HOME AUTOMATED ARTIFICIAL INTELLIGENCE MIRROR

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Abstract: ***The productivity of a company could be increased if the product has the multitasking capacity. The use of technology has become the regular task in one's day-to-day life. Home Automation concept is one of the fast blooming technology in this modern world. The main secret for Home Automation depends on the fast growing concept called Internet of things (IoT). Though the applications of IoT may vary accordingly, the main fact that relates to the common man is how it can be used to make day to day life easier and faster. This is where the concept of Home Automation using IoT and Artificial Intelligence comes in. The proposed system implements home automation using the automated intelligent home mirror. The mirror possesses the ability to display welcome note, date and time, the current weather condition and outside temperature. It also possess the ability to answer user queries through voice assisted AI chat bot and have the control over the other automated devices in home. These features of the mirror will be implemented using the raspberry pi board and the facial detection will be done through Opencv.***

IndexTerms – IoT, automation, temperature, raspberryPI, artificial intelligence, voice assisted.

I. INTRODUCTION

This proposed project has been developed with the aim to increase the use of more connected devices for the better enhancement of the automated world. The introduction of Internet to the world has not only transformed the scope of technology but also transformed our lives by connecting us more easily to the world of information and other people in the virtual world. The best example for this evolution is that the Mobile phones then transformed into the smartphones and PC's then evolved to Laptops. The proposed project is exploring a new way to use technologies in a more effective way. The state of innovation currently is to provide more information, but less interaction to get it. The device that has been designed and developed for the automation of home through new approach is called "Automated Mirror". It is a wall mounted mirror which displays the needed information to the user such as weather, time, date, important news updates and greetings. The mirror will solve the problems that many people experience every day, like the getting of information without any interruption or distraction. The user might need a suggestion at the end of a hectic day like before going to bed, the user may want to know whether it will snow or rain or whether it will be sunny the next morning so that they can plan their day accordingly.

The Internet of Things(IoT) is been defined as the network which consists of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these objects to connect and exchange data. Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing Internet infrastructure. The IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, virtual power plants, smart homes, intelligent transportation and smart cities.

The aim of this project is to implement the new way through which people could receive information through voice query. We see wall mounted clocks, which provided people with access to the time at a glance. We have displays in airports to show the timetable so that passengers can see the information. We also see massive tickers and advertisements. We have tried to personalize this concept and bring it to the home. The Automated Mirror lets people use their device less, while being presented with more. This is a major step in the evolution of information gathering technology. This is the moment technology is starting to get out of the way. Heads will be up, hands will be set free.

The rest of the paper is organized as below. In Section II, we present some related projects. Section III provides the overview of the proposed system and the Section IV presents the overview of key hardware and software components of the Automated Mirror. Section V discusses the result on execution of the proposed system. Section VI concludes the paper with some discussion on future work. Section VII briefs about the further references of this system.

II. RELATED WORK:

The Automated Mirror represents a natural interface that facilitates access to personalized services. This is an attempt to contribute to the design of a smart environment in which the interface is used for interaction. Below it is been briefly commented on some related research in this direction. The Automated Mirror contains some devices equipped with a LED screen enhanced externals devices. However, most of them support entertainment and some interactive tasks. The work has been reviewed as follows:

- The Reveal Project [1], 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. A peculiar feature is the medicine box scanner, which allows the user to buy medicines recognizing their packages.
- Cybertecture Mirror [2], is a complete PC contained into a 37 inches mirror, equipped with a 32 inches LCD screen. Through a smartphone application, the user accesses different information overlaid on the reflected image. The interface allows to visualize 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 [3] 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 Centre, etc.).
- Connected Store Demo [4] by eBay and Rebecca Mink off provides interactive experiences in both the store showcase and in the fitting room. Once finished, the shopper prepares the fitting room with all the items. Inside the fitting room, the user exploits the mirror for looking for other items and/or providing feedback. In addition, she may select some of them for buying.
- Brushing Teeth Mirror [5] displays the information collected by a smart brush about inflammations or infections of the teeth and gums.
- Medical Mirror [6] 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 reflected image.

In comparison to works described above, our work is different in that we aimed to develop a working system for providing services in the ambient home environment based on open standards and off-the-shelf technology, where the automated mirror is the interface to access/control various data feeds, information services, and appliances in the environment through the voice assisted query and commands.

III. PROPOSED AUTOMATED MIRROR:

Figure 1 shows a schematic view of the proposed automated mirror. The mirror is eventually a technologically augmented interaction device. The objective of designing the mirror is to provide a natural interface in the ambient home environment for accessing various services such as location based weather, time, calendar etc. as well as provide access to the control of home appliances through voice query. The project includes downloading the Raspbian operating system based on Debian and extracting the image on SD card, inserting the card in the Raspberry PiSD slot an then performing the required steps. We plan to deliver a working prototype i.e. design and development of a futuristic Automated Mirror on Raspberry Pi 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 automated 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. All these components reside behind a special mirror known as a Two Way Mirror.

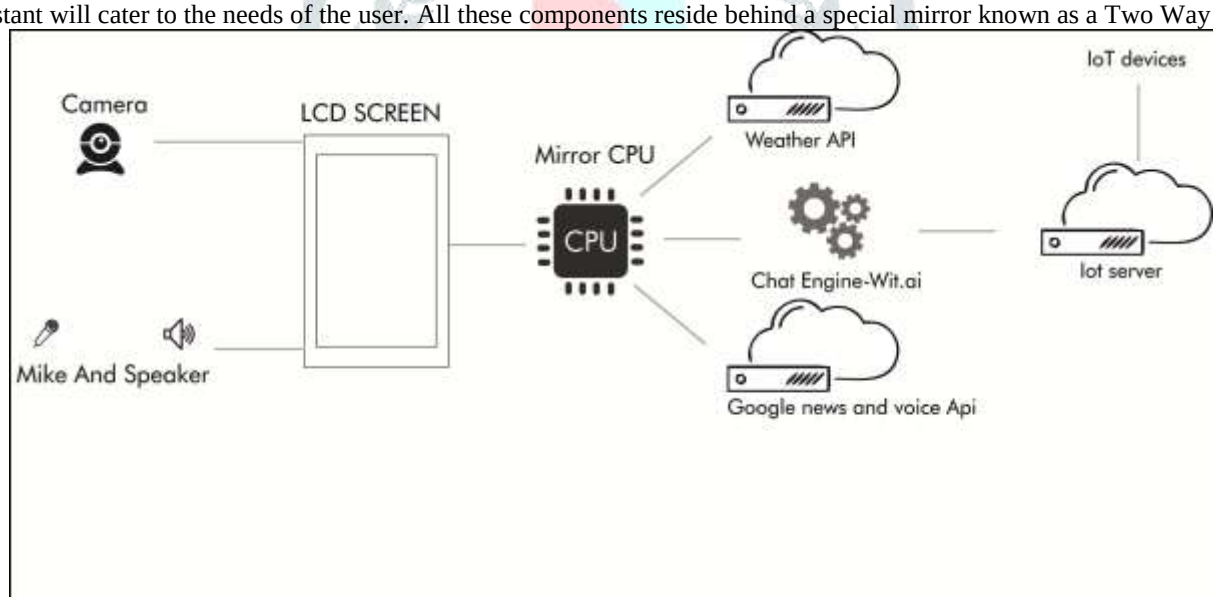

Figure-1 architecture of the proposed automated mirror.

IV. HARDWARE AND SOFTWARE SPECIFICATION:

A. 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 processor, Video Core 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 Wi-Fi .The Raspberry Pi is the back bone of this project and is used to fulfil 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 people faces.

3) LCD panel

An LCD panel placed behind the mirror is used to present to the user the desired interface.

4) Mirror

A special mirror known as a two way mirror or observation mirror is used in this project. A two mirror is special as compared to an ordinary household mirror. Unlike a household mirror, the two way mirror is not painted with an opaque color on the back , instead its left untouched. This gives the property of the mirror being reflective one side and transparent/translucent from the other. Hence the two way mirror acts as mirror as long as there is no light send from the back of mirror.

5) *Frame/Enclosure*

An enclosure is used to cover all the hardware behind the mirror so that the mirror looks as close as possible to a normal mirror as show in the Figure 2.

6) *Microphones*

One mode of interaction with the smart mirror is through microphones. Two microphones are used to power the voice recognition capabilities of the device. USB microphones has to be used because the Raspberry Pi does not have regular microphone input.

B. Software components overview

1) OpenCV

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for businesses to utilize and modify the code. The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects etc. OpenCV has more than 47 thousand people of user community and estimated number of downloads exceeding 7 million. The library is used extensively in companies, research groups and by governmental bodies. It has C++, C, and Python, Java and MATLAB interfaces and supports Windows, Linux, Android and Mac OS. OpenCV leans mostly towards real-time vision applications and takes advantage of MMX and SSE instructions when available. OpenCV is written natively in C++ and has a template interface that works seamlessly with STL containers. 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.

3) NodeJS

NodeJS is a JavaScript engine for server side applications. It comes included with Electron and we used it to launch processes to control things that are not available in web APIs such as the sensors and microphones for voice recognition.
We also used it to access the file system and read the app files.

4) Python

Python is a high-level, general purpose, interpreted programming language. It is 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.

V. RESULT:

The automated mirror tends to display the output for the user queries through the display monitor screen provided during the designing phase. As soon as the user appears in front of the mirror, it starts to act as an automated mirror until which it tends to remain as a normal home mirror. Then it starts to display the basic notifications like the temperature, weather, and social media notifications like news feed. User can query through voice that will be answered by the chat bot. The Monitor is the primary display that the device uses and it is the only end of interaction for the user. The user remains unaware of the rest of the functionality and therefore interacts primarily with the monitor itself. An acrylic sheet is placed on top of the Monitor to turn it into a reflective surface. Apart from being inexpensive, the sheet may also be replaced in the event of any damage, thus making it a more feasible option. The sample display screen for the automated mirror is been specified in figure-2 as shown below.

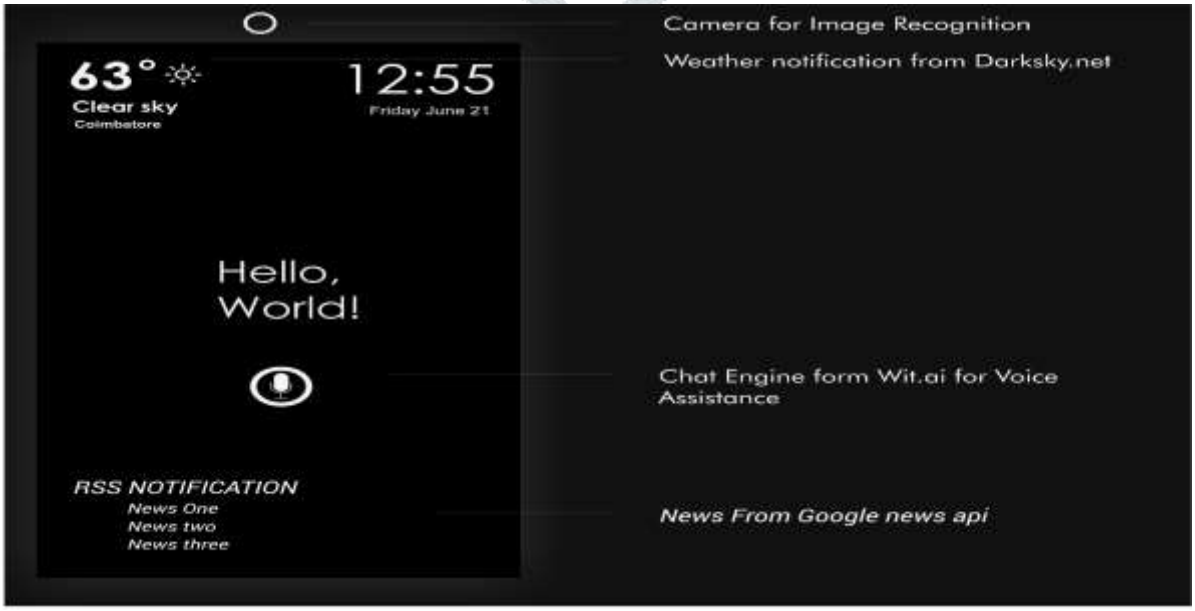

Figure-2 the sample result of automated mirror

VI. CONCLUSION:

The designed intelligent automated mirror provides natural interaction between users and the automated home services. The mirror display is provided by a flat LED display monitor which displays all the necessary information that are queried by the user. The mirror also provides the facility to control the home appliances through voice query. We have developed a functional prototype to demonstrate our work. Overall, the prototype provides an easily extendable framework that can be utilized to provide even more functionality to the user. In our future work we will investigate how the surrounding context of the user and the environment can be utilized in order to provide optimal service experiences in the home environment. 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 the technology integration, but a mirror is one of the best places to start.

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