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Design and implementation of smart mirror using Raspberry Pi 3

Mrs. V. Jyothi [1] Mr.Kota Shiva Kumar [2]

[1]*Assisstant professor, Department of Electronics and communication engineering, Vardhaman College of Engineering, Hyderabad.*

[2]*M.Tech, Department of Electronics and communication engineering, Vardhaman College of Engineering, Hyderabad.*

Abstract

There is market boom with recent launches of new and smart products which behaves like computers and mobile phones. Mirrors used for salon as well as 3 D mirrors are much expensive with limitations on public uses. For Home based IOT (Internet of Things) this project is used with the help of raspberry pi. Proposed a smart mirror with host controller as raspberry pi and as a control chip at core level microcontroller STM32F030C8T6 is used. System connected to raspberry pi is linked to wi-fi network through API which displays the weather information, time and date which is displayed on display. User can ask any information like time, weather and some other details to APP mirror and mirror can broadcast the required information. Proposed designed smart mirror is very low cost device, low complexity, size is very small with many useful applications.

Keywords: Microcontroller STM32, smart mirror, Raspberry pi, broadcast information, API interface.

I. INTRODUCTION

The standards and the quality of the life are improving day by day because of upcoming of embedded devices using various technologies. By interactive computing we can achieve various benefits by integrating various technologies. We can design various innovative products or devices by means of wireless networks. It provides not only comforts to the one who uses it, but also security and convenience to various users at homes and industries in various ways. Currently various devices

Like smart watches, smart TV's already existed and now comes the new concept which is smart mirror. These smart mirrors are nothing but intelligent mirrors that are limited to few places like public places and commonly used in hair saloon shops in foreign countries. The reason why it is not used at public places is that they are expensive and there is slight delay in the picture.

Daily we spend some time after we fresh up to find out how our dress is looking, get ready by looking at it. This time can be effectively used for getting latest updates regarding weather, new, time and other information too. Lot of time can be saved by using these intelligent mirrors. All the above listed smart features like providing weather report, local time and other data can be obtained by using raspberry pi.

For dealing with such situations, we can control the electrical appliances at home at our home by providing convenience to all the users of it by means of network connection between the devices and the lamps respectively. It works in the following way like firstly the users need to give certain instructions to it and the sensors present in the system will be able to recognise their voice and respond accordingly based on the requirement.

For this purpose, we design a system that is based on three main objectives.

In which the first objective is designing an intelligent mirror that is a smart mirror based on raspberry pi, secondly, for implementing the smart mirror we need a voice recognition system, finally we need to perform the testing on the raspberry pi for checking how it works for users.

II. RELATED WORK

The smart mirror which is presented in this paper provides services to the users by facilitating access to them in various ways as mentioned. It basically acts as an interface between the devices naturally. This interface is used in the environment for interaction as commented below.

The well-known context aware home environments are Philips Home Lab [1]. They provide various projects to the users as per their preferences. Their works are of intellectual and creative. Let us take for instance the interactive mirror [2] by them. They are presented in the bathrooms and provide some information according to the user's interests. Here are the few activities that can be performed by the children. They can spend time in watching their favourite videos while they are taking brushing. Even elders can spend time for knowing weather reports of various places, watch interesting ones. Here both the LCD's flat screens are combined together by the help of central processor for facilitating various intended services to the users according to their interests.

Smart environments are realised by the use of Ambient Artificial Intelligence (AMI) [3]. It results in the vast changes in the domain like industry and home environments by its intelligence The change brought by the AMI is that humans are surrounded by various interfaces which are connected together and it is given by European consortium. It is very user friendly for interacting with humans.

When this AMI is employed in the home environment it provides quality, convenience, as well as the security to the residents by providing utmost safety for both elderly people and people with disabilities and physically challenged people at home, hospitals, workplaces. It is mostly helpful for people with disabilities. The innovations of AMI has created a surprise to various fields like home automation, and workplaces

The regular mirror which we keep at homes does not do any smart work. We waste around twenty minutes or so in front of the natural mirror. So to overcome the wastage of time we designed a prototype called smart mirror that covers the time we spend some time in reading newspaper. It can be viewed as the problem statement for the paper.

III.PROPOSED WORK

In proposed work we designed smart, intelligent mirror which uses raspberry pi and STM32 controller. Smart mirror is the combination of Raspberry pi, controller module, wi-fi module and API interface. Controller Module is the core brain of the proposed mirror which is the main part of the system. It consists of two modules in proposed work, one is microcontroller STM32 and another is raspberry pi module.

Display module consist of plasma display which is used to see the functional changes with size of 24 inch and 1-way display. Clock module is used for getting exact time and date with the help of CMOS based module. For wireless transmission and reception, we used Wi-Fi module. For hardware and software module connectivity we used programming.

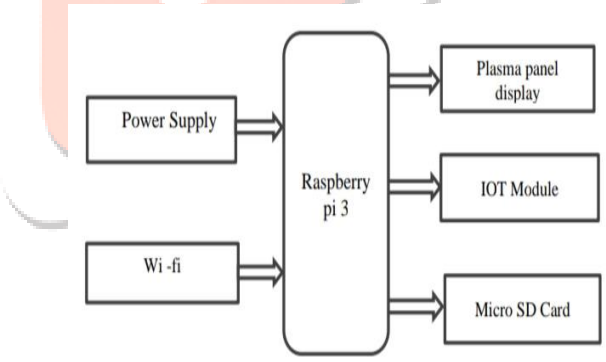

Fig. 1 Proposed Work Block Diagram

Proposed work block diagram consists of following modules,

1. Raspberry Pi 3
2. Wi-Fi Module
3. IOT Module
4. Micro Sd Card
5. Power Supply
6. Plasma Panel Display

Fig. 2 Raspberry pi module

In this project we used raspberry pi connected to computer and remaining application is implemented. Raspberry pi is the module which works as small computer which is connected to computer to understand processing using mouse and keyboard.

Fig.3 Wi-Fi Module

We used ESP Wi-Fi module which is very low-cost module produced by Shanghai based company for full TCI/IP stack. This module mainly used to design IoT applications for embedded system. To communicate with this Wi-Fi module, microcontroller sets some commands and with UART we need to set some baud-rate for communication.

IoT (Internet of Things) is used for better life of human beings with added intelligence. IoT module is designed for wireless communication with flexibility and long duration access. It makes wireless connections between devices connected to system. Depending on the type of application IoT module will be selected which provides specific features.

Micro SD card is abbreviated as Secure Device which is designed by SDA (SD Association). It is mainly used in portable devices. Some companies like SanDisk improved MMC's (Multimedia cards) to get industry standards. It is used to store information or commands.

Power supply is the main requirement for working of this proposed device. There are multiple parts for proposed module which require different voltage and current requirement. Raspberry pi module requires 5 V input while other devices may work with 230V input.

We used plasma panel display, which uses plasma, ionized gas that respond to electrical field. It is very flat panel display. Previously it is used in television (TV). This can be used for smaller application as for big application in the market LCD and LED took very much attention of users than plasma display.

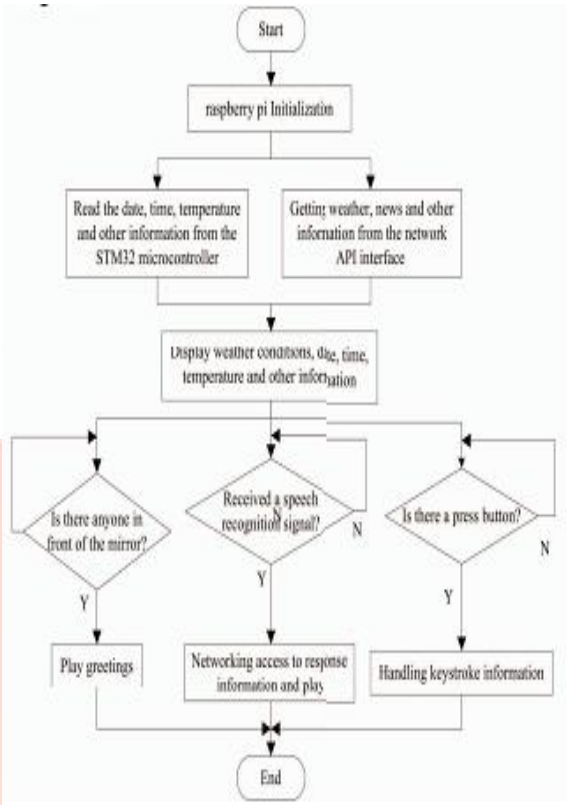

Fig.4 Raspberry pi Working Flow Chart

The working flow start with initialization of raspberry pi model. In second step their includes two steps, one is collecting the data from STM32 like temperature, time, date, etc and second is getting information from API like weather, etc.

Many other information is required while designing like detection of anyone Infront of door or no, is anyone press any button , depending on that there is need of response from smart mirror as output.

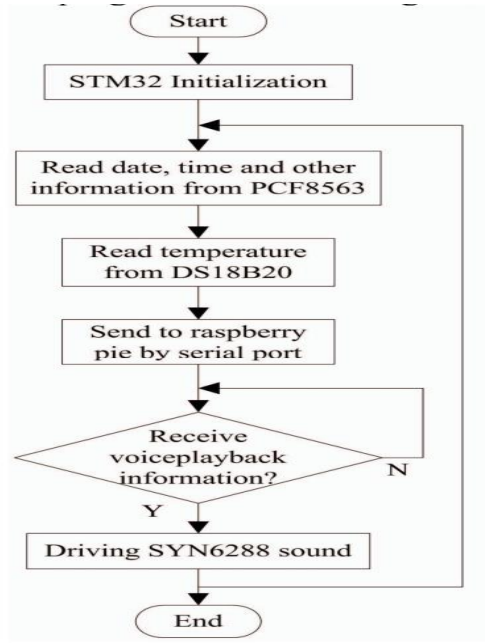

Fig.5 Controller STM32 Working Flow Chart

Controller STM32 is used for controlling commands for interface.STM32 is a 32-bit microcontroller and designed by STMicroelectronics. There is need of initialization, reading an information such as time, date, temperature and send information to raspberry pi through serial port. From raspberry pi further process will be considered.

IV. Results

Below complete hardware output information is mentioned which we got from smart mirror device implemented with the help of raspberry pi.

Fig.6 Proposed Smart Mirror Interface with Mobile

Proposed hardware connection between raspberry pi, microcontroller and other devices is shown above. Hardware connections are very important to get proper transfer of information from one module to other and to get perfect output at last.

Fig.7 Main Display for Smart Mirror System

Smart mirror displays the project title, temperature, time on plasma display. This display is made of plasma display which is preferred over LCD and LED for our application.

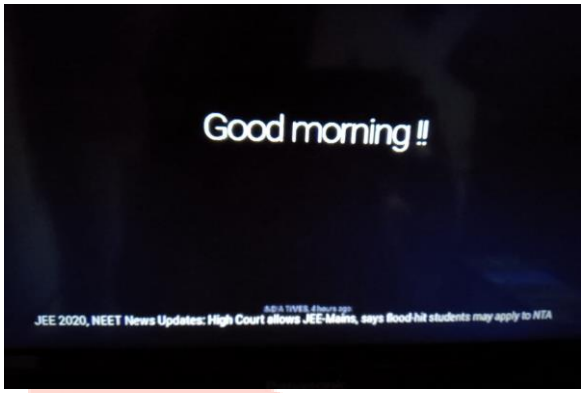

Fig.8 ‘Good Morning !!’ display on smart mirror

At morning time smart mirror displays ‘Good Morning!!’ message and news information at the bottom.

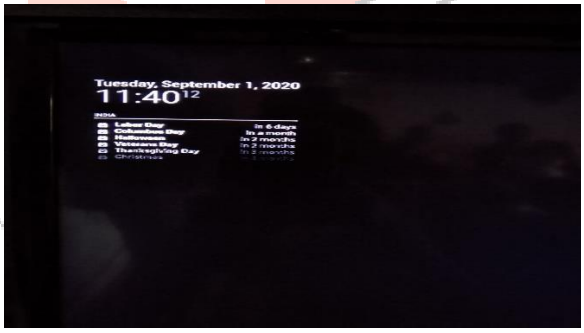

Fig.9 Smart mirror display showing special days

In the year 2020, all the special days will be displayed. Using this display the nearest special day can be seen on display.

Fig.10 Smart Mirror display showing weather Details

Smart mirror is showing weather information on plasma display. It is showing the specific day as well as 1 week weather information on display.

V. CONCLUSION

In this application we used host controller as raspberry pi and main controller as microcontroller STM32.Raspberry pi and Wi-fi module are interlinked which provides weather details , date , time,etc with the help of API interface which is further showed on plasma display for users.User can very easily interact with proposed smart mirror using API interface from the mobile app.Smart mirro preferred over other applications as it has very simple operations with small and low cost hardware part.It is so much userfriendly for even new user.Smart mirror has many advantages in different domain as we as family purpose we can use it.Further same model can be used for face recognition , object identification, etc.

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