

Speech Recognition By Intelligent Surface

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Abstract- *Our way of living has advanced a lot. Making efficient use of time has become a major aspect in human life. We present a surface that assimilates information, offered through an interactive user interface. The system gives basic information, like weather forecast, date, time and also supports different commands which are recognized through speech. It displays data that is retrieved from the web. This system is voiced controlled using Raspberry Pi.*

Keywords- speech recognition, Raspberry Pi, acrylic mirror

I. INTRODUCTION

The world is witnessing an astonishing amount of new technology making it difficult to distinguish the boundaries between humans the web and the tangible world. People need to be informed about world and its current affairs whether it is through internet or television. And thus, we present an interactive system, surface which is an attempt of virtual application on real mirror. We start our day with daily routines in front of the mirror and what if you look in the mirror and see something more than yourself?

Intelligent surface can be used for customization by the users for heat sensors and camera. A person standing in front of mirror can access his personal information; his appointments while brushing his teeth or washing his hands.

It is a raspberry pi driven monitor behind a acrylic mirror. The Raspberry Pi features a Broadcom system on a chip (SoC), which includes an ARM compatible central processing unit (CPU) and an on-chip graphics processing unit. It also includes Secure Digital (SD) cards used to store the operating system and program memory in either the SDHC or Micro SDHC sizes. A server is installed in the Pi and a web page is created using PHP. The web page displays time, weather widgets, a random greeting to the mirror's reflection as if by magic.

In 2016, a smart mirror model was put forward in which the framework offered services, like the display of personalized weather information, date, time and many more applications.

There are many ideas based on the idea of gesture motion using passive infrared sensors where the information is summoned from the internet. The information displayed contains forecast, calendar, sound cloud and many more other applications. The system also introduced speech recognized application when a person gave a command [1].

Another existing mirror which is similar to [1] named as Magic Mirror. The intelligent surface can interact with person given a human interaction a basis. There are many researches where using camera sensor human emotions can be detected and the mirror responds to the suitable emotion [3].

The paper is intended to be a software platform that could be used to develop different applications of the intelligent surface that the developer can customize according to his needs. In the prototype designed the users could interact with the mirror through external hardware. It uses a server design that allows one to overcome the boundaries of a web browser. The design is extendable with the capability to add on services as per the desired application as decided by the developer. This supports growth in the smart mirror development field.

In recent years home automation has gone through several changes. Home automation controls many applications through voice commands, PIR sensor, camera interaction for facial expressions and recognition. Home automation is huge upcoming industry giving a boost for new technological inventions, an interactive system may have problem with voice commands in public space and so a touch interface module can be used but in smart mirror which is being used in private voice commands prove a better interaction for a person involved in his daily activities in front of surface.

There have been lot of researches in the field of speech recognition and we have opted it in our planned system. An interactive system is more convenient for people to interact with. Speech recognition is a technique where the system recognizes what the user has spoken and act according to it. The paper we put forward contains speech recognition where a set of commands are spoken remotely from a device like a smartphone. Voice controlled automation system can be used to operate the Distributed Control Systems without the interaction of the handwork and interfacing with the spoken

words only [8]. The system we put forward takes information from web.

II. SYSTEM ARCHITECHTURE AND COMPONENTS

Living in the 21st century most of the thing we look around is smart. Everyone wants to get rid of the current system and replace it with something new. The function of the planned system is to make a mere surface into something cooler, i.e. rather than looking ourselves in the surface it shows something more.

Intelligent surface is a device which uses the services of internet to display weather, time, date and other widgets.

The block diagram shows the architecture of the planned system. The planned surface is an LCD panel behind an acrylic mirror, in front of the display device. When the system is not in use, the surface will act as a normal mirror and when it is in use, the mirror is transparent for the user to see the display. The monitor will then display the time, weather, news feed and other services.

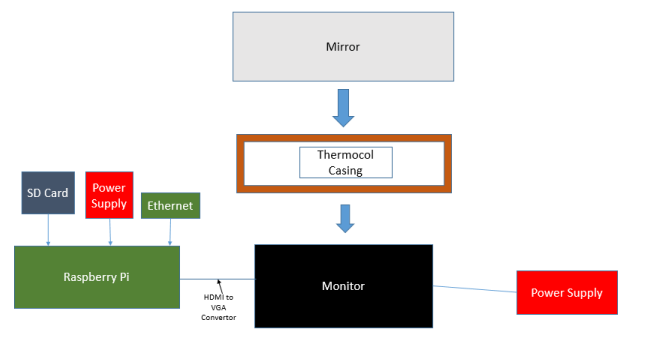


Fig. 1 : Block Diagram of Intelligent Mirror

COMPONENTS USED

- Raspberry Pi
- LCD Monitor
- Acrylic Mirror
- VGA to HDMI Converter

Raspberry Pi - The Raspberry Pi is a small debit-card sized single-board computer. Its function is to collect the data from the web and display it on the monitor screen. The version of the Pi used in the proposed project is Raspberry Pi 3 Model B.

Raspberry Pi has:

- 4 USB ports

- Full HDMI port
- 40 GPIO pins
- Audio jack
- Ethernet port
- Display interface
- Micro SD card slot
- Camera interface
- Video Core

Led Monitor-The monitor is the display of the smart mirror. It is placed behind the one-way mirror. It is connected to the Pi via HDMI to VGA convertor cable.

The Mirror-A normal mirror will not work. A mirror with one side as transparent and other side as reflective is used, the screen will be black in monitor but mirror will still be reflective when monitor is off.

VGA to HDMI-The Pi 3 has a HDMI output providing with connectivity with display devices. However, monitors having HDMI support were a bit expensive, so we chose a smaller screen monitor which has a VGA input. Thus, VGA to HDMI convertor will be used to connecting the monitor and the Raspberry Pi.

SD Card-A microSD card being a storage device is where the Raspbian OS is installed. It is inserted into the microSD slot available in the Pi.

Raspbian OS-Raspbian is a free operating system for the Raspberry Pi which is available on its website. It is available in the form of a disc image file which should be downloaded and burned in the microSD card.

The interface built on a raspberry pi allows us to use JavaScript language. Nodejs is used for developing tools and applications using JavaScript framework. Nodejs is not a programming language. It is an open source where developers can use JavaScript framework in runtime environment to create tools and applications. Nodejs allows developing web servers using javascript. It uses the designed API to reduce the complications while writing the server applications [9].

Plugins are used which are accountable for the information displayed. People can write their own plugins to customize their applications to be displayed. Plugins consist of HTML file, CSS file, JavaScript file and a GUI [9].

HTML file: It is hypertext mark-up language used for relating display structure of plugins in its display classes

which allows you to structure the element in certain place inside other HTML elements.

CSS: It is a language that describes the style of an HTML document. It contains file for styling of plugins display classes.

JavaScript: It is scripting language. JavaScript files are used for summoning information to control plugins display classes.

GUI: GUI stands for graphical user interface which is used by user by using graphics to interact with applications. It permits user to customize plugin settings.

To explain plugins further easily consider a furnished room as a frame work , although the room is furnished we may need some more things depending on our needs , so you bring new items to suite your requirement these are plugins. It is a piece of software containing a group of functions that can be added to a WordPress website. Considering the above example, API is the interface that defines how you are going to use those items, they basically let you use an item without knowing the internal details. It is set of routines and protocols and tools for building software applications which specifies how software component should interact.

III. IMPLEMENTATION

The procedure for implementing the Intelligent Surface is as follows: -

- A. **The Monitor-** For saving the cost of the system monitor with VGA input is chosen.
- B. **Mirror-** Intelligent Surface is proposed in order to use precious time more efficiently in our day to day life. A two-way mirror is chosen to fulfill our purpose of the system so that it shows more than just our self. Its size is chosen such that it is slightly larger than the monitor chosen.
- C. **Casing-** In order to hold the system a frame is required. So, to accomplish this we chose polystyrene framing by taking proper dimensions across the monitor and the mirror.
- D. **VGA to HDMI-** Since the monitor chosen does not have a HDMI port we need to use a VGA to HDMI convertor for the convenience that Pi only has a HDMI port.
- E. **Installing OS-** Raspbian which is an OS based on Debian Linux is supported for Raspberry Pi and can be downloaded from its website. Its image file is first

downloaded and the using Etcher is burned into microSD card and then inserted in the Pi.

- F. **Implementing Hardware-** This task requires to just connecting all the components at the proper positions as described. The monitor is set behind the mirror and is connected to the raspberry pi via HDMI to VGA cable while the power is plugged to the Raspberry Pi. Then the system boots up.
- G. **Installing Dependencies-** Our system which is similar to [1][4] uses Raspberry Pi Model 3B. The OS used in the system is Raspbian which is easily available from their website. It is named Jessie based on Debian OS. The image disc from the site is downloaded and is burned in the memory card using Etcher software. The OS is then booted for the first time and using the terminal the system is upgraded to the latest updates. Now for the interactive display to run the services we need to install an environment to run the JavaScript's file. So we have install Node.js which is an open source java script run time environment which has different modules in it. Node Package Manager called as npm is also installed which is a package manager for JavaScript runtime environment for Node.js. npm also install different modules in the system which help to run the JavaScript [7]. A different directory is first created in the Pi for all the modules and dependencies be at one place. All the .js files are stored in this directory. Before running the smart mirror for the first time we need to first rotate the display of the monitor in a vertical position which is done by editing a config file associated with the display. Then we need to configure the monitor in a way that when the system boots it must not show the raspberry logo and that is directly runs the java scripts from the directory in which they are stored and also the screen saver is turned off.

IV. APPLICATION

Intelligent Mirror is the emerging concept in this fast-changing IT world. In this fast-moving world time optimization is of main concern. So, with this product the mirror shows more than yourself. Getting up early in the morning and going for your routines we look into the mirror. With this mirror, it will provide with time, calendar, news feeds over the web, social messages and many more stuffs. It also has following applications: -

- **Smart Dressing** - used in fashion field as a way of smart dressing where people without wearing make-

ups and clothes can see how they will look into the mirror.

- Security - Based on Facial and Speech recognition used for authentication purpose.
- Medical - The skin grafting and all the other skin related problems can be fixed by using Intelligent Surface.
- Criminal database - Identifying criminal
- Home automation - The mirror helps in controlling the house smart appliances and access many other services.

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V. CONCLUSION AND FUTURE SCOPE

The initial goal is to create an Intelligent Surface which displays weather forecast, date and time, random greeting, mp3 player and YouTube and much more could be done as it is a learning process within itself. We could use it for fashion purposes where one could try different dresses and also could put on makeup which is all virtualized on mirror you are standing in front of. It is also being used in medicine purposes where one could have his daily health stats on the mirror. One could check his emails and traffic status in the morning while refreshing. There is already an advancement in the smart mirror where they are making a cross modular platform where it allows you to develop your own module.

With the availability of more new plugins one could add many more functions to the Intelligent Surface like temperature sensor, gesture sensor and light sensor.

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