through the TV or web.

## 2. PROBLEM STATEMENT

The world we live in today has become a place of the fiercest competition, whether it is in sports, entertainment, or the job market. In order to be the best, one needs to allocate an extraordinary amount of time to their goals with little distraction. However, the advent of information technology tends to act like a dual-edged sword when it comes to work productivity; sometimes one can use the ease of information to help them complete a task, but it can also provide significant distraction. Ultimately one strives to be their best, but the interruption of keeping up with the daily news, or preparing for incoming weather can hinder one's progress. Taking time throughout the day for these various activities can be extremely distracting and greatly cut into performance.

Along with information, people greatly value their appearance, spending approximately an hour a day

in front of the mirror during their morning and night routines. This is a significant amount of time where important things are taking place, but the mind is not working. It would be extremely useful to spend that time on the phone or computer completing any of the tasks mentioned above, but unfortunately it is difficult to do so while preparing for the day.

The goal of the Smart Mirror is to provide a single easy to access location for a person to receive all the information that could affect how they prepare for the day. Through the use of LCD displays and a two-way mirror, weather, time and date, and news are available at a glance.

Additionally, a user-friendly interface, accessible from any Wi-Fi enabled device, allows the user to easily setup the connection to their home Wi-Fi, change the location from which they receive the weather, and select a source from which to receive the day's headlines[10]. By building these features into a mirror, which most people will already be using in their morning routine, it is possible to present this information in such a way that it will seamlessly blend together with the task of morning grooming.

## 3. LITERATURE SURVEY

1. "Smart Interactive Mirror Display" Devi Singh and Varsha Singh, 2019 International Conference on Machine Learning, Big Data, Cloud and Parallel Computing (Com-ITCon), India, 14th -16th Feb 2019

A suit of six applications are presented on the 32" high-definition screen surrounded by a framed encasing that contains speakers and a webcam. These apps include weather, Twitter, news, to-do list, calendar, and music. The smart mirror application by is run from a central computer with Windows 8.1 which features a multi-core CPU, solid-state memory, and wireless connectivity. The application can be interacted with use of the Leap Motion controller. This controller allows for touch-free control of the smart mirror by use of finger swipes, taps, and circles. There is also the option to use voice control to play music, post a tweet, or add a task to the to-do list. Finally, the mirror monitors its own temperature and humidity levels so that if the bathroom becomes potentially harmful to the computer's hardware, it can execute preventive measures and shut the system down.

2. "Design and Development of a Smart Mirror - Using Raspberry Pi " Jagdish A.Pateljayshri T.

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In Today Society Information Is Available to Our Phones, Our Laptops, Our Desktop and More. The One That Concerns The Common Man Is Now It Can Be Used To Make Day To Do Life Easier And Faster .This Paper Design And Development Of A “Smart Mirror” With Use Home, Industries, And Platforms. This Project Which Would Collect Real Would Machine Data and Data Would Be Transmitted from The Machine and Managed by The Raspberry Pi Board. This Project Is Used by Raspberry Pi3 Version Model-B. This Smart Mirror Is Latest Version of Raspberry Pi. This Mirror Is Developed by Multimedia Futuristic Smart Mirror. The Mirror Is Implemented as A Personalized Digital Device with Peripherals Such as Raspberry Pi, Microphone, Speaker, Ledmonitor with Reflected One Way Mirror Provides Most Basic Common Such As Weather Of City, Updates Of News And Headlines Corresponding To Location.

3. “Artificially Intelligent Smart Mirror using Raspberry Pi” Abdullahil Kafi, M. Shaikh Ashikul Alam, Sayeed Bin Hossain International Journal of Computer Applications (0975 – 8887) Volume 180 – No.16, February 2018

#### 4. OBJECTIVES

To develop a smart mirror device as well as an operating system to run on similar devices.

1. The operating system would support running apps and would show weather, time, calendar, recent email, news and compliments depending on the time.
2. To play songs based on emotions of the person.
3. To Controls appliances (such as fan, lights, tv) based on voice commands.

#### 5. FUNCTIONAL REQUIREMENTS

1. Must be able to display information on screen
2. Must be controlled by something without requiring direct input
3. Must be connected to the web to receive incoming data
4. Must be module-based and contain sample default modules
5. System defaults in low power sleep mode

6. Must be able to scale to multiple screen sizes

Recommended:

1. Controlled by alternative input methods
2. Live RSS feed displays
3. Integrate more advanced web modules, perhaps a browser
4. Sleeps when certain time has passed

Non-Functional Requirements:

- A simpler user interface than a computer
- System has good performance for users
- System maintains good reliability for users
- Display disappears and becomes a mirror
- A friendly user interface that works by selecting modules
- System remembers username and can reply to user by name

Hardware Requirements

- Raspberry Pi
- Webcam
- Speaker
- Microphone
- Relays

Software Requirements

- Operating system: Windows XP / 7
- Coding Language: Python
- Software: Open CV

#### 6. DESIGN & METHODOLOGY

- (1) Time and Date: The time of the CPU used (Raspberry Pi) in the mirror was shown
- (2) Calendar: The international calendar in the mirror as well as the upcoming holidays was integrated in the system. The help of open source website to fetch the API of the calendar was taken.
- (3) News: The news functionality was integrated, which will show the RSS feed of any newspaper of the world.
- (4) Artificial Intelligence (AI): Figure below shows the working principle of AI.

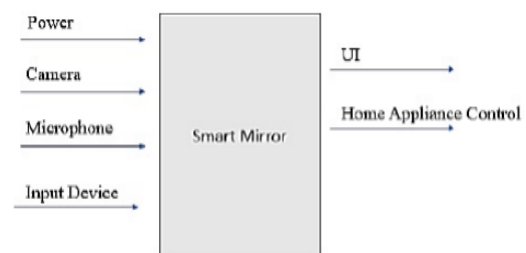


Figure : Google Speech recognition on AI Smart Mirror Implementation

1. AI will take voice information as input and through voice recognition, will identify users. Processing audio or speech is more time consuming than processing text. So, the audio input will be converted into text through speech software, here used google speech to perform this task.

2. To make AI understand the text, wit.ai was used which would have intent and entity [13]. Then the AI needed to retrieve relevant information as per user request and this the knowledge phase was called. Once the information is obtained, AI needs to form a complete sentence to express the information, so this is done in the Natural Language Generation state.

### 6.1 Home Automation Application

Smart mirrors are straight from science fiction. They're part of an optimistic vision of the future that imagines a world where screens and data are everywhere, ready to feed you whatever information you need at a moment's notice. Basically, the mirror is looks like normal mirror but when someone stand in front of it the scene changes. The mirror provides a functional, user friendly and interactive UI to its user for accessing their social sites, messengers, etc. It has widgets for displaying the current whether conditions, Time, Events, Latest news headlines Virtual dressing, a smart way of having trials with your fashion sense make things quite easy in malls. Having such intellectual mirror will only surge the beauty of home[12]. The raspberry pi is programmed using python and connects to a monitor with inbuilt speaker so as to provide an onscreen interface and voice assistance as well.

### 6.2 Facial Emotion Detection Implementation

Facial emotions are important factors in human communication that help us understand the intentions of others. In general, people infer the emotional states of other people, such as joy, sadness, and anger, using facial expressions and vocal tone. According to different surveys verbal components convey one-third of human communication, and nonverbal components convey two-thirds. Among several nonverbal components, by carrying emotional meaning, facial expressions are one of the main information channels in interpersonal communication. Therefore, it is natural that research of facial emotion has been

gaining lot of attention over the past decades with applications not only in the perceptual and cognitive sciences, but also in affective computing and computer animations

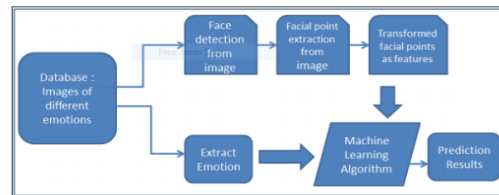


Figure : Facial emotions in conventional FER approaches, the FER is composed of three major steps, as shown in Figure (1) face and facial component detection, (2) feature extraction, and (3) expression classification. First, a face image is detected from an input image, and facial components (e.g., eyes and nose) or landmarks are detected from the face region. Second, various spatial and temporal features are extracted from the facial components. Third, the pre-trained FE classifiers, such as a support vector machine (SVM), AdaBoost, and random forest, produce the recognition results using the extracted features

## 7 APPLICATIONS

- Face recognition
- Controlling of electrical components like light , Fan and others using voice commands
- Music Playback

## 8. CONCLUSION

The Smart Mirror system we've got developed combines the concepts and methodologies that are implemented in other systems like smartphones which does multitasking at one point of your time. it's a unique method of making a wise interactive system that's reliable and simple to use. we've got focused on an interactive and user-friendly appliance that's beneficial to the user. The Smart Mirror that we've got developed provided a natural interaction between user and also the ambient home services that were operated using the smart mirror. The architecture has been adapted from the event and deployment of varied services. The smart mirror that we've got developed has accomplished the objectives that we had set once we first began to work on this project. It most efficiently allowed the user to induce the data from various sources, managing daily tasks, set and acquire the remainders set for the day, play music, stream media, while

spending their time before of the mirror as their daily routine.

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