

# International Journal of Innovative Research in Science, Engineering and Technology

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## Personalized Interactive Smart Mirror Integrated by IoT and Raspberry Pi

P.Deivendran, S.Hemanathan, A.Jesu Jobim Jaspon, C.Santhosh Kumar

Department of Information Technology, Velammal Institute of Technology, Chennai, Tamil Nadu, India

**ABSTRACT:** Internet of Things (IoT) is a concept where an object having the ability to transfer data over a network with blazing speed and reality. Herein comes with a proposed system called Smart Mirror. It is a concept of smart home-based Internet of Things (IoT). Relevant information can be traced such as time and date, weather, warning, traffic, and location map. The system acts as a medium of interaction between people and systems. The users would be recognized either vocally or via camera to acquire response from system. The methodological approach used in this project is The Evolutionary Prototyping which gathers all requirements and designs the system in a quick method. A prototype is built to evaluate and deliver feedback. The system is impacted in such a way that it actually learns from the user queries and in return, caters to user's satisfaction. With this technology, users can be able to manage their daily activities by integrating the system with perceptiveness.

### I. INTRODUCTION

Everyone knows what a mirror is. In mirrors, we see our reflections. But what happens when you combine the idea of a mirror with technology? What possibilities are there and how smart could a mirror be? These are number of the queries for innovating such a technology. Possibly a light operating system with basic functionalities to gear this. The device was to go beyond an ordinary mirror, to have a screen inside that you would be able to interact with by using voice commands, hand gestures and even facial recognitions for multiple users.

The idea is a great combination of many of the things we have known: web technologies, electronics, UI design, etc.

The AMI (Ambient Intelligence) 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. AMI faces challenges building the gap between the human and interface system. The Smart Mirror was developed in four months, starting with the software and finally integrating it with the hardware. On the whole results were good because a higher level of interactivity has been achieved by being able to use voice commands, gestures and smart phones.

### II. LITERATURE SURVEY

- A. Tomoki Hayashi, Hideaki Uchiyama, Julien Pilet, and Hideo Saito specified, "The system can be deployed in real life home settings and feedback from wider set of users could be obtained for further enhancement of the system."
- B. Ana C. Andrés del Valle and Agata Opalach, "The Persuasive Mirror: computerized persuasion for healthy living , the features are all personalized using face recognition technique and is better optimized with new generation of visualization " Accenture Technology Labs, France.
- C. The Reveal Project , created in the New York Times research and development, consists of an LCD Display covered by a mirror glass. The device exploits a Microsoft Kinect for tracking user's movements in real-time. It visualizes different information on its surface (calendar, mail, news, online shopping websites, instant messenger etc.). In addition, it responds to vocal commands.

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- D. Tatiana Lashina, Philips Research, Netherlands quoted about the activity of, “ When the user is using the mirror, the system will check for reminders against him/her at that particular time. If so, it will remind and also send a message to a hand held device of the use”.

### III. EXISTING SYSTEM

- Philips HomeLab is a testbed for creating perspective and context-aware home environments. Among several projects, their work on creating an intelligent personal care environment uses an Interactive Mirror in the bathroom to provide personalized services according to the user's preferences. For example, children can watch their favourite cartoon while brushing their teeth. The mirror can provide live TV feeds, monitor the latest weather, and so on. The mirror is a combination of one or more LCD flat screen displays specifically combined with a mirrored surface and connected with a central processor to provide the intended services. The Interactive Mirror serves as a motivation to provide ambient feelings in the home environment.
- Medical Mirror combines computer vision and signal processing technique for measuring the heart rate from the optical signal reflected of the face. The prototype consists of an LCD display with built-in camera and a two way mirror fitted onto the frame. The smart mirror recognizes the presence of a user when she stands in front of it and, after about 15 seconds, it displays the heart rate below the user's image.

Multi Display in Black Mirror [5] by Toshiba is a prototype that combines the functionalities of a tablet together with the reflecting surface of a mirror. It provides two configurations taking into account two different home environments: the bathroom and the kitchen. Considering the bathroom, the prototype provides useful information for the beginning of the day such as the weather forecast and fitness information coming from personal devices

### IV. PROPOSED SYSTEM

The requirements and specifications of the Smart Mirror took inspiration from people's every day devices that they use including PCs, tablets and smart phones. The mirror integrated similar features from each to give the user what they would expect out of a modern 'smart' device. Figure. 1 is a schematic view of the smart mirror concept. Smart Mirror is a simple mirror that has been enhanced with the help of technology. The aim of the mirror is to provide an easy way for one to access information services such as news feeds, weather, traffic alerts, etc.

The project includes downloading the Raspbian operating system based on Debian and extracting the image on SD card, inserting the card in the Raspberry Pi SD slot and then performing the required steps. We plan to deliver a working prototype i.e. design and development of a futuristic Smart Mirror on Raspberry Pi 3 for the ambient home environment as well as for commercial uses in various industries. Most people have mirrors at home, so the concept of a smart mirror that you can interact with is attractive and can be fantasized by anyone.

At times no one has time to read the newspaper or switch on the TV right in the morning to check the news headlines or the weather forecast. If a mirror serves to this purpose, one can imagine the amount of time it will save and be of such a great use. The device was to look like a regular mirror but would have a screen inside. The project which would collect real world machine data such as location based latest news and headlines, weather reports, and as well as show us the local time. The data would be transmitted from the machine and would be managed in a central database. We have also worked on including Artificial Intelligence in the Smart Mirror wherein a Voice enabled assistant will cater to the needs of the user.

The Smart Mirror CPU is the Raspberry Pi 3 computer. This is where all the software components would lie in. The CPU takes in video information from the camera, runs that information through the facial recognition model and

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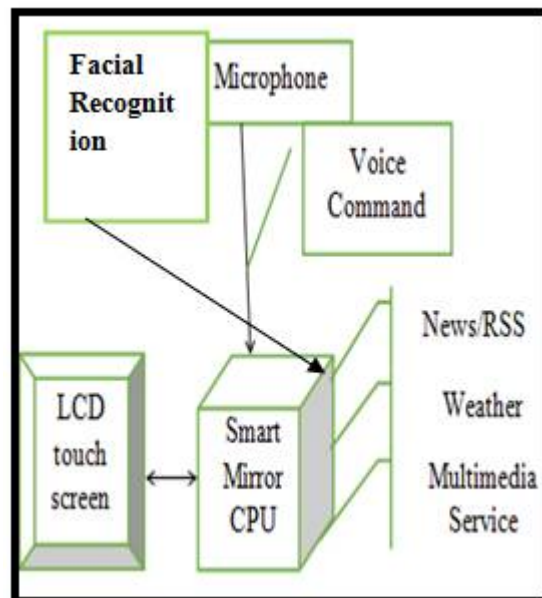
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identifies the user. After the CPU knows the person standing in front of it, it would retrieve the information programmed to show for that user. Finally, the CPU projects this information on to the connected LCD Screen.

The mirror uses a camera as its input source and it is the users face that provides the region of interest. The first step in the pipeline given is to detect new moving objects - objects that was not there before. The most basic way to differentiate moving objects in a video feed is to use a single image as a reference frame. Moving objects are then detecting by doing a pixel by pixel subtraction proceeded by applying a threshold to create a binary image where black pixels indicates no change and white pixels indicates a change - or movement.



### V. RELATED WORK

Our Smart Mirror represents a natural interface that facilitates access to personalized services. This is an attempt to contribute to the design of a smart mirror-like interface as well as the smart environment in which the interface is used for interaction. Below we briefly comment on some related research in this direction. The Smart Mirror contains some devices equipped with a touch screen or TV enhanced external devices. However, most of them support entertainment and some interactive tasks. The work has been reviewed as follows:

Mirror 2.0 [1] combines the advantages of a smart phone and a mirror. It contains an LCD display positioned behind the glass. It provides news and weather information and it allows the playback of both videos and music.

Smart Washbasin displays different information in a washbasin mirror such as mails, weather forecast, the water temperature and pressure, the calendar and the user's weight measured through a built-in-scale in the base portion. The device consists of an Android Tablet that displays the widgets on the basin mirror, made with a semi-reflecting glass put on top of an LCD display. It is possible to control it without touching the screen surface, since it is equipped with proximity sensors able to track the hands position and motion.

NEOD Framed Mirror TV is a standard LCD screen (up to 50 inches), covered by a mirror, and specifically designed for the screen. The screen provides some TV functionalities, but it does not provide more interactive features.

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Smart Mirror for home environment allows to control all the smart devices at home. It relays on face recognition for authenticating the user and displays personalized information (news, mail, messages etc.). The system exploits a - Brushing Teeth Mirror displays the information collected by a smart brush about inflammations or infections of the teeth and gums. Cyberecture Mirror [7], is a complete PC contained into a 37 inches mirror, equipped with a 32 inches LCD screen. Through a smart phone application, the user accesses different information overlaid on the reflected image. The interface allows visualizing instant messages, the calendar, the mailbox, and the weather forecast. In addition, it provides information on the user's physical state. Indeed, the device provides a set of external wireless sensors that allow to measure the user's weight, fat, muscle and bone mass.

- Interactive Mirror [8] by Panasonic seems to be an ordinary mirror: neither camera nor the other sensors suggest the features of a smart object. Once the user sits down in front of it, the mirror displays an enlarged frame for her face, together with menus for accessing different functionalities. The system analyses the face hydration, wrinkles and other details in order to recommend products and treatments to take care of her skin (e.g., to make it softer etc.), to slow ageing and so on. The mirror supports the user in buying such products. In addition, it provides make-up style previews, simulating lighting and ambient conditions (e.g., at home, outdoor, shopping center,(etc).

## VI. HARDWARE COMPONENTS OVERVIEW

### 1) Raspberry Pi

Raspberry Pi is a credit-card sized computer manufactured and designed in the United Kingdom by the Raspberry Pi foundation with the intention of teaching basic computer science to school students and every other person interested in computer hardware, programming and DIY-Do-it Yourself projects. The Raspberry Pi has a Broadcom BCM2837 system on a chip (SoC), which includes 4 ARM Cortex-A53 1.2 GHz cores as the processpr, VideoCore IV GPU and with 1 gigabyte of RAM. It does not include a built-in hard disk or solid-state drive, but it uses a microSD card for booting and persistent storage. It also includes Bluetooth 4.1 Low energy and a 2.4 Ghz 802.11n Wifi [12]. The Raspberry Pi is the back bone of this project and is used to fulfill all computational requirements. The Raspberry Pi computer has come out with various versions over the years. Our project employs the use of Raspberry Pi 3 Model B. A microSD card is used to store the operating system and all the software related code for the project.

### 2) Webcam

A simple USB powered webcam is used to recognize peoples faces.

### 3) LCD panel

An LCD panel placed behind the mirror is used to present to the user the desired interface. interface that works seamlessly with STL containers [13]. This project will utilize the facial recognition algorithm from the OpenCV library to recognize users.

### 2) Raspbian OS

Raspbian is a free operating system based on Debian optimized for the Raspberry Pi hardware [14]. Raspbian comes with over 35,000 packages, pre-compiled software bundled in a nice format for easy installation on Raspberry Pi computer.

### 4) Python

Python is a high-level, general purpose, interpreted programming language. Its very popular in the Raspberry Pi community and it has lots of support and libraries. We used it with the microphone to detect sounds and also for control of sensors.

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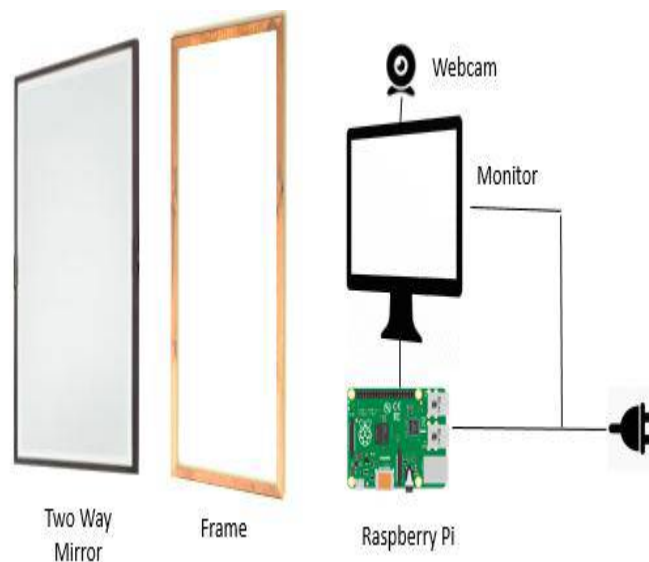
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### VII. MIRROR DESIGN AND ARCHITECTURE

- Facial Recognition: A webcam placed behind the mirror is used to recognize the user standing in front of the mirror. By recognizing the person, the mirror then knows how to interact or behave next
- Customized user profiles: The output of user recognition then triggers the display of the interface. The interface is designed as per the user. The interface allows a user to view Rich Site Summary (RSS) feeds of social media and email, have access to maps, calendar, weather and time.



### VIII. CONCLUSION

The Smart Mirror thus accomplishes this, by still being a mirror without all the technology inside it, making it very approachable to use and integrating seamlessly into our lives. The Smart Mirror has scope in the field of IoT and home automation. The Smart Mirror can be connected to the home appliances, mobile devices, etc. which can expand the functionality of the mirror.

The facial recognition technology used can be future enhanced as a means of security. Adding security means that no one can try to access sensitive data that maybe displayed on your mirror via the use of APIs. We believe that the future of the home will be a brilliantly connected ecosystem of smart technology designed to make your life easier, more enjoyable, and efficient. Obviously there are a ton of opportunities in the home for technology integration but a mirror is one of the best places to start.

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