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IoT Based Home Automation using Smart Mirror

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Abstract:- Internet and mobile phones connect us more easily in the virtual world. Smart phones with the concept of Internet of things connect us to everyday objects. Intelligent mirrors with computations using microcontrollers and computer provides the information on the places located on the mirror. Smart mirror uses microcontroller cards and associated with web for retrieving information from the web. This will be displayed in the mirror. The proposed smart mirror displays the information such as weather, data and time, calendar, captures picture from camera, multimedia information such as music, voice control and local news from the web. Rasberry pi 3 microcontroller is used as hardware to control the sensors and the smart mirror. This will act as brain of the interactive system and it is powered by python scripts for mirror software. Google assistant Application Programmable Interface is used as personal assistant for interacting with web. IFTTT – a free web service to access open source API's for customizing Google assistant. The device looks like an ordinary mirror. It has screen inside that is capable to interact using voice commands and smart phones.

Keywords:- *Application Programmable Interface ,IFTTT Python, Raspberry Pi;*

I. INTRODUCTION

With the advancement of technology, most of things which we are using in our day to day life is automated. Few examples are smart phone, cars, cities and homes. Home automation system is required to monitor the essential things that includes temperature, power, closing and opening of doors/windows, turning on and off the light and fan and water tank. This can be done from anywhere at any time through mobile. With the help of Internet of Things (IoT) , multimedia and artificial intelligence essential services may personalize to manage the activities in a comfortable manner. IoT is a integrated technology consisting of wireless sensors and internet .Smart mirror offers weather, news update, local date and time. In future smart mirrors are enabled with security performs to manage the payment of electricity bills, phone bills, insurance policy details and daily appointments. Smart mirror may be implemented by using raspberry pi and data from the internet. Rsapberry pi runs with raspbian Jessie pixel operating system. user interface may be developed by using web browser or java script or python[1-5].

Limitations of the existing mirror are users must have an android mobile phone with application installed. Data transaction may be disconnected when the server goes down. This can be overcome by using the smart mirror both in offline and online mode. The proposed smart mirror will display date and time, current weather condition, remainders, energy meter. It has the ability to display widgets, to detect the presence of the user, to navigate the User Interface on user motion.

The remaining sections of this paper are organized as follows. Section II reviews the existing work. Proposed system is explained in Section III, Results and comparison with existing work is explained in Section IV.

II. RELATED WORKS

IOT with rasberrypi technology has been used many advanced applications with advanced results. Smart mirror is used to design interface which is integrated with both personalized data and computing services for controlling house hold smart appliances. Interactive mirror are developed featured with multimedia, personal information that support users in the daily activities. Interactive mirror is a touch and gesture functional mirror.[6-8] The users used this for video show off different types of drawing and 2D games that are displayed using a projector. Smart mirror is not only used for environment purpose but also provides solution to many problems faced by users on a daily basis. Magic mirror uses TV with a mirror finish and uses Microsoft kinect to track movement and take in voice recognition. The whole system is run from a Windows PC. It has the ability to check email, calendar, and social media, which are implemented in the proposed smart mirror as well. Similar works are environment monitoring system can remotely monitor environments parameters such as temperature, humidity etc. Patient monitoring system can be used to wirelessly monitor patients. Physiological parameters such as temperature, blood pressure and ECG.[9-12] Wireless Industrial automation system which is based on Raspberry pi technology. It controls industrial devices, manages power activities and also monitors the employee activities. Home automation with IOT gives huge benefits. Sensors are used to monitor the system. The proposed system includes raspberry pi as a processing unit, temperature sensing, automatic light system, water level sensing system and relay system to control the electronic appliances at home[13-15].

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III. PROPOSED SYSTEM

The proposed system consist of sensors, relay, water level meter, microcontrollers, LED Screen and google home.

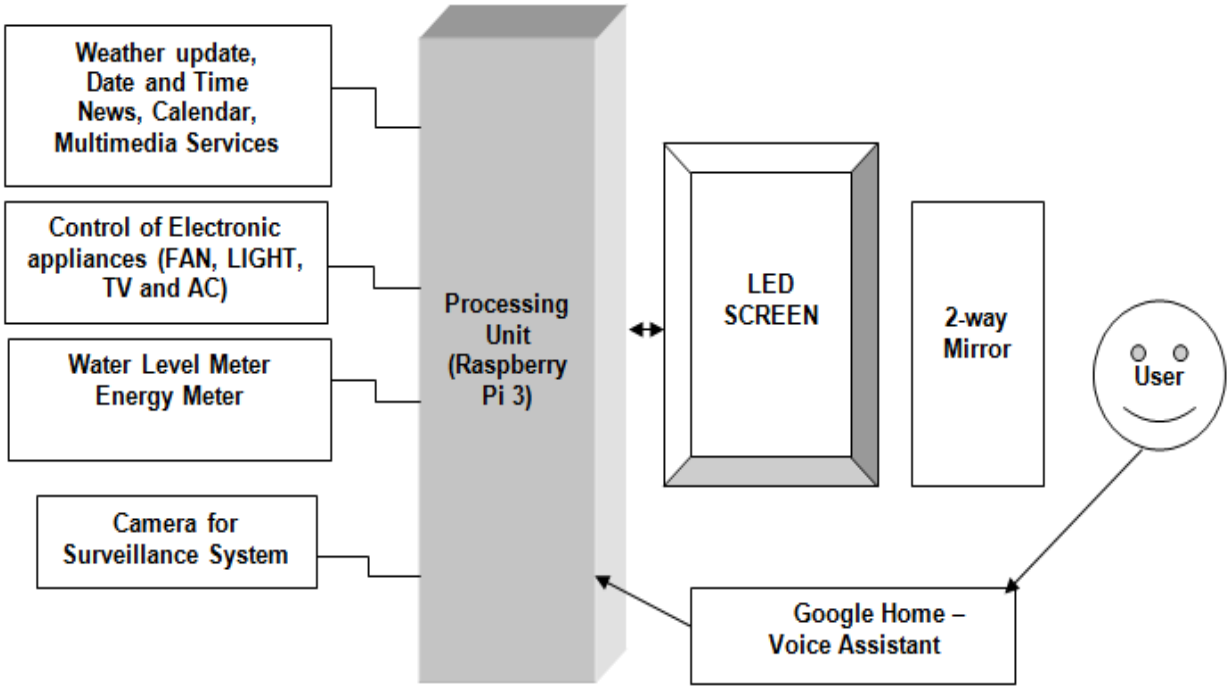

Fig 1:- Block Diagram

Figure 1 shows the block diagram of proposed smart mirror. The mirror is an interaction device. This mirror displays the location based services such date, time, calendar, weather etc . The setup of home automations using Raspberry Pi 3 interacts with the user using voice enabled based assistant system . It also displays the headlines of the news or weather forecast. It looks like a regular mirror but it has screen inside. Transmitted data managed in a centralized data base. A flat monitor is used for the displaying the information. The Smart Mirror contains several information; It is a simple webpage that contains an embedded browser in it. Once the mirror is invoked It automatically displays the information to the user like date, time and newsfeed etc., Secondly mirror is triggered as per the command to control the sensors and electronic appliances such as fan, light, AC and TV. The information is transmitted through WI module to Rasberry Pi using MQ Telemetry Protocol (MQTTP). It is a light weight protocol for publishing/subscribing message. It has low bandwidth, and high latency. It is used in machine to machine or Internet of Things, mobile applications where bandwidth and battery power are minimum. The Mirror user Interface widgets instruct Raspberry Pi to control the requested Services by the user. The Raspberry Pi is configured to listen to voice commands and performs associated task with it. The Smart Mirror is powered by Raspberry Pi and the output is displayed in monitor to the user. This can be implemented in the home, work, college and public environments. The Smart Mirror widgets are very customizable according to the user's requirements. Open source software is used and this can be easily integrated with any of IOT enabled sensor boards for extending more services to the user. It provides customized profiles Management Where Users can create their own profiles and store them in the system.

According to this profile, customized services are provided to the user Information's such as Weather, Date, Time, News, Calendar and Multimedia Services is provided to the mirror using google assistance. It uses IF This Then That (IFTTT) protocol, a free web based services for web page and mobile applications. It controls the services with Application Programmable Interface (API's) like SMS. It presents information's such a weather, date and Time, calendar etc. "This" refers to trigger an applet. From an RSS feed, notifications are received based on keyword or phrase. "That" refers the output that results from the input of the trigger. Here applets are made from trigger and actions and here it is used to send the information from the Internet to the raspberry pi and then to the mirror. One of the applications of IFTTT is home automation for instance switching of lights, detecting motion in room etc. sensors for water level and energy meter is directly connected to WIFI module enabled with arduino for transmitted the data to Rasberry Pi . Electronic appliances are controlled using relay and the information is sent to blink server and through WIFI module data is transmitted to Raspberry Pi . Camera Module is connected to provide surveillance feature. Python Script is written to automate the process and it is executed in Raspbian Operating system. It is a debian based Linux operating system for the Raspberry Pi. Data are stored in google cloud Application Programmable Interface. Figure 2 shows the hardware setup.

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Fig 2:- Hardware Setup

➢ *Rasberry pib+*

Fig 3:- Raspberry Pi

The Raspberry Pi 3 Model B+ . It has Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit SoC @ 1.4GHz, 1GB LPDDR2 SDRAM,2.4GHz and 5GHz IEEE 802.11.b/g/n/ac wireless LAN, Bluetooth 4.2, BLE,Gigabit Ethernet over USB 2.0 (maximum throughput 300 Mbps), Extended 40-pin GPIO header, Full-size HDMI, 4 USB 2.0 ports, CSI camera port for connecting a Raspberry Pi camera, DSI display port for connecting a Raspberry Pi touchscreen display, 4-pole stereo output and composite video port, Micro SD port for loading your operating system and storing data , 5V/2.5A DC power input and Power-over-Ethernet (PoE) support (requires separate PoE HAT).

➢ *Google Home*

It supports audio formats such as HE-AAC, LC-AAC, MP3, Vorbis, WAV (LPCM), Opus, etc. It has 802.11b/g/n/ac(2.4GHz/5GHz) Wi-Fi for high performance streaming and Bluetooth for AVRCP Controller, target, A2DP sink,A2DP source, GATT Server, GAP. It contains speaker with 2" driver +dual 2" , power adapter of 100-240V -1.1A 50-60Hz, ports and connectors with DC power jack and Micro-USB port . It supports android 5.0 and ios 10 and higher. It enables users to speak voice commands to interacts with services through google personal assistant software. Home automation is done using this. Google assistant is an artificial intelligence powered virtual assistant developed by google.

➢ *Water Level Sensor:*

It is an ultrasonic sensor HCSR 04. It has four pins . Pin 1-+5V,Pin 2- trigger pin . It is an input pin . It is kept s 10us to initialize measurement by sending US wave. Pin 3 echo pin . It is output pin and it goes high for a period of time which is equal to time taken for the US wave return back to sensor. Pin 4 –ground. It covers the measuring distance of 2cm to 450cm with an accuracy of 3 mm. Its operating current is less than 15 mA and frequency as 40 Hz. It supports raspberry Pi

➢ *Camera:*

5MP Infrared IR Night Vision CMOS Camera Module For Raspberry Pi The Raspberry Pi Camera Board. It has 5MP (2592×1944 pixels) with Omnivision 5647 sensor in a fixed focus module. It attached to Raspberry Pi using 15 Pin Ribbon Cable, to the dedicated 15-pin MIPI Camera Serial Interface (CSI). This CSO bus has high data rates, and it carries pixel data to the BCM2835 processor. It is capable of 2592 x 1944 pixel static images, and also supports 1080 p @ 30 fps, 720 p @ 60 fps and 640 x480 p 60/90 video recording.

CMOS sensor type is used, WIFI Module : ESP8266 It has 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2),general-purpose input/output (16 GPIO),Inter-Integrated Circuit (I²C) serial communication protocol, analog-to-digital conversion (10-bit ADC),Serial Peripheral Interface (SPI) serial communication protocol,I²S (Inter-IC Sound) interfaces with DMA(Direct Memory Access) (sharing pins with GPIO),,UART (on dedicated pins, plus a transmit-only UART can be enabled on GPIO2), and pulse-width modulation (PWM). It employs a 32-bit RISC CPU based on the Tensilica Xtensa L106 running at 80 MHz (or over clocked to 160 MHz). It has a 64 KB boot ROM, 64 KB instruction RAM and 96 KB data RAM. External flash memory can be accessed through SPI.

➢ *Dual Purpose Display*

The LED Screen is used for the displaying of the widgets to the user by collecting data from internet and converting it into widgets.

➢ *Software Module*

Software Platforms and Languages used in the proposed module are**:** Application Running on Raspberry Pi is developed using Python language, Web Application is developed using open source IFTTT and blink server and Database: Google cloud Application Programmable Interface.

- Step 1 : Data transmission using MQTT protocol wifi module to Rasberry Pi configure the server with local host as 1883,topic as esp, mode as receive , set interval as 30000 etc
- Step :2 set the local host and port number with time format and metric values.
- Step 3: write the code for extracting the values of clock, calendar, holiday's list, weather and newsfeed from Internet
- Step 4: collected information's are stored in google cloud.

IV. RESULTS

The Figure 4 displays the date, time, list of holidays, weather update and news.

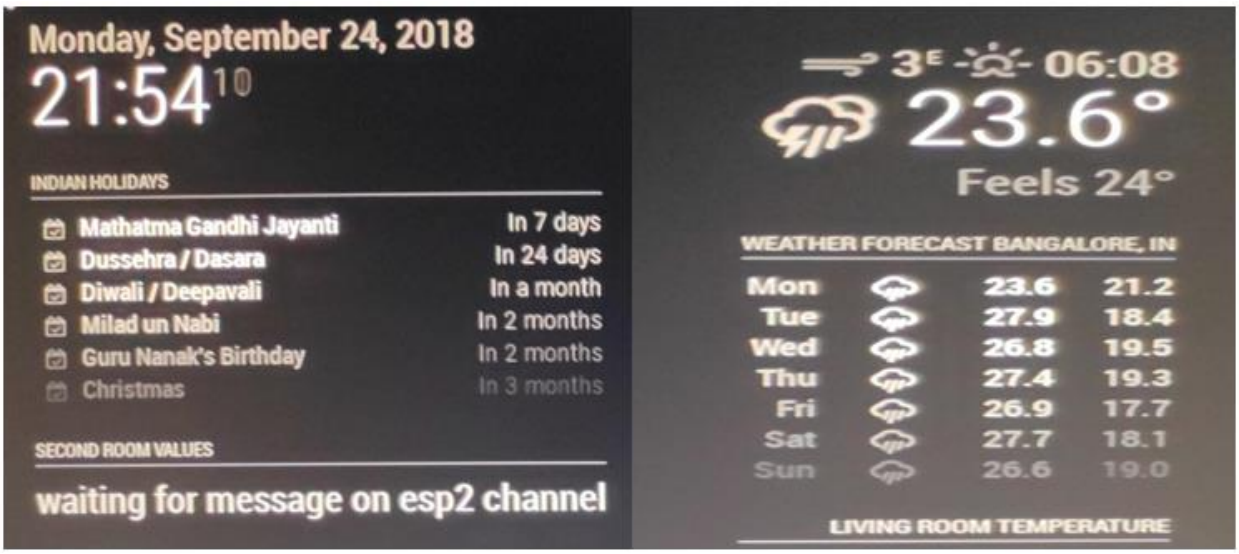

Fig 4:- Output Screen

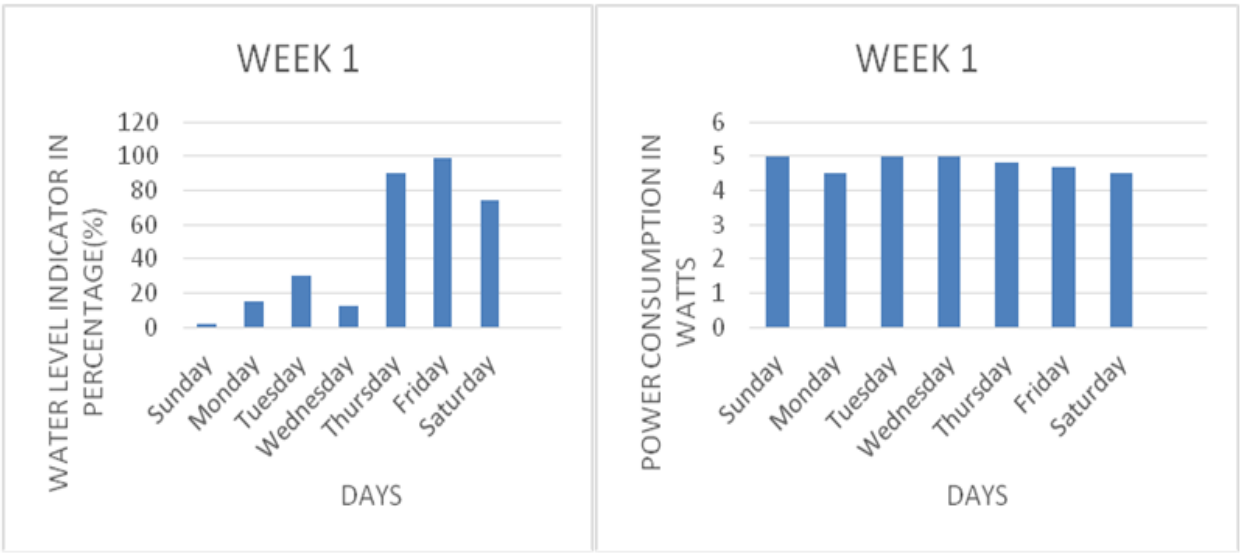

Fig 5:- Analysis of Water Level indication and Power Consumption

Figure 5 depicts the analysis of water level and power consumption of a week. Percentage of indication and power consumption are taken in y axis and number of days is taken in x axis. It is inferred that water level and power consumption is varied based on utilization.

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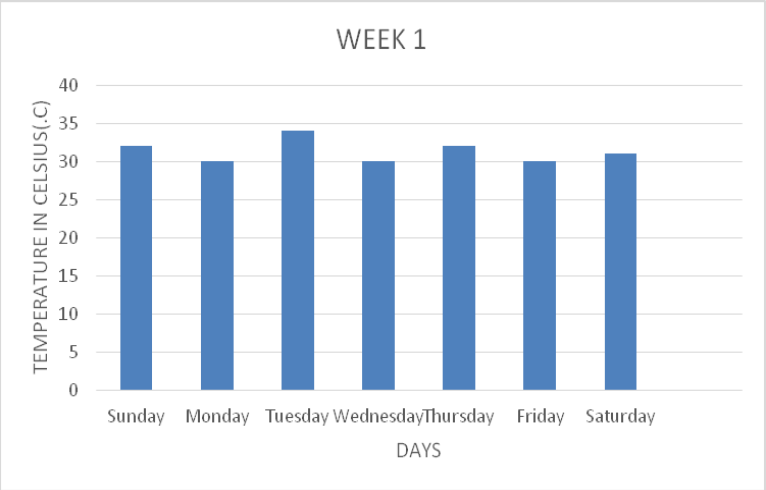

Fig 6:- Temperatures in Celsius

Figure 6 shows the weather report of a week. Temperature in Celsius is taken in y axis and number of days is taken in x axis. From the graph it clearly shows the temperature is above 30 degrees on few days.

Feature	Raspbian magic mirror-smart mirror to monitor children by using raspberry pi technology	Design and development of smart mirror using raspberry pi	Smart mirror –A home automation system implemented using ambient artificial intelligence	Home automation using Smart mirror
App Requirement	Yes	No	No	No
Voice Recognition	No	Yes	Yes	yes
Touch screen	No	Yes	No	No
Gestures	No	No	No	No
Fitness	No	No	No	No
Music Support	Yes	Yes	Yes	Yes
Video Support	Yes	No	Yes	No
Water level monitor	No	No	No	Yes
Weather	Yes	Yes	Yes	Yes
Energy meter	No	No	No	yes
Social Networking	No	No	No	yes

Table 1:- Comparison

A comparison of the proposed module with the existing one is given in table 1 It is inferred that the when compared with the existing mirror the proposed mirror does not require any application. It provides voice recognition, music support, water level monitor, energy meter, weather report, and social networking features.

V. CONCLUSION

The proposed mirror provides home automation with IOT enabled. It has surveillance system for monitoring. It uses raspberry pi b+ for automation and displays the additional information such as weather, time, date, calendar, news update etc. During the development, few limitations are identified: if the Internet connection is down, the system won't be able to continue the connectivity and the data won't be stored in the database. Data transaction may disconnect when the server goes down. It's an open source, security is needed. In order to provide security the proposed system may be implemented using microchip AVR Microchip Technology. AC164160 AVR-IoT WG Evaluation Board is to provide IoT with sensor node solutions. It can interface with smart modules to reduce the complex algorithm. It consists of cryptographic coprocessor chip to store private keys, validate the firmware, and offer a secure boot process for the device. It establishes a secure connection to the Google Cloud IoT. This secure connection is achieved by using JSON Web Token to authenticate the device

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