RESEARCH ARTICLE OPEN ACCESS

MULTI-PURPOSE MIRROR USING SINGLE BOARD COMPUTERS

[1]M.Pazhamalai [2]P.R.Jeevarathinam [3]P.Naveen kumar [4]Dr.T. Magesh

[1,2,3]B.E Student, [4]Asst.Professor, EEE department, R.M.K Engineering college.

Abstract:

This paper presents the design and development of a smart mirror which is used to perform multiple operations such as monitoring of real time temperature, humidity and air quality also to monitor the energy usage of electrical appliances in home. Single board computers are perfect match for the project of smart mirrors. Any Single board computer can be used to make a smart mirror. We are going to display the energy usage data in a graphical view, a bar graph, from which the user can easily render data from it. The existing models use wifi or internet network to know the outside weather and climate. In this project we are going to monitor the real time temperature and humidity and transfer the data through a low-cost wireless communication module. We are going to use a simple offline voice recognition for moving between weather and energy usage data.

Keywords — **Smart mirror, Single Board Computer, wireless low-cost communication, Raspberry pi, Voice recognition.**

□. INTRODUCTION

Smart mirrors ,also known as magic mirrors, are widely employed interactive component to show climate, time, date, news feeds etc.. . The data is collected from web API's. In our model we are going to feed the Single Board Computer, raspberry pi in our project, with sensors monitoring real time temperature, humidity and energy usage of electrical appliances. The sensor used to monitor temperature and humidity is DHT22 which will transmit the data through a low-cost transceiver, NRF24L01. With this we can able to give the mirror, more accurate data than the data collected from web API's. Another sensor, ACS712, is used to monitor the current usage of an electrical appliance. When each of the electrical appliances are connected to the sensor we will be able to have the graphical view of their energy usages. Voice recognition is used to shift from one data to another. It can be done by using microphones and offline voice recognition libraries. Other basic components such as monitors, Acrylic sheets are used to improve interaction with the user.

□. THEORY

The main aim of this project is to change the purpose of the smart mirror project, rather than being used only to display news events and reminders, we use it to display the energy usage of every electrical equipment with the help of sensors. Secondly we tend to change the data source, which is web API's, since they are less accurate in monitoring the temperature and humidity around a particular area. Instead we are going to install sensor/s around the house and transmit the data to the smart mirror which is acting as a data hub.

In our model, we also change the communication medium between raspberry pi and the data source, which is often used to be wifi network. Here we are going to use low-cost nRF transreceivers, to transmit the data from the data source i.e sensors to the data hub raspberry pi. The advantages of these transreceivers over wifi networks is that they are available in cheap costs and secondly they consume very less power. nRF module consumes power approximately around 15mA while sending and receiving data which is very low when compared to the power consumption of wifi modules.

Smart mirrors are perfect applications for displaying the temperature, humidity and air quality indexes. The reason is, mirrors are always used when a person leaves from home. So the accuracy level of the data places major role here. We are going to use DHT22 sensor, successor of DHT11 sensor which is less accurate when compared to 22 model, which will be acting as a data source for temperature and humidity.

The purpose of smart mirror and devices such as Alexa, Amazon echo are similar such as home automation using voice commands etc. But the smart mirrors has a great advantage of large

displays which can be used to present the data visually more attractive. To utilize that advantage the energy usage of electrical equipments is going to be presented in a graphical manner which will be more convenient for data interpretation than just telling in a speaker.

. RELATED WORK

In our model, our aim is to keep things more accurate and cost-effective. The related works we had gone through for making this project, uses rely on online data sources. [3] Michael Teeuw made the smart mirror to display a complement, weather, date, time and news feeds. He got his data from many online web API's. Weather data was extracted from Openweathermap.org, ical calendar for dates and NOS news for daily news feeds. He chose a observation mirror for his project. [3] Michael Teeuw created a web page to show all these data using HTML, CSS and JavaScript. Teeuw created a platform called MagicMirror[2] to run it on all linux based single board computers.

[4] dylan pierce's MirrorMirror is just as same as that of Teeuw's MagicMirror except the fact he used some acrylic mirror instead of observation mirror to cut down the cost. He changed some of the data sources such as simpleweatherjs.com for temperature and humidity values. He made MirrorMirror as an open source to run on any raspbian pi by just installing his code from github.

[2] The professors from university of Ottawa, proposed that smart mirrors can be made less human intervention for smart home purposes. He proposes to use Ambient Intelligence (Aml) in smart mirror applications. On an attempt to reduce the human intervention, he proposes to use face recognition. He also uses web service as a data source. He gives a basic architecture of the smart mirror and develops a model for getting data from web API's.

[1] Yursi in his "Smart mirror for smart life" project, proposes smart mirror as a Internet Of Things device similar to Alexa, Amazon Echo and Google Home. Here the smart mirror uses the users command to control lights and other electrical equipments in home. [1] Yursi injected smart home with the help of the smart mirror as an interface. He, like other smart mirror projects, displays date, time, climate, weather, warnings, location, traffic etc.. . He is also getting his source from the web API's and using Javascript, Css, Html for displaying those data in a attractive manner. At last he uses SONUS technology, which is a offline voice recognition software, to recognize the hotword. He is using SONUS as a medium of communication between user and the magic mirror. Upon recognizing a hotword, subsequent process is deployed to deliver the feedback.

[5] Fatma Ok's "Smart mirror application with raspberry pi" deals around how to use raspberry pi for this project. The author uses voice recognition as a medium of communication between the mirror and the user. The author uses microphones for getting the voice input and gets other data from web API's to display it on the mirror.

. DRAWBACKS

From all these above smart mirror projects, the first drawback comes from the less accurate data of temperature and humidity from web API's. Secondly since these projects are collecting their data from web API's they must be given a continuous Internet connection either by means of an ethernet or a wifi network. So the power consumption of these devices will rise due to the continuous extraction of data from web API's. Third parameter focuses on cost of maintenance. Since it needs an internet connection continuously, the cost will increase. Other than that since the power drawn is high, electric charges will also rise. Our model will be reducing all these drawbacks by using different techniques.

. PROPOSED MODEL

In our model, to handle the first drawback of less accurate data on temperature and humidity, we are using DHT22 sensor, successor of DHT11 sensor, which measures both temperature and humidity. This sensor draws maximum current of 2.5mA. It will be having 4 pins VCC, data, Nc, and GND. This sensor will measure data for every 2 seconds and it will be having a ADC chip inside which will convert analog signal to digital signal. This sensor will be interfaced with an arduino board. The data produced from the arduino board will be sent to the smart mirror using a low-cost communication device called nRF24L01. This device uses 2.4GHz to transmit data and can cover upto a distance of 90 meters. These devices are

called transceivers since they can both transmit and receive data. There are totally 120 channels for transmitting data and each module can be connected to 6 different devices at a time. These modules uses 8-pin SPI interface, which is supported both by arduino and raspberry pi, to connect to the boards. They can transmit data at a speed of 2Mbps. The module connected with arduino will be acting as a transmitter and the module connected with raspberry pi will acting as the receiver. This system, arduino, DHT22, nRF24L01 will be placed outside the come for the better measurement of temperature and humidity. With this we had overcome the first drawback of less accurate data and it also uses very less power when compared to wifi connection. The nRF24L01 module uses just 15mA power during transmitting and receiving data which is less than that of a small LED.

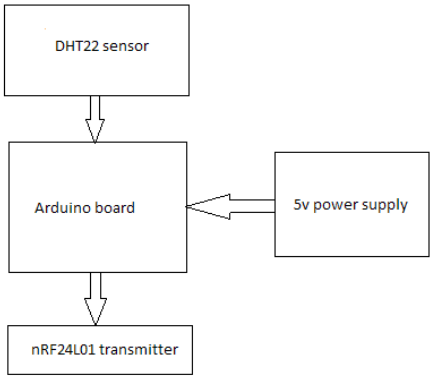

Fig 1. Temperature and humidity data source block diagram.

The data collected by the nRF24L01 receiver will be stored in a file inside raspberry pi. A simple web page has been created to show the data to the user using HTML, CSS and Javascript. The webpage will be totally black except the text in white color. Due to this the user will be able to see his face throughout the mirror and only the text will be displayed at the bottom of the mirror.

For the measurement of energy consumption of electrical devices we are using ACS712 sensor, which can measure upto 5A current, for each component. This sensor has 3 pins. VCC, GND, OUT. Since the voltage will be constant, power consumption can be measured by noting the time taken by the sensor to turn its output to off. Since raspberry pi has 40 GPIO pins many sensors can be connected to it. The data will be stored in a text file in raspberry pi. The webpage which was created to display this data graphically, will render the data from the same text file.

Microphones are used to detect the hotword which is used to shift between temperature and humidity data to energy usage data. I have employed JAVA program to detect a few hotwords with the help of a voice to text library called CMUSphinx. Since not too many hotwords are needed, offline library are capable enough to detect few hotwords.

A PIR Motion detector sensor is used to detect the human intervention. When PIR sensor detects a motion, the first webpage comprising of temperature and humidity will be displayed. After that the microphone starts listening for a keyword. When keyword is received it shows the next energy usage data. For all the time the data will be continuously collected from the ACS712 sensor and the DHT22 sensor. The overview of the block diagram is shown in Fig 2.

□. FUNCTIONAL OVERVIEW

Our model will be performing the following functions as follows:

1. A Acrylic sheet is used to act like a mirror. This will act as a regular mirror.
2. Apart from being a regular mirror, it will display the temperature and humidity data on the screen.
3. User can be able to shift between temperature, humidity data and energy usage data by telling a hotword.

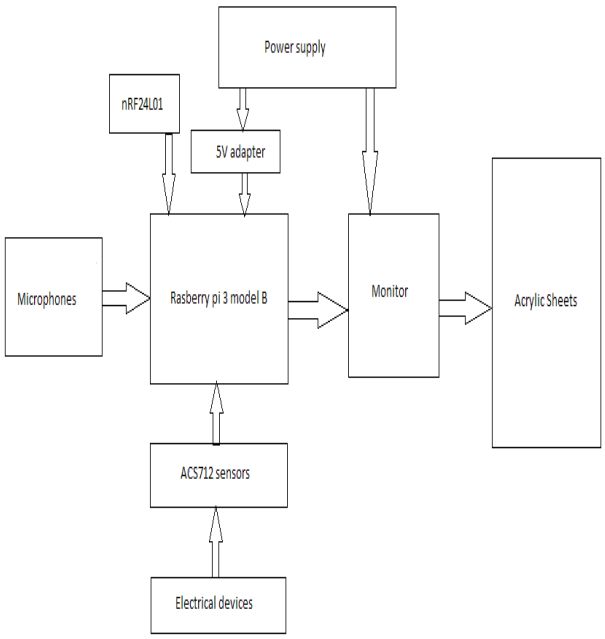

Fig 2. Smart mirror block diagram.

□. CONCLUSION

We have designed a smart mirror that tends to provide accurate data to the user. We have used a square LED display to display the results. Any single board computers can be used to employ as a smart mirror. In our future we will make the smart mirror to control the home appliances with respect to the change in temperature and humidity. The system can be made much more interactive by adding speakers etc..

REFERENCES

[1] Muhammad Mu'izzudeen Yusri, Shahreen Kasim "Smart mirror for smart life", may 2017.

[2] M. Anwar Hossain, Pradeep K. Atrey and Abdulmotaleb El Saddik "Smart mirror for ambient home environment", University of Ottawa, october 2007.

[3] Michael Teeuw MagicMirror^2 , published by raspberry pi blog in 2015.

[4] dylan pierce "Building MirrorMirror" published in blog dylanjpierce in 2015.
Available:
http://blog.dylanjpierce.com/raspberrypi/magicmirror/tutorial/2015/12/27/build-a-magic-mirror.html

[5] Fatma Ok "Smart mirror application with raspberry pi" oct 2017.