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DESIGN AND IMPLEMENTATION OF SMART MIRROR AS A PERSONAL ASSISTANT USING RASPBERRY PI

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ABSTRACT - *The world is moving fast and we are constantly left wanting for time and finding out things that can be postponed or cancelled just because we run out of time in the day. They say every second counts and we considered this saying in the best of letter and spirit. We normally spend about 10-20 minutes in-front of a mirror in our daily lives. We planned to make this time also productive and useful to the person using the mirror. We are moving towards a world with smart things and appliances. In the proposed idea we present an Interactive Smart Mirror with various features to make sure that every minute of the user is utilized properly. The smart mirror will be acting as a Personal Digital Assistant providing day-today schedule and appointments pulling the information from the users google account, it is also capable of displaying real time information such as live weather updates, local time of a particular location and also helps the person to get in touch with the current affairs happening around the world. It can also be implemented as weight tracker which makes sure that a person is fit by tracking and displaying the user's weight on daily basis. Further, the mirror can also be used to control lighting and window blinds in the room providing a single point of control for electrical things in the room.*

***KEY WORDS*: Smart Mirror, Daily Updates, Google Calendar Connection, Live News Updates, Environment Control, Parametrization and Data relevance mapping, Load cell, Instrumentation amplifier, Fitness Helper, Weight Watcher, Time Saver, Time Optimizer, Personal Assistant, Motor Control, Python, Raspberry - Pi**

1.INTRODUCTION

Time is what we want most, but, what we use worst - William Penn

Time management is an important aspect in our life. Multitasking along with technology helps us to maintain an efficient schedule. Recent advancements in technology has paved way to automate things around us. Smart phones, tablets, Personal Computer's provide us, up-to-date information with respect to current news, social media, personal appointments but still they all are a means of distraction as they interrupt one's routine. They cannot be carried everywhere as there is a risk of damage. Our solution to the problem is to turn the mirror Smart. Usually the sole purpose of the mirror is for personal grooming / admiring oneself, decoration and architecture. As looking at the mirror costs time and getting ready takes time by combining both of these times can managed efficiently. Smart Mirror is embedded with various electronic features. Smart Mirror as a personal assistant plays an important role for people with tight schedule providing quick updates of current trending news, day-to-day appointments as well as local time and weather reports of the day. It can also act as a fitness tracker, assisting one to maintain good health by tracking user's weight on a daily basis only when the user stands in front of it. Further it can be extended with features controlling the electrical things of bathroom environment.

2. RELATED WORK

Few investigations have been carried out in this area. By adding technologies in the mirror multiple tasks can be performed simultaneously. With advancements in Internet of Things and its applications, the mirror is designed such that the residents are able to control their smart home appliances and they can also access personalized services while enhancing the user profile [1].

Face Recognition based authentication can be used to detect multiple users in home environment. Webpage based interface is used provided to access the data [2].

Mirror can be embedded with various electronic features such as GPS navigation, Bluetooth connectivity, wireless communication which enables voice recognition and hands-free calling [3].

Sonus technology can also be added as a medium of interaction between user and system [4].

Certain advanced functionalities like personal motivation, selection of musical tunes, interaction with television and remainder of a service can also be provided by the smart mirror [5].

Smart Mirror can be applied in various fields like Hotels, Retail stores and also in workplace environment. It can be used in offices where it can be accessed by multiple users [6]. It can also be used to monitor the health of elderly people at home by incorporating IoT. This IoT connected mirror provides updates and location of an elderly parent to their respective patient [7].

Mirror can also be made touch screen based and modular by dragging and dropping the various plugins needed [8].

Security can be ensured by using Speech Recognition based mirror for shelf security. PIR sensor can be used to identifying the users in front of mirror [9]. Two webcams can be used one for face recognition while the other for home surveillance [10].

3. PROPOSED SYSTEM

Fig-1 below shows the block diagram of a smart mirror. The proposed smart mirror aims at displaying the user's image as well as providing customizable information. In the proposed design, a wall mounted single sided mirror will be used as it is capable of displaying user relevant information such as current weather reports, local time and date, recent trending headlines, his/her personal health conditions and personal appointment updates from the google calendar. The user's weight and other health conditions can be monitored live whenever the user stands on a load cell integrated stool. This will be able to suggest and motivate the user to reduce weight if required. The stool fitted with switches can also be able to control the lighting conditions and window blinds in the bathroom as required. All of these information from the load cell integrated stool can be sent to the mirror application via Wi-Fi module.

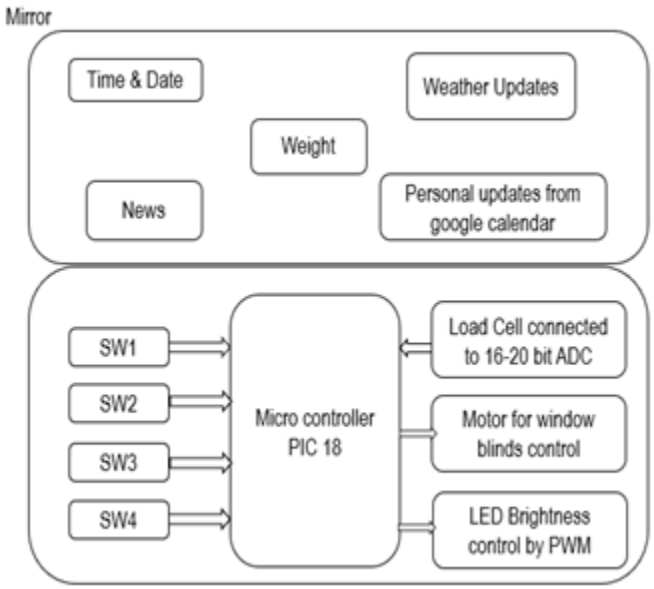


Fig -1: Block Diagram of Smart Mirror

Smart mirror is a Raspberry Pi (low powered minicomputer) based display when connected to internet it picks and displays the necessary information in the presence of the user. In the proposed system, a model B Raspberry Pi 3 is used which contains 512MB SDRAM, runs on Linux platform and needs 700mA. A single sided mirror is placed on the LCD screen which acts as a regular mirror when there is no light behind it or act as a glass window where information is displayed. Only when the user stands in front of the mirror the customized information will be displayed. In order to retrieve updated data from the web sources various data feeds can be used such as RSS feed.

Fig -2: Architecture of a Smart Mirror

The personal schedule of events and the updated weather reports can be obtained by using Google Calendar API and Weather API. For the displaying these useful information Tkinter, a standard library GUI python module is used.

4. IMPLEMENTATION

The Smart Mirror interface is designed and implemented such that only when an authorized user appears in front of the mirror only then his/her customized data is displayed after proper authentication. The load cell integrated stool plays a major role in authenticating the smart mirror. Only when the weight sensed by the load cell is same as the weight stored in the health database the updates are retrieved from the internet and displayed.

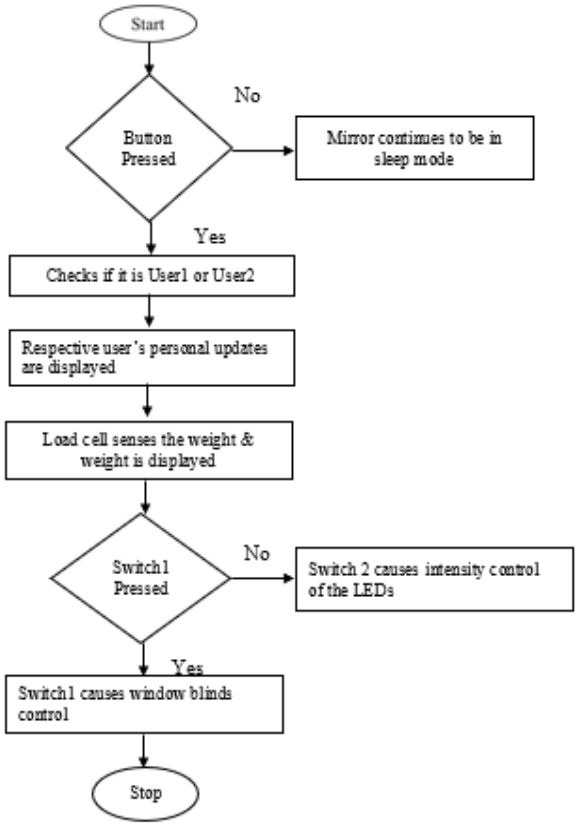


Fig – 3: Flow Chart of Smart Mirror

The flowchart of the smart mirror system is as shown in Fig-3. Initially the mirror will be in sleep mode acting like a normal mirror reflecting. The mirror is designed such that it can be accessed only by two users. When the user 1 presses the button his/her respective schedule from the google calendar can be retrieved and is displayed on the mirror. The load cell senses the weight of a person which after processed by the PIC 18 controller can be uploaded to cloud later this data can be displayed on the mirror via the Wi-Fi module.

Fig -4: User Interface of Smart Mirror

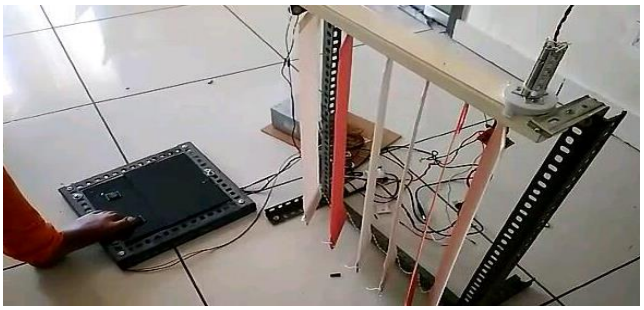
To begin with a single sided mirror is used such that it is semi-transparent acting as a mirror when the screen is black and a glass window when information has to be displayed.This mirror is mounted on a 17' LCD monitor as it is relatively cheap and with simple touch buttons.Later the control panel of this monitor is connected and placed in the casing with raspberry pi 3 model attached to it using a HDMI cable.The pi model runs on raspbian operating system with its Wi-Fi configured through which mirror is connected to internet.The main advantage of using pi is that is allows the users to develop and test the interface on usual Personal Computer.

Fig-4 shows the user interface of a smart mirror were in various API's and feeds are used to retrieve the data and display the same.Google Calendar API is used such that when a valid user stands in front of the mirror then it automatically logins into his/her account and picks the upcoming events of that day.RSS feeds are used to pick the latest topmost headlines periodically.Dark Sky Weather API is used to get the current location and the climatic conditions of a particular place based on the location through the latitute and longitude.The real time and date is picked from the system and displayed.

With the help of the load cell integrated stool the mirror can be used as a fitness tracker.Whenever a user stands on the load cell he/she has to indicate to the mirror that he is a valid user by keying a button it is then the mirror gets authenticated and personalized data is displayed. The load cell integrated stool also controls the ligthing conditions in a room and windows blinds movement all of which is done using a microcontroller. A PIC 18 microcontroller is used in order to process the incoming data and command the motors for window blind control and by employing pulse width modulation techniques the lighting conditions of the room can be controlled.

Fig -5: Intensity Control Using PWM and MOSFETs

Fig-5 shows load cell integrated stool controlling the brightness of LEDs using Pulse Width Modulation Technique. The varying duty cycle of the pulse width modulated signal is used to vary the intensity of the LEDs. By pressing the switch, the user is capable of controlling the brightness of the room.



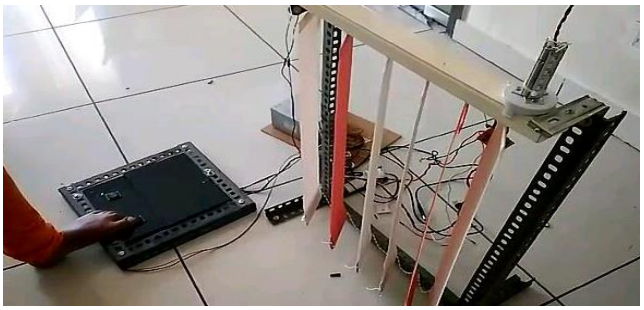


Fig -6: Vertical Blinds Movement Control

Motorized control of the window blinds is as shown in Fig-6. By controlling the switches in steps, the window blinds movement can also be controlled vertically. The switches in turn control the motor in steps.

5. CONCLUSION

This paper proposes a smart system which allows users to utilize a household object as an interactive interface providing customizable services. The tracking of health is an added advantage in leading a healthier life. With the functionality of controlling the light settings it can be applied in various fields such as beauty parlors and hotels.

Further to keep the mirror secure face recognition technique can also be incorporated as a means of security. It makes sure that only authenticated users can access the information on the mirror while others cannot. It can also be used as an evidence for theft detection. Life can be made easy and enjoyable by embedding more and more features on to the mirror interface such as getting the traffic updates, emotion recognition and also tracking of our attire daily.

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