A SMART MIRROR WITH DATABASE ACCESS

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Abstract— *A Smart mirror is a reflective mirror with programmable applications and digital display for the home, office and public environments. This paper presents the design and development of an interactive smart mirror with artificial intelligence for the database as well as for commercial uses in various fields. The mirror is extensible and easy to use. This project which would collect real world information and the information would be transmitted from machine and would be controlled by Raspberry Pi 3-Model B using python language. The Smart Mirror implemented as a personalized digital device equipped with Raspberry pi, microphone, speakers, LED monitor covered with a sheet of reflective one way mirror provides one of the most basic information such as temperature, latest updates of news and headlines and local time. The data can be accessed according to the user needs by using the Google search. The Smart Mirror recognizes the verbal commands and listen to the user question and responds them.*

Keywords— *Smart Mirror; Raspberry pi 3; Interactive; Personalized Device*

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1. INTRODUCTION

Mirror is an object that is available in every homes where in we see our reflections but the main motive of this project is to develop a smart mirror as well as an operating system to run on similar devices. The device has to look like a regular mirror but would have a LED screen inside and the would be able to interact with the mirror by using voice commands and smart phones. The operating system would support running apps and would also provide a simple API for third-party developers. The main features of the smart mirror is to display basic information like weather, time, news and the database. The smart mirror has the necessary applications and features needed for time efficiency focused device.

The mirror automatically recognizes that the user present and turns on the screen behind the two-way mirror. The smart mirror must offer benefits of using modern technology while integrating seamlessly into the standard routines of most people. The smart mirror must be simple and as intuitive as possible. The smart mirror would be used to merge technology and the need for information into anyone's daily schedule. With the mirror in place, the user could interact and obtain the information they want during their normal morning and night routines.

This smart mirror aims 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 smart phone 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 places.

2. RELATED WORKS

On surveying the existing methods, a smart interactive system has been developed. The researchers have made analysis to improvise the lifestyle. A lot of researches are being done in this area from which same features adapted. One of which is the voice controlled automation system. Speech recognition [1], [4] could be used to automate the tasks which require hands-on like recognizing speech commands to perform tasks like turning on/off light and other home appliances. A code relevant to the command is transmitted to microcontroller wirelessly the speech recognition.

In the recent years, the Home Automation systems has undergone many changes due to the introduction of various Wireless technologies that has seen the emergence of many standards. ZigBee, 802.15.4 is an IEEE standard used for data communications [11]. Zigbee is focused at applications that require lower data rate, higher battery life, and secured networking. Zigbee is best suited for periodic or irregular signal transmission from the sensor. The wireless home Automation system is implemented in home environments, without changes in the basic requirements. The automation centres on recognition of voice commands use ZigBee communication modules with microcontroller. The home automation system is intended to control electrical appliances like lights in a home using voice commands [1].

One of the attempt in smart interactive system is that the one for social emotion alleviation in the smart home. The Prototype established to smart furniture for the smart home is a magic mirror table. In this paper, a prototype of smart furniture for the smart home "a magic mirror table" is introduced. The proposed system has a camera to capture the person's facial expression who is viewing [3].On analysing these expressions, the system can determine the

emotion of the person. If the person is in a negative emotion, then the

system speaks positive sentences and plays the person's favorite music to mitigate his/her emotion. The experimental results confirm that the system is able to appease the sad mood of the viewer. In addition, the proposed system can serve as a calendar for event reminding. On analyzing these attempts we adapted smart interactive system, which displays the basic information like weather; time, holidays list, and notifications from social media.

Other researchers are followed for achieving smart home [5], it is found that many interactive systems are developed to make the people more convenient while interacting with the system. Another approach is that PIR based human motion [2]. The proposed system uses PIR Sensor to know the presence of human in the room. A passive infrared sensor is an electronic sensor that measures infrared radiation from the objects and human beings in its field of view. They are often used in PIR based motion detectors [12]. PIR sensors allow you to sense motion, almost all these are used to detect whether the person has left or moved in to the range of sensors [12]. They are comparatively small, inexpensive, low-power and easy to use. For this reason they are commonly found in appliances and gadgets that we used in homes or businesses. Another work in interactive system is that smart furniture [8]. It is furniture that is implemented in such a way that it provides an interactive system to access information. The proposed system has it display information that is fed from the web.

3. CONSTRUCTION AND WORKING

    A. *Input unit*

    B. *Output unit*

    C. *Processing unit*

are the key components of the system.

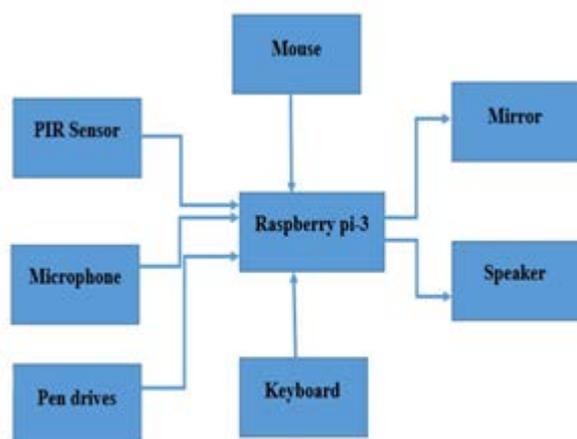The overview of the system design is explained in this section.

Fig 1: Block diagram

A. *Input Unit*

The input unit consists of PIR sensor, mike, pen drive, keyboard and mouse. The sensor outputs this to the raspberry pi3 upon which the mirror display gets activated. In case the user prefers wireless interaction with the mirror, he/she can provide voice inputs through mike. Also data in pen drive can be an input.
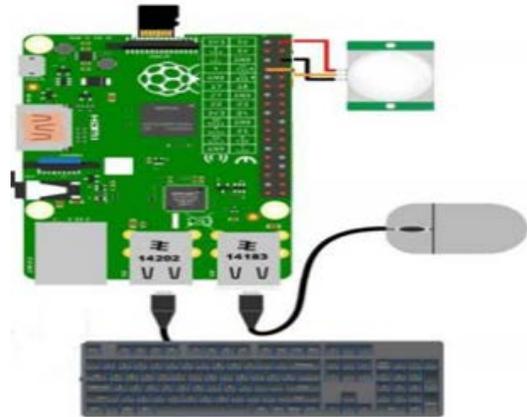

Fig 2: Reference model

1. *PIR Sensor*

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are often referred to as PIR, "Passive Infrared", "Pyro electric" or "IR motion" sensors.

Working:
The sensor in a motion detector is actually split in two halves. The PIR sensor itself has two slots in it, each slot is made of a special material that is sensitive to IR. When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a positive differential change between the two halves. When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change. These change pulses are what is detected.

2. *Microphone*

A microphone, colloquially nick named mic or mike, is a transducer that converts sound into an electrical signal. Microphones are used in many applications such as telephones, hearing aids, public address systems for concert halls and public events, motion picture production, live and recorded audio engineering, sound recording, two-way radios, megaphones, radio and television broadcasting, and in computers for recording voice, speech recognition, VoIP, and for non-acoustic purposes such as ultrasonic sensors or knock sensors.
Working:

The sensitive transducer element of a microphone is called its element or capsule. Sound is first converted to mechanical motion by means of a diaphragm, the motion of which is then converted to an electrical signal. A complete microphone also includes a housing, some means of

bringing the signal from the element to other equipment, and often an electronic circuit to adapt the output of the capsule to the equipment being driven. A wireless microphone contains a radio transmitter.

3. Keyboard

The keyboard is a typewriter style device which has an arrangement of buttons and keys which acts as a mechanical lever or electronic switch. The keyboard has character printed on the keys and on each press of a key typically corresponds to a single written symbols. The keyboard size depends on the extent to which a system is used where an action is produced by a combination of subsequent and simultaneous keystroke or multiple pressing of a single key. A keyboard with few amount of keys is called a keypad.

3.1 DESCRIPTION

Standard alphanumeric keyboards have keys that are on three-quarter inch centres (0.750 inches, 19.05 mm) and have a key travel of at least 0.150 inches (3.81 mm). Desktop computer keyboards, such as the 101-key US traditional keyboards or the 104-key Windows keyboards, include alphabetic characters, punctuation symbols, numbers and a variety of function keys. The internationally common 102/104 key keyboards have a smaller left shift key and an additional key with some more symbols between that and the letter to its right (usually Z or Y).

Also the enter key is usually shaped differently. Computer keyboards are similar to electric-typewriter keyboards but contain additional keys, such as the command or Windows keys. There is no standard computer keyboard, although many manufacturers imitate the keyboard of PCs. There are actually three different PC keyboards: the original PC keyboard with 84 keys, the AT keyboard also with 84 keys and the enhanced keyboard with 101 keys. The three differ somewhat in the placement of function keys, the control keys, the return key, and the shift key.

Computer mice have one or more buttons to allow operations such as selection of a menu item on a display. Mice often also feature other elements, such as touch surfaces and "wheels", which enable additional control and dimensional input.

4. WORKING

A mouse typically controls the motion of a pointer in two dimensions in a graphical user interface (GUI). The mouse turns movements of the hand backward and forward, left and right into equivalent electronic signals that in turn are used to move the pointer.

The relative movements of the mouse on the surface are applied to the position of the pointer on the screen, which signals the point where actions of the user take place, so hand movements are replicated by the pointer. Clicking or hovering (stopping movement while the cursor is within the bounds of an area) can select files, programs or actions from a list of names, or (in graphical interfaces) through small images called "icons" and other elements. For

example, a text file might be represented by a picture of a paper notebook and clicking while the cursor hovers this icon might cause a text editing program to open the file in a window.

Gestural interfaces occur more rarely than plain pointing-and-clicking; and people often find them more difficult to use, because they require finer motor control from the user. However, a few gestural conventions have become widespread, including the drag and drop gesture, in which:

1. The user presses the mouse button while the mouse cursor hovers over an Interface object
2. The user moves the cursor to a different location while holding the button Down
3. The user releases the mouse button

Other uses of the mouse's input occur commonly in special application-domains. In interactive three-dimensional graphics, the mouse's motion often translates directly into changes in the virtual objects' or camera's orientation. For example, in the first-person shooter genre of games (see below), players usually employ the mouse to control the direction in which the virtual player's "head" faces: moving the mouse up will cause the player to look up, revealing the view above the player's head.

A. MOUSE

A mouse is a hand-held pointing device that detects two-dimensional motion relative to a surface. This motion is typically translated into the motion of a pointer on a display, which allows a smooth control of the graphical user interface. Originally wired to a computer, modern mice are often cordless, relying on short-range radio communication with the connected system.

Mice originally used a ball rolling on a surface to detect motion, but modern mice often have optical sensors that have no moving parts. In addition to moving a cursor,

A related function makes an image of an object rotate, so that all sides can be examined. 3D design and animation software often modally chords many different combinations to allow objects and cameras to be rotated and moved through space with the few axes of movement mice can detect.

B. PROCESSING UNIT

The raspberry pi3 is the heart controlling unit of the smart mirror system. The PIR sensor's input is the processed by the Raspberry pi3 which automatically turns the mirror on
after which the user gets complete access to an attractive display(smart mirror).The voice inputs extracted from the mike are processed by the Google assist controlled by the Raspberry pi3.

Raspberry pi3:

The Raspberry pi 3 is a series of small single board computer developed in United Kingdom by the Raspberry Pi Foundation. The Raspberry pi 3 is a quad-core ARM

cortex-A53 processor, is described as 10 times the performance of Raspberry pi 1.The Raspberry pi 3 is approximately 80% faster than the Raspberry pi 2.This adds wireless LAN and Bluetooth connectivity making it the ideal solution for powerful connected designs.

Processor speed ranges from 700 MHz to 1.2 GHz for the Pi 3; on-board memory ranges from 256 MB to 1 GB RAM. Secure Digital (SD) cards are used to store the operating system and program memory in either SDHC or Micro SDHC sizes. The boards have one to four USB ports. For video output, HDMI and composite video are supported, with a standard 3.5 mm phono jack for audio output. Lower-level output is provided by a number of GPIO pins which support common protocols like I²C. The B-models have an 8P8C Ethernet port and the Pi 3 and Pi Zero W have on-board Wi-Fi 802.11n and Bluetooth.

C. OUTPUT UNIT

The output units are mirror and speaker. The mirror has its basic information like date, time, temperature, upcoming holidays of the month and recent news from a synchronized news websites. The user can then work into the system just like any PC on switching the mode. Also an added feature of voice outputs are provided by the speaker which makes the smart mirror a complete interactive and attractive device.

Speaker:

Computer speakers, or multimedia speakers, are speakers sold for use with computers, although usually capable of other audio uses, e.g. for an MP3 player. Most such speakers have an internal amplifier and consequently require a power source, which may be by a mains power supply often via an AC adapter, batteries, or a USB port (able to supply no more than 2.5W DC, 500mA at 5V). The signal input connector is often a 3.5 mm jack plug (usually color-coded lime green per the PC 99 standard); RCA connectors are sometimes used, and a USB port may supply both signal and power (requiring additional circuitry, and only suitable for use with A Computer Battery-powered wireless Bluetooth speakers require no connections at all. Most computers have speakers of low power and quality built in; when external speakers are connected they disable the built-in speakers. Altec Lansing claims to have created the computer speaker market in 1990.

Computer speakers range widely in quality and in price. Computer speakers sometimes packaged with computer systems are small, plastic, and have mediocre sound quality. Some computer speakers have equalization features such as
bass and treble controls. More sophisticated computer speakers can have a subwoofer unit, to enhance bass output. The larger subwoofer enclosure usually contains the amplifiers for the subwoofer and the left and right speakers.

Some computer displays have rather basic speakers built-in. Laptop computers have built-in integrated speakers, usually small and of restricted sound quality to conserve space. Instead of using a computer speaker for better sound, a computer can be connected to any external sound system, typically a high-power high-quality setup.

An unusual design by HiWave Technologies, the DyadUSB USB-powered stereo audio amplifier module used in the SoundScience QSB 30W Portable USB Speakers allows a USB-powered and driven stereo speaker pair to supply 30W of power for short periods with a signal that has short high-power peaks and much lower average power, as most music and speech does. It stores energy from the USB connection during quieter periods, delivering high power for the peaks. (With a constant sine-wave input, power output cannot exceed the 2.5W that any USB speaker can deliver). The module is claimed to require less power most of the time, increasing laptop computer battery endurance, and delivering clean, unclipped sound peaks.

Working

In order to translate an electrical signal into an audible sound, speakers contain an electromagnet: a metal coil which creates a magnetic field when an electric current flows through it. This coil behaves much like a normal (permanent) magnet, with one particularly handy property: reversing the direction of the current in the coil flips the poles of the magnet.

Inside a speaker, an electromagnet is placed in front of a permanent magnet. The permanent magnet is fixed firmly into position whereas the electromagnet is mobile. As pulses of electricity pass through the coil of the electromagnet, the direction of its magnetic field is rapidly changed.

This means that it is in turn attracted to and repelled from the permanent magnet, vibrating back and forth. The electromagnet is attached to a cone made of a flexible material such as paper or plastic which amplifies these vibrations, pumping sound waves into the surrounding air and towards your ears.
Components a speaker:

1. Cone
2. Electromagnet (coil)
3. Permanent magnet.

The frequency of the vibrations governs the pitch of the sound produced, and their amplitude affects the volume - turn your stereo up high enough and you might even be able to see the diaphragm covering the cone move. To reproduce all the different frequencies of sound in a piece of music faithfully, top quality speakers typically use
Different sized cones dedicated to high, medium and low frequencies.

5. OUTPUT

Fig 3: Output

Figure 3 is the image of the output of our project. It can be seen that data like time, temperature and recent update from a synchronized news website.

6. APPLICATIONS

Embedded electronics including cameras, displays and sensors are also the parts of smart mirror technologies as they help in converting a simple mirror into an electronic device. Smart mirrors can be used in various applications based on the customers' demands among which a few are explained as follows,

1. Automotive

The focus on enhanced road safety drives the demand for incorporating new electronic functionalities to the automotive mirrors. Activated light sensors, and electro chromic self-dimming smart mirrors have significantly improved road safety by increasing response times as well as reducing driver fatigue.

2. Advertising

Smart mirror as the name suggests is a captivating electronic device. Advertisements are usually forecasted to draw the customers' attraction and motivate them to buy the product. Furthermore advertising in a smart mirror becomes a more captivating idea and becomes a successful attention seeker.

3. Home automation

The functionalities of a smart mirror in home environment include the control of household appliances and access to personalized information services. The mirror display is provided by a touch-based flat monitor, which streams live continuous feeds from a web camera connected to the mirror to mimic a traditional mirror function. In addition, facial recognition technology has been used to authenticate a user to provide personalized service access.

7. CONCLUSION

A smart mirror used as a notice board provides the users an innovative experience of interacting and accessing the information effortlessly. Power consumption is a major factor that every system has to be concerned with. Here in our smart mirror system, by making use of sensor we have reduced the overall power consumption. Thus the mirror will display information only in the presence of human.

Using web browsers as primary display method is quite common for the smart mirrors. We have extended the services to interactive with user through voice control. The system can help students as well as teachers to gather information from smart mirror. It is found as an attractive way for letting them know events regarding college and other news/data.

The mirror also has picture-in-picture sub-display that facilitates maps, videos via YouTube and other display services. We have developed a functional prototype to demonstrate our work. It can be used as an extended service for many different applications, meeting the users' requirements.

8. ACKNOWLEDGMENT

REFERENCES

[1] "Voice controlled automation system," in Multi topic Conference, 2008.INMIC 2008. IEEE International , vol., no., pp.508-512, 23-24 Dec. 2008 doi: 10.1109/ INMIC 2008.4777791

[2] PIR-sensor based human motion event classification," in Signal Processing, Communication and Applications Conference, 2008. SIU 2008. IEEE 16th , 20-22 April 2008

[3] Yuan-Chih Yu; You, S.D.; Dwen-Ren Tsai, "Magic mirror table for social-emotion alleviation in the smart home," in Consumer Electronics, IEEE Transactions on ,vol.58, no.1, pp.126-131, February 2012 doi:10.1109/TCE.2012.6170064K. Elissa, "Title of paper if known," unpublished.

[4] Implementation of speech recognition on MCS51 microcontroller for controlling wheelchair," in Intelligent and Advanced Systems, 2007. ICIAS 2007. International Conference on , vol., no., pp.1193-1198, 25- 28 Nov. 2007

[5] S. Helal, W. Mann, H. El-Zabadani, J. King, Y. Kaddoura and E. Jansen,"The Gator Tech Smart House: a programmable pervasive space," IEEE Computer Magazine, vol. 38, no. 3, pp. 50 60, Mar. 2005.

[6] K. Fujinami, F. Kawsar and T. Nakajima, "Aware Mirror: A Personalized Display Using a Mirror," Third International Conference, User Interaction, Pervasive Computing, vol. 3468, pp. 315 332, Munich, Germany, May 2005.

[7] John See and Sze-Wei Lee, "An Integrated Vision-based Architecture for Home Security System," IEEE Transactions on Consumer Electronics, Vol. 53, pp: 489-498, No. 2, May 2007M. Young.

[8] H. Sukeda, Y. Horry, Y. Maruyama, and T. Hoshino, "Information-Accessing Furniture to Make Our Everyday Lives More Comfortable," IEEE Trans. on Consumer Electronics, vol. 52, no. 1, pp. 173 178, Feb. 2006

[9] Jun-Ren Ding, Chien-Lin Huang, Jin-Kun Lin, Jar-Ferr Yang and Chung-Hsien Wu, "Magic Mirror", Ninth IEEE International Symposium on Multimedia 2007.

[10] A.A. Bagade and N.B.Hulle, "Magic Mirror For Mentally Ret