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# SMART MIRROR INTEGRATED WITH SMART ASSISTANT

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**Abstract: -**This paper is focused on making the use of a simple yet indispensable object mirror in a more avant-garde way. In this we have incorporated a virtual assistant that will act as an interface between user and a mirror. It will also show basic details such as temperature, news feed, time, etc. While showing this information the user experiences keeps the simplicity of the mirror and still effectively relay the information.
The setup is quite inexpensive and easy to handle making it accessible to the larger spectrum of society. Materials used in the smart mirror are affordable and durable. All the software packages are open-source and requires very limited amount of processing power. Programs while running consumes slighter amount of internet. Since all the components are integrated into one piece making it more of a plug and play device. While attaining such functionalities we have used the prevalent concepts of Internet of Things, Artificial Intelligence, Pattern Recognition and much more.

**Keywords***:* Smart Mirror, IOT, Virtual Assistant, Raspberry Pi, AmI, Artificial Intelligence

## 1. Introduction

In this world everyone needs to be a comfort in life. Modern man has invented different technology for his sake of life. In today's world, people need to be connected and they are willing to access to information easily. Whether it is through the television or internet, people needs to be informed and in touch with the current affairs happening around the world.

There has been a steady and significant growth of use of smart devices in the past decade. This is as a result of the growth of the industry of Internet of Things (IoT). Each day there are more and more smart devices, vehicles, buildings and other objects, which consist of software and electronics, that are interconnected either by some network or to the Internet. These smart things have the main purpose of collecting and exchanging data [5]. The constantly increasing usage of smart interconnected devices on a global level, led to a growth of smart homes as smart technology ecosystems, whose purpose is to coordinate and optimize our daily activities.

The vision of Ambient Intelligence (AMI) has brought a new twist to decade-old research initiatives in the industry realizing smart environments. The AMI vision, as proposed by the European Consortium, promotes a paradigm in which humans are surrounded by intelligent and natural interfaces offered by heterogeneous computing devices that are connected to everyday objects. The resulting environment is able to identify and react to actions and the presence of individuals. Thus, Aml can be seen as the driving force for a more user-friendly environment that enables effective support for human interactions.

## 2. Background

### *2.1 Smart Mirror: A Novel Framework for Interactive Display [12]*

Athira S, Frangly Francis, Radwin Raphel, Sachin N S, Snophy Porinchu, Ms. Seenia Francis
Our lifestyle has evolved in such a way that optimizing time is the most important thing. Based on the user studies and prototype implementation, we present the development of an innovating appliance that incorporates interactive services of information, offered through a user interface on the surface of a mirror. Our work is based on the idea that we all look at the mirror when we go out, so why don't the mirror become smart. The framework will offer basic services, like the presentation of personalized weather data, time, date and will incorporate some additional functionality, like reminder service by mobile synchronization and through social media. Our framework is based on detecting presence of human using Passive Infrared sensors and Wi-Fi connectivity. Once a person comes in front of the mirror, it displays the information that is being fed from the web. This data or information includes calendar, time, weather, news feed, notifications and so on. Our framework also discusses about the speech recognition and its application in control mechanism in home appliances and opening and closing of shelf. We use speech recognition to automate many tasks that usually requires hands-on human interaction, such as recognizing spoken commands to perform something like turning on lights or shutting a door. Our framework also introduces speech activated music player and plays the music when a person gives a command.

### *2.2 Building a Smart Mirror [13]*

Josep Cumeras i Khan, Treball de Fi de Grau
The Internet transformed our lives by connecting us more easily to information and other people in the virtual world. Mobile phones then became smartphones and since then this concept has erupted and morphed into the Internet of Things, things which connect us to everyday objects. There is no end of objects that could be made "smarter", some being more suited to this than others. Mirrors, for example, provide a large surface ideal for displaying information and interacting with. Most people have mirrors at home so the concept of a smart mirror that you can interact with is attractive and has been fantasized in many futuristic movies.

### *2.3* An Intelligent Multisensory Mirror for well-being self-assessment [14]

Yasmina Andreu-Cabedo, Pedro Castellano1, Sara Colantonio, Giuseppe Coppini, Riccardo Favilla, Danila Germanese, Giorgos Giannakakis, Daniela Giorgi, Marcus Larsson, Paolo Marraccini, Massimo Martinelli, Bogdan Matuszewski, Matijia Milanic, Mariantonietta Pascali, Mattew Pediaditis, Giovanni Raccichini, Lise Randeberg, Ovidio Salvetti, Tomas Stromberg
The face reveals the healthy status of an individual, through a combination of physical signs and facial expressions. The project SEMEOTICONS is translating the semeiotic code of the human face into computational descriptors and measures, automatically extracted from videos, images, and 3D scans of the face. SEMEOTICONS is developing a multisensory platform, in the form of a smart mirror, looking for signs related to cardiometabolic risk. The goal is to enable users to self-monitor their well-being status over time and improve their life-style via tailored user guidance. Building the multisensory mirror requires dressing significant scientific and technological challenges, from touchless data acquisition, to real-time processing and integration of multimodal data.

### *2.4* Design and development of a smart mirror using Raspberry Pi [15]

Vaibhav Khanna, Yash Vardhan, Dhruv Nair, Preeti Pannu
Interactive computing, with wirelessly connected embedded devices that are being used in various day– to–day activities, are changing and improving the standards of the quality of life. Based on this interactive computing and communication technologies, many devices/products are now emerging and with this multimedia intelligence it is providing comfortable, secure and convenient personal services everywhere whether it is home or various industries and making a lot of users comfortable. We look at the mirror daily and interact with it psychologically to find out how we look and how our attire is. The interactive mirror is a development effort to augment the mirror with proper embedded intelligence for offering enhanced features such as weather of the city, latest updates of news and headlines and local time corresponding to the location. The Smart Mirror would help in developing smart houses with embedded artificial intelligence, as well as finding its applications in industries.

In the late 1990s, Eli Zeikha and his team at Palo Alto Ventures presented a future vision Ambient Intelligence

(AmI). This vision is for the 2010-2020 time frame. This vision is leading the industry to develop intelligent environments. The vision is to develop an environment with natural interface that includes heterogeneous digital devices connected to everyday objects. This environment can recognize and respond to user actions and also includes networking, voice recognition, face recognition, artificial intelligence, machine learning and so on.

This AmI environment provides security, availability and resourceful to the users. The features generally expected in AmI are:
1. Embedded Heterogeneous devices that are to be integrated into the network to create an environment.
2. Context Cognizant: All these devices can recognize the situational context.
3. Customization: All these devices can be customized according to specified user needs.
4. Adaptation: Through machine learning, these devices can adjust nature and behaviour and respond accordingly.

| Feature | Microsoft's Magic Mirror | Ekko Smart Mirror | Apple Mirror Rafael Dymek | Nuovo Smart Mirror | Perseus Smart Mirror | Naked 3D Fitness Tracker |
|---|---|---|---|---|---|---|
| Platform | Windows | Customized | iOS 10 | Android | Customized | Customized |
| App Requirement | No | Yes | Yes | Yes | No | No |
| Voice Recognition | Yes | No | No | No | Yes | No |
| Touchscreen | No | No | Yes | No | No | No |
| Gestures | No | Yes | No | No | No | Yes |
| Fitness | No | No | No | No | No | Yes |
| Music Support | Yes | Yes | Yes | Yes | Yes | No |
| Video Support | Yes | Yes | No | Yes | Yes | No |
| Automatic Sleep | No | No | Yes | Yes | No | No |
| Weather | Yes | Yes | Yes | Yes | Yes | No |
| Map | Yes | No | Yes | Yes | Yes | No |
| Social Networking | Yes | No | Yes | Yes | Yes | No |

A Detailed Comparison of Mirror [16]

## 3. PROBLEM STATEMENT

The AmI aware smart environments and surrounding, whether it is the home environment or the distributed environment, uses a variety of smart technologies. These technologies integrate sensing, processing, reasoning, and networking capabilities in addition to heterogeneous applications, services and digital contents. With all of these rich technologies involved, AmI faces challenges unobtrusively, in order to provide computing intelligence in the surrounding environment [8].

The advancement of the key technologies and a variety of smart artefacts will play a major role in providing ambient intelligence in the home environment. Research in this direction has addressed the development of smart pen, gate reminder, GIA (picture management device), smart wardrobe, smart dressing table, smart bed, smart pillow, smart mat, smart picture frame, and so on. The development of smart appliances may be considered as the realization of the vision "the real world is the interface". Our work is geared towards this direction and is focused on the design and development of a smart mirror interface for the ambient home environment.

## 4. METHOD

We propose a smart mirror which is an interactive system and helps to know notifications as well. It is an attempt to contribute something more to the design of a real mirror system so that the interface is used for virtual application. Today everyone is busy, but for a while he will look into the mirror when he goes out. What if you look into the mirror and could see something more than yourself? It feels good What if your mirror could detect you and let you to know that you have an important business meeting at 4pm today? What if the mirror could tell you that it's cold outside and recommend you to wear a sweater? For this purpose, we introduce an interactive mirror. We do not value efficiency at home in the way as we do in a business office. The system has application in the glass tables also. This information can be fetched into the table. At a same time, we can access and get notifications of social media like Facebook, Google plus, Gmail etc., provided that the table is large enough. Smart Mirror was developed for application in a personnel room; its features include user detection, display method. In several investigations in interactive systems, smart homes have been developed by combining monitor and mirror systems. Pyroelectric infrared sensor is used to detect the infrared radiation changes in the environment and this has a relative sensitivity to the human [7].

Home automation, socialization, entertainment, etc. will be provided by AmI along with an intention to develop a smart appearance for the AMI's environment.

There are different types of smart mirrors offered or available in the market. Some of them are discussed below:
The proposed Smart Mirror will perform the following tasks:

1. A normal two-way mirror and acrylic glass which will display a real time reflection.
2. On start-up, the mirror will display weather, time and news.
3. The mirror will play music and videos.
4. The mirror would be able to zoom in and out of images in real time.
5. The mirror will automatically sleep if a person disappears from front using sensors.
6. The mirror can be synchronized with our email to provide updates and reminders.
7. The mirror will also support multiple user profiles.

## 5. LITERATURE REVIEW

a) State of Art: Review
The main strengths of this project are that this is a new kind of smart device that people don't see every day and it looks very spectacular. The platform has a very simple API that makes it very easy for developers to make apps. The voice recognition is very accurate thanks to Google's services [10]. The smartphone integration works very well and it is something that hasn't been done with smart mirrors before. Of course, there are also weaknesses: the app ecosystem is currently very small, the glass could be more reflective but it can be easily changed, the swipe gestures are sometimes unreliable and finally I would have liked to have the hardware and software more decoupled because currently the sensors and microphones are tied to the software and it can be difficult to make the OS work with different hardware. However, this can also be solved given enough time by making the software more modular.

b) Face recognition
With this technology integrated in our mirror we make our mirror capable enough to identify and verify a person. This will be our first step in the direction of security. Our method will generally work by comparing selected facial features. Here we are using MMM-Facial-Recognition_Tools which is an open source repository developed in node.js to setup and train a facial recognition module for our smart mirror. The scripts which are used in this repository are based on scripts from pi-facerec-box. It will be suitable for our web cam and works well with a RaspberryPi.

c) Our Voice Assistant – Ophelia
We made our own voice assistant: Ophelia for our smart mirror. A software agent which can perform tasks or services for an individual and interacts through natural voice is referred to as a Virtual Assistant. Building Ophelia was an intriguing task for us. Mainly, Google Text-to-Speech and Wolfram Alpha was used for Ophelia.

1. Google Text-to-Speech

Google Text-to-Speech is a screen reader application developed by Google for Android. It supports

applications reading aloud (pronunciation) text on the screen which supports many languages. Text-to-speech can be used by applications such as Google Play Books to read aloud through Google Translate to read translations aloud, providing useful pronunciation statistics through Google Talkback and other applications based on spoken comments, as well as by third party applications. Users must install voice data for each language. Applications such as Text Plus and WhatsApp use the Text to Speech feature to read aloud messages and provide voice response functionality.

2. Wolfram Alpha

Wolfram Alpha is an integral part of our Voice Assistant Ophelia. It is a computer engine or answer engine developed by Wolfram Alpha, a research subsidiary of Wolfram. Being an online service that answers real-time questions directly through the "structured data" response account from outside sources, rather than providing a list of documents or web pages that may contain the answer as a search engine.

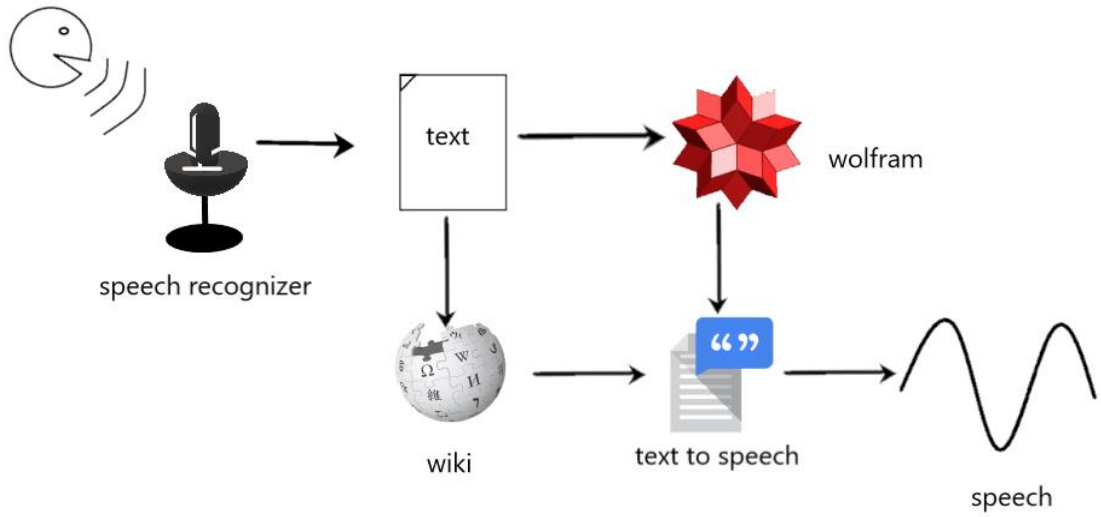
Wolfram Alpha is written in 15 million lines of Wolfram Language code and runs on more than 10,000 CPUs. The database currently contains hundreds of data sets, such as "All current and historical weather". Data sets have been accumulated over several years. Structured data sets (as distinct from automatic data) are verified for quality either by another scientist or expert in a related field, or by a person who acts in writing and simply proves that the data sets are "acceptable".

3. Speech Recognition

Google Cloud Speech-to-Text will use its extremely efficient neural network model to correctly identify speech and convert it into the textual form. The API we are using is extremely powerful and easy to use. It can recognize 120 languages and variants which will become handy in many non-English speaking regions of world.

The important features are: -

- Automatic Speech Recognition
- Noise Robustness
- Global Vocabulary
- Word Hints
- Real-time Streaming or Pre-recorded Audio Support
- Noise Robustness
- Inappropriate Content Filtering
- Automatic Punctuation
- Model Selection




Flow Diagram

## 6. FUTURE SCOPE

The scope of this study is to develop an efficient and cost-effective solution for the development of a Smart Mirror to reduce and possibly eliminate the need for the user to make time in their daily morning or nightly routine to check their PC, tablet, or smartphone for the information they need. The mirror will provide the information with little to no effort from the user with the goal of not being a burden that he or she must maintain. The mirror wouldn't be another activity, rather an enhancement to the already common use of mirrors in most modern bathrooms [4].

The mirror will do the thinking for the user. First, it will turn on and off by itself. Then, it will update with the user's calendar schedule, to-do lists, Twitter, news, and weather. The information wouldn't be thrown in the user's face, but unobtrusively displayed on the edges of the mirror to still allow use of the actual mirror. The mirror provides common information most people check their smartphones or tablets for, such as weather, news, Twitter and schedules. This allows the users to read, think, and plan their day while getting ready in the morning or night [6].

## 7. CONCLUSION

Our system integrated the concept and methodologies that have been implemented in many existing systems a smart mirror system. It is a novel application of creating a smart interacting system. The system is reliable and easy to use, in this interactive system; we have been concentrating on an interactive system for home. There exist many benefits from the smart mirror. A service-oriented architecture has been adapted for the development and deployment of the various services, where the mirror interface, the news feeds all use Web service communication mechanisms. By utilizing sensor, we can reduce the power consumption since the mirror will display information only in the presence of a human.

The future prototype is ripe with potential and probably robust in terms of functionality. It utilizes facial recognition software to push up personalized data including health status, a calendar, news feeds, and other information relevant to your morning routine. It uses voice commands to switch between each views and gestures to interact with content. Rather than confined to a home we can implement the functionality to a glass material. So that it can have a wide range of applications like one can setup this functionality to a glass table, which he used in office. This will help him to know about notifications from many sites at the same time in a single screen. Another application is that this functionality can be setup in public places.

## 8. ACKNOWLEDGMENT

Success is not only the hard work and innovation but also the inspiration and motivation. Completing this task was never one-effort. It is the result of invaluable contribution of number of individuals.
We feel great pleasure to submitting this research paper on Smart Mirror & it's voice assistant Ophelia. We wish to express our deep gratitude towards our guide whose untiring efforts only, to bring our best out of us.

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