

HOME MONITORING AND CONTROLLING SMART GADGET

A Project Report Phase – II

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering Degree in Electronics and Communication Engineering

by

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SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC

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APRIL - 2023



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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of DHANALA VENKATESHWARLU (Reg.No:39130113), and KANTA SAI SRAVAN (Reg.No:39130208) who carried out the project entitled "**HOME MONITORING AND CONTROLLING SMART GADGET**" under my supervision from November 2022 to April 2023.

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Dr. T. RAVI, M.E., Ph.D.,

Submitted for Viva voce Examination held on 25.04.2023

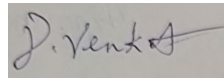
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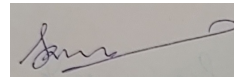
DECLARATION

We, **DHANALA VENKATESHWARLU (39130113)** and **KANTA SAI SRAVAN (39130208)** hereby declare that the Project Report entitled “**HOME MONITORING AND CONTROLLING SMART GADGET**” done by us under the guidance of **Dr.T.RAVI, M.E., Ph.D.**, is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electronics and Communication Engineering.

1)



2)



SIGNATURE OF THE CANDIDATES

DATE: 25.04.2023

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ABSTRACT

The Internet of Things (IoT) has revolutionized the way we interact with our homes, providing us with unprecedented control and automation over home appliances and environment. An IoT based smart devices has been developed with a graphical user interface (GUI) for remote monitoring and controlling the entire sub-station equipment which enables intelligent and seamless experience for a user. Our lifestyle has evolved in such a way that managing time is the most important thing. This results in Smart Gadget developed with Raspberry Pi, and a portable display which is used to monitor the data of IoT devices in Home and control them remotely. It reduces time consumption by displaying the useful information on the screen, so that multiple works can be done at a time.

The Gadget is having different modes for various applications like: for monitoring temperature, humidity, air quality and gases levels present in air, water level in tank etc. in real time. And also, for controlling the electrical appliances of various kinds (like bulbs, fans, water motor, etc.) inside the house. DC fans are the tools to control the home temperature system. The NodeMCU board can send the system data to the cloud which is essential for monitoring and controlling of the entire substation. Using a GUI interface helps the user to easily interact and understand the control system. The Raspberry Pi acts as the central processing unit of the Smart Gadget system. By using the touchscreen display, it is very helpful for physically challenged people and elder people. The smart gadget enables to make flexibility in home monitoring and controlling system with single portable device.

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CHAPTER 1

INTRODUCTION

An IoT smart gadget is an electronic device, generally connected to other devices or networks via different wireless protocols (such as Bluetooth, Zigbee, near-field communications, Wi-fi, Li-fi, or 5G) that can operate to some extent effectively. At present, many intelligent products are emerging, smart TV, smart watches, smart glasses, smart bands, smart doorbells and smart locks, phablets etc. To achieve a comfortable life man has invented different technologies for his needs. IoT has made it possible for the physical world to meet the digital world and cooperate with each other. It offers numerous benefits to organizations by enabling them to automate and simplify their daily tasks. IoT devices are hardware devices, such as sensors, gadgets, appliances and other machines that collect and exchange data over the Internet. They are programmed for certain applications and can be embedded into other IoT devices. The IoT devices are used for various purposes like for home and industrial security, activity tracking, motion detection etc. Most popular IoT devices in recent times are:

- Amazon Echo Plus Voice Controller
- Footbot
- August Doorbell Cam
- Phablet
- Fitness Bands

1.1 IoT DEVICES

As of 2021, there were 21.7 billion active connected devices in the world today, out of which more than 11.7 billion (54 percent) are IoT devices. This means that there are more IoT devices in the world than there are non-IoT devices. IoT devices can range from small ordinary household cooking appliances to sophisticated industrial tools. Each IoT component has a Unique Identifier (UID) and they can also transmit data without the assistance of humans. The networking, communication and

connectivity protocols depend largely on the specific IoT application deployed. IoT has made it possible for the physical world to meet the digital world and cooperate with each other. It offers numerous benefits to organizations by enabling them to automate and simplify their daily tasks.

1.1.1 Types of IoT Devices

- **Amazon Echo Plus voice controller** is a popular and reliable IoT device. It is capable to run songs, do phone calls, setting timers and alarms, ask questions, providing information, checking the weather, managing to-do & shopping lists, managing house instruments, and several other things.

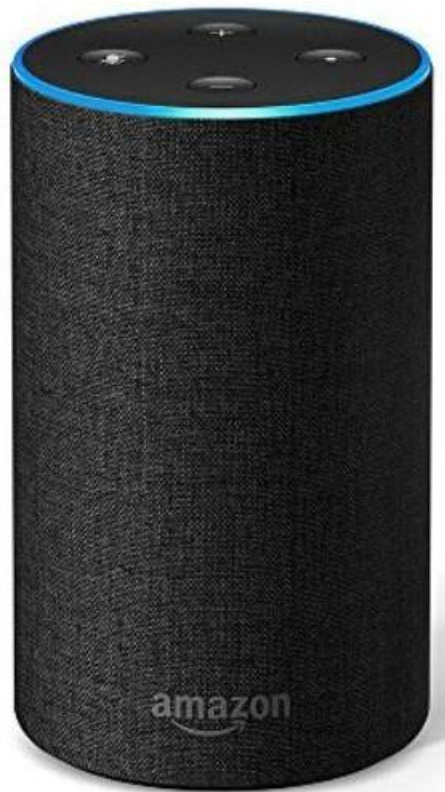


Fig: 1.1: Amazon Echo Plus
source [16]

- **Amazon Dash Button** is basically a device that gets connected over internet Wi-Fi and makes sure that the user does not lack important household items like soft drinks, grocery material, medical and personal care, kids and any pet items ever again.

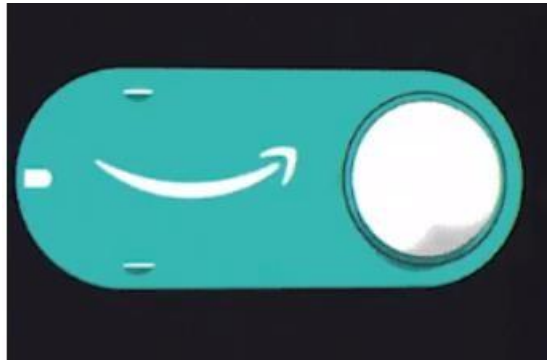


Fig: 1.2: Amazon Dash Button

source [16]

- **August Doorbell Cam** is an effective IoT innovation. August Doorbell Cam allows user to answer the door from anywhere or remote location. It constantly checks the doors and also captures motion changes in the doorstep.



Fig: 1.3: August Doorbell Cam

source [16]

- **Foobot** is a reliable IoT device which is helpful in measuring indoor pollution and leads to improved air quality in houses, workplace, and indoor public spaces. It often gives accurate results.



Fig: 1.4: Footbot

source [16]

- **Nest Smoke Alarm** is a very useful IoT device. It is a smoke alarm that thinks, speaks and alerts user's mobile phone about any un-wanted emergencies in the home. It automatically tests itself.



Fig: 1.5: Nest Smoke Alarm

source [16]

1.1.2 Functions

IoT Smart Gadget provides several functions such as

- Collecting the data from sensors and storing the data securely.
- The collected data is transferred to cloud server, processed, and analyzed to

take actions according to the results.

- In certain specific cases, sending and receiving data is not a convenient solution, as real-time action is necessary. Instead of sending data to sever, the processing is done closer to devices. The data can be collected centrally at later stage if necessary.
- Controlling the appliances and saving the energy.
- Alerting the user, if any unusual or drastic changes occurs in data which is monitored.

Different IoT devices have different functions, but they all have similarities in terms of how they work. Firstly, IoT devices are physical objects that sense things going on in the physical world. They contain an integrated CPU, network adapter and firmware, and are usually connected to a Dynamic Host Configuration Protocol server. It also requires an IP address to function over the network.

1.1.3 Applications

Applications of IoT Devices are

- Pollution monitoring and reporting
- Wearable Bands
- Smart Door access control system
- Smart thermostats and humidity controllers
- Autonomous driving
- Healthcare
- Activity Recognition in Sports
- Tracking and Locating
- Environmental Condition Monitoring
- Fall detection and prevention
- Smart Assistant speakers
- Smart Grids

1.2 RECENT TRENDS AND FUTURE

The basic trends regarding IoT Smart Gadgets are

- Smart home security cameras provide alerts and peace of mind. Activity trackers are sensor devices that can monitor and transmit key health indicators in real-time. User can track and manage the blood pressure, appetite, physical movement and oxygen.
- IoT-enabled detection systems, sensors and cameras can be placed in restricted areas to detect trespassers. They can also identify pressure buildups and small leaks of hazardous chemicals and fix them before they become serious problems.
- Motion sensors can detect vibrations in buildings, bridges, dams and other large-scale structures. These devices can identify anomalies and disturbances in the structures that could lead to catastrophic failures. They can also be used in areas susceptible to floods, landslides, and earthquakes.

1.3 ORIGIN OF IDEA

IoT is really just getting started and the estimations for the future growth of IoT devices are at the high end of the scale. In the next few years, people will be connected in ways that are deemed impossible today. So we came up with this Home Monitoring and Controlling Smart Gadget which reduces the problems in home monitor and control system.

1.4 ORGANIZATION OF THE REPORT

The project report is organized into six chapters.

Chapter 1: This chapter focuses on introduction about Smart Devices. The recent trends and origin of the idea are discussed.

Chapter 2: This chapter provides detailed literature survey related to the project, Literature summary, problem definition, Objectives of the project.

Chapter 3: This chapter describes about the existing system and its function. The system has Raspberry Pi as the major component. It even explains about the limitations of the existing system. And proposed methodology.

Chapter 4: This chapter describes about the Proposed Smart Gadget System and its function in detailed with hardware description, block diagram, circuit diagram and flowchart..

Chapter 5: This chapter describes about the results and detailed discussion on proposed home monitoring and controlling smart gadget system.

Chapter 6: This chapter describes about the detailed conclusion and future scope of proposed home monitoring and controlling smart gadget system.

CHAPTER 2

LITERATURE SURVEY

This chapter provides detailed literature survey related to the project, Literature summary, problem definition, Objectives of the project.

R. Vinay et al. (2020) focused on a smart mirror which provide access to receive all the information that could affect how people plan for the day. For weather and news update, a person will always have to stand in front of time which is more time-consuming. To get rid of these problems smart mirror is introduced. Switching on and off of lights through voice commands can be done. So this reduces the risk of accidentally electric shock especially for children [1].

The Smart mirror is developed by Raspberry Pi as the host controller, and SMT32F030C8T6 microcontroller as the core control chip. Raspberry Pi is connected to the network via WIFI, and the weather information, clothing index, time, date, and other information are obtained by the API interface display. The user can interact with the mirror through the mobile APP, and can communicate with the mirror through the voice synthesis module SYN6288. The system realizes the functions of face recognition, speech recognition, voice playback, control of fan and room light. Smart mirror has a small size, simple operation, low cost, high degree of user-friendly, personalized user interface, and other advantages, it also assists the user with news updates. It is suitable for families, and has broad application prospects.

Denny Hardiyanto et al. (2019) designed a smart mirror to display laboratory information media using Raspberry Pi. The smart mirror has two inputs, namely the PIR sensor and internet information (API, iCal, and Rss). PIR sensor served to send a signal to the Raspberry to change the monitor mode to energy saving mode if there was no one who mirrored. Internet information was used to synchronize modules with internet data so that information from the internet could appear on the screen and could be updated automatically [2].

Raspberry is a mini computer used to process information on a smart mirror. This

information was generated by a program developed from a website that contained a collection of information. The information in the smart mirror was connected to the internet network, therefore the displayed data was actual. Smart mirror required a mirror to be utilized to display information from the monitor. The utilized mirror was a one-way mirror. This mirror had the ability to transmit light from the monitor, so the mirror looks like a monitor. After analyzing the tests that have been carried out, there are several conclusions, namely information that has been successfully created and successfully displayed on the smart mirror are time information, academic calendar, weather, news, practicum schedules, prayer times, and compliments.

Dr. M.S.S. Rukmini et al. (2016) described a system for Remote control of appliance based on Raspberry Pi. In initial stage Home automation has been recalled associated an application has been developed within the and stage that is focused on the humanoid method. Mobile devices area unit glorious in providing a program in an exceedingly home automation approach. And will be ready to communicate with a home automation network via associate internet however ineffectual to instantly be to bear with devices within the network, as these devices in all probability place into impact low power consumption protocols almost like ZigBee, Wi-Fi etc. It focused on dominant home appliances through humanoid gismo utilizing Wi-Fi as communication protocol further more as raspberry pi as server system. the techniques discussed are; Java based Home Automation System, Home Automation with GSM, Home Automation based on SMS [4].

Imran A. Zualkernan et al. (2009) presented the architecture of a wireless monitoring system that allows home-owners to monitor various components of their smart home. The architecture is based on the Zigbee protocol that is cost-effective and scales to a large number of devices. The system can be interfaced with existing smart home automation systems to allow multiple users to wirelessly monitor their home appliances status and get real-time data from the World Wide Web such as weather and traffic status, stocks market prices and public transportation schedule [7].

Kohichi Ogawa et al. (2022) proposed a method to notify home appliances status by monitoring the LED indicators of their control panel. In the future, a plan for informing

users of the appliance status, including using sound from the home appliance itself is considered. Also making the monitoring device smaller to fit different home appliances. In addition, recognition of the home network configuration for the monitoring of the home appliances and the servers that conducts the monitoring process are essential to research elements is done. Furthermore, the application of this study will also enable us to monitor the behavior of the elderly and people with disabilities. To verify the method's effectiveness of system, it is necessary to conduct experiments using various home appliances. In future research, planning experiments using multiple home appliances helps to improve the notification of home status system [3].

Praveen Kumar et al. (2016) presented a low-cost and flexible solution to the smart home. The appliances of the home can be controlled by different methods such as GUI interface and World Wide Web. The person of the house can watch his family, security guard and the building from anywhere and anytime as per his interest or requirement. It improves the security of the building, and the person can alert as well as can take necessary steps toward family safety. The system reduces the effort of the person of the house for monitoring and controlling of the appliances as well as handling of the visitor in the most respective way by authenticating and proper response. This system can also be used for reducing the wastage of electrical energy in the house by proper scheduling and monitoring of the appliances. The system response is good and sustainable for long time operation [5].

Boyoung Lee et al. (2009) proposed a status monitoring system for home appliances controlled by IR controller. Existing camera monitoring systems is attractable because users can see with their physical eye, but it requires many cameras, and sometimes it is useless for the appliances which generates audio signal only. To overcome this weakness, this proposed current measuring method to determine the status of the appliances. Using this system, increase of the reliability of users is done, who control home appliances using Internet or cellular network remotely [8].

Muhammad Raisul Alam et al. (2012) identified several future directions of smart home research. The trends indicate the increasing popularity of using middleware to

integrate heterogeneous devices. Because multivendor devices will coexist in future, the use of middleware is an efficient solution to create networks that will overcome the limitations of diverse device integration. It seems that home intelligence will be employed in a distributed manner. This distributed intelligence may be applied in the form of smart devices. The system will also use different user interfaces to acquire user feedback, most of which will be based on auditory, visual, and haptic perceptions. Recently, people have become concerned about information security, which can be easily solved by using concepts from computer security and cryptography [6].

Md. Emdadul Haque et al. (2019) proposed a customizable GUI and an inexpensive embedded system with internet connectivity for monitoring and controlling several devices and home appliances remotely, using android-based smart phone application or computer-based application. The system consists of a customizable GUI that facilitates the users' demand; micro-controller helps convey the user input to the system; wireless connection to the devices under the system. This study explains the overall design of a low cost Home Automation System (HAS) with wireless (WiFi) system (Internet). This HAS is designed to assist and provide support in order to fulfill the needs of children, elderly people and common disabled individuals in their home [9].

In addition, the smart home concept based on IoT improves the standard of living at home. The main control system implements a client server relationship to provide remote access from smart phone through wireless Internet technology. The switches of the electrical appliances are synchronized with the entire control systems in a way that every user interface displays the real time status of the existing switches. Using EEPROM, the last status is preserved and in case of power cut, the system will retain the last-known reading when it recovers from a sudden calamity. The novelty of the system is it gives permission to multiple users at the same time to access the system and change their priority. This system is designed with customizable GUI, inexpensive embedded system, and it is easy to install, control and monitor with an array of electronic devices widely used in everyday home chores.

Nikolay Valov et al. explained a system on home automation system with

raspberry pi. It provides one home automation solution, outlining a combination of the selected hardware components and a potential software solution. The Raspberry Pi microprocessor, which is linked to sensors for data collecting, is a significant piece of hardware in the project that is being demonstrated. The microcomputer runs the proposed software system to handle various home devices and reports, organise and process this data, create various home automation modes, and analyse the gathered data. One of the most popular and practical methods for carrying out IoT projects, gathering sensor data, and controlling various devices is the Raspberry Pi. Implementing these kinds of projects is made easier by the device's capacity to install and run web apps and database management systems. The prototype mentioned in the article has to be evaluated to determine how it performs while operating actual devices before it can be utilised in daily life. In this instance, it was tested only with various coloured LED lights that represent various output events. It will be important to use stepper motors as an example to function in real-world situations. Also, the suggested web application's security has to be evaluated and improved. It's also feasible to develop a mobile app with a unique user interface and notification system. After data for more than a year has been gathered, it would be highly beneficial to further develop the system's self-improvement [11].

Bhaumik Vaidya et al. (2017) built a system on smart home automation with a special door monitoring system for elderly persons. It means that a planned home automation system employing a Raspberry Pi module and an Android application has been made. AC Via an Android application, user may operate appliances like a bulb or fan with touch or voice. An application specifically designed for operating devices and viewing status has been created. For security and surveillance purposes, an automatic door monitoring system utilising a USB camera, Python, OpenCV, Raspberry Pi, and an Android mobile is suggested. Elderly and disabled individuals living alone in their homes can especially benefit from it. The database for appliance status at a certain moment has been created [12].

2.1 LITERATURE SUMMARY

Based on the survey that mentioned above there are existing system that helps in displaying data in the form of information on the mirror and with the survey a user can only monitor the data displayed on the screen or mirror, but they won't include control of electrical devices. There are many journals and papers regarding Smart Mirror. With this proposed Smart Gadget we rectify the disadvantages of the existing paper and updates with monitoring data and also controlling electrical appliances.

2.2 PROBLEM DEFINITION

To develop an IoT based home monitoring and controlling smart gadget system that provide access to receive all the information from the sensors preinstalled in the house, and helps in monitoring and controlling respective devices remotely. It is difficult for a person to manage entire house; it is more time-consuming process. To get rid of these problems smart gadget was introduced. This device reduces the risk of accidental electric shocks especially for children and elder people.

2.3 OBJECTIVE OF THE PROJECT

- To understand existing home monitoring system by detailed literature survey
- To analyze information from sensors by using Raspberry Pi 4.
- To design and develop portable smart touchscreen gadget which communicates with Raspberry Pi, for monitoring and controlling house.
- To analyze the performance of proposed smart gadget.

CHAPTER 3

AIM AND SCOPE OF THE PRESENT INVESTIGATION

This chapter describes about the Existing Smart Mirror System and its function. The system has Raspberry Pi as the major component. It even explains about the limitations of the existing system.

3.1 SMART MIRROR

An interactive smart mirror prototype is build based on Raspberry Pi. That can recognize the face and display his mail, news update, and all the basic information like time, weather, calendar, and music play, and some home automation application (switching on and off of lights and fan).

The Smart mirror is developed by Raspberry Pi as the host controller, and SMT32F030C8T6 microcontroller as the core control chip. Raspberry Pi is connected to the network via WIFI, and the weather information, clothing index, time, date, and other information are obtained by the API interface designated by the extranet. At the same time, the relevant information is displayed on the display.

The user can interact with the mirror through the mobile APP, and can communicate with the mirror through the voice synthesis module SYN6288. The system realizes the functions of face recognition, speech recognition, voice playback, control of fan and room light. Smart mirror has a small size, simple operation, low cost, high degree of user-friendly, personalized user interface, and other advantages, it also assists the user with news updates. It is suitable for families, and has broad application prospects.

The main goals of the Existing System are:

- To implement weather, calendar, date and time module in

Raspberry Pi.

- Face recognition using Raspberry Pi.
- Voice recognition and interaction using Raspberry Pi.
- Implementation of Home Automation in Raspberry Pi.

The user can interact with the mirror through the mobile APP, and can communicate with the mirror through the voice synthesis module SYN6288. The system realizes the functions of face recognition, speech recognition, voice playback, control of fan and room light. Smart mirror has a small size, simple operation, low cost, high degree of user-friendly, personalized user interface, and other advantages, it also assists the user with news updates.

3.1.1 Function

A smart mirror is a two-way mirror that is 70% reflective and 30% transparent. And behind the mirror an LCD display is placed and it is connected to the Raspberry Pi.



Fig: 3.1: Smart Mirror with LCD display at backend

source [1]

3.1.2 Raspberry Pi

It is known as card type computer is a microcomputer mainboard based on ARM. Raspberry Pi is connected to the Wi-Fi and information is accessed

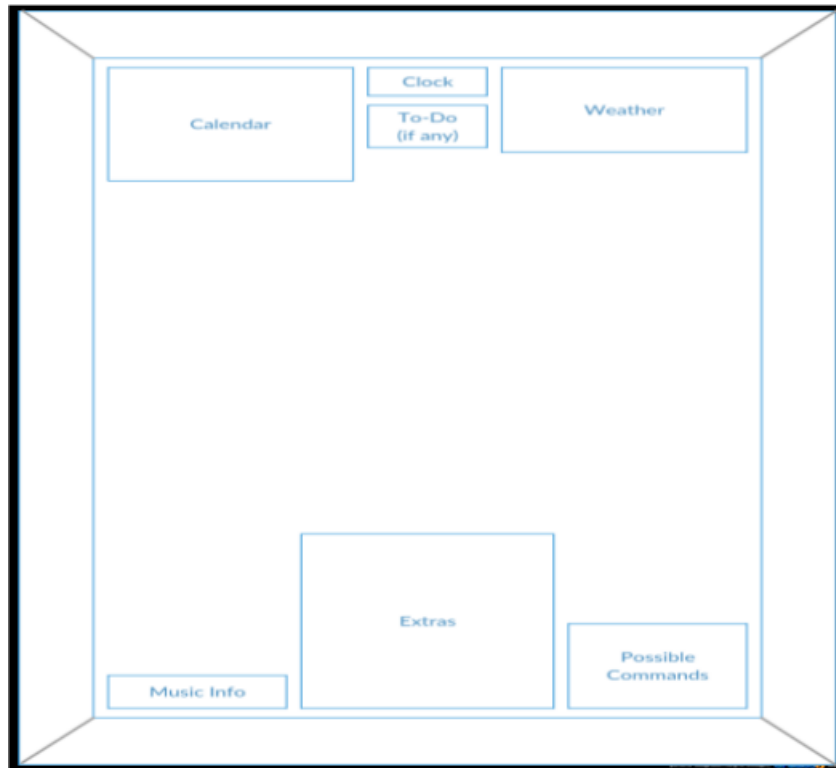


Fig: 3.3: Mirror Display

source [1]

Existing System Algorithm for information system

Step 1: Switch on the power supply.

Step 2: Initialize the SMT32 microcontroller.

Step 3: Get the date, time, and weather details from the predefined URL and get the news from the internet.

Step 4: Send the acquired data to Raspberry Pi through the serial port.

Step 5: Display it on the mirror via an LCD monitor.

Step 6: Switch off the power supply when it is of no use.

Step 7: End.

3.1.3 Objectives

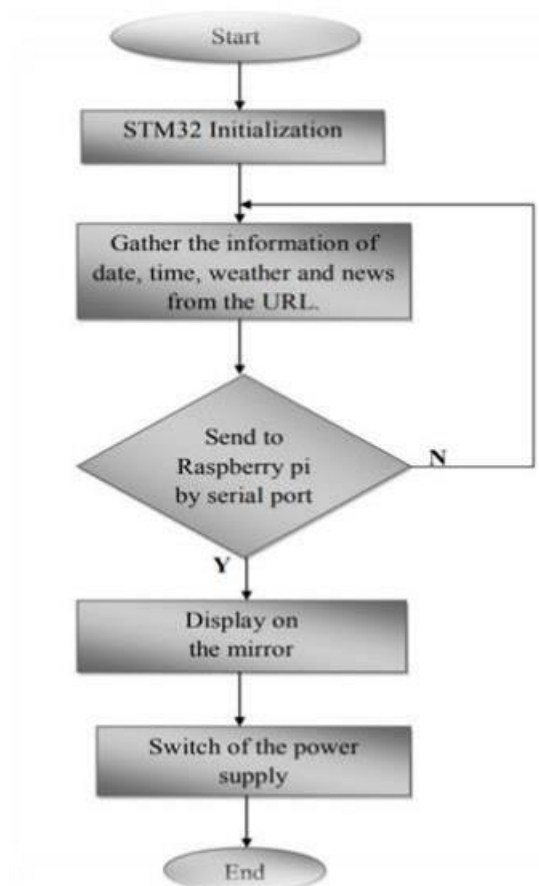


Fig: 3.4: Information System Flow chart

source [1]

Face recognition is an add-on to the project. Initially the system is trained by adding data of the image. The software used here is Python. LBPH (Local Binary Pattern Histogram) algorithm is used in identification. Initially the person face is captured by web camera several times depending on the need of the user, but approximately 100 pictures for better accuracy. And each picture is divided into n number of pixels. It is stored in the Raspberry Pi memory. Then when a person stands in front of the mirror his face will be compared with the stored images and if it matches then it will display the name of the user as stored in memory during the training process. It displays email content if the person is registered. Else it just greets and accepts comment through Wireless

Transceiver Module. Haar-feature is used in face recognition. It is a sequence of rescaled square-shaped functions, similar to Fourier-analysis. There are two types of edge features and line features. It uses greyscale images 0-255 shades of black.

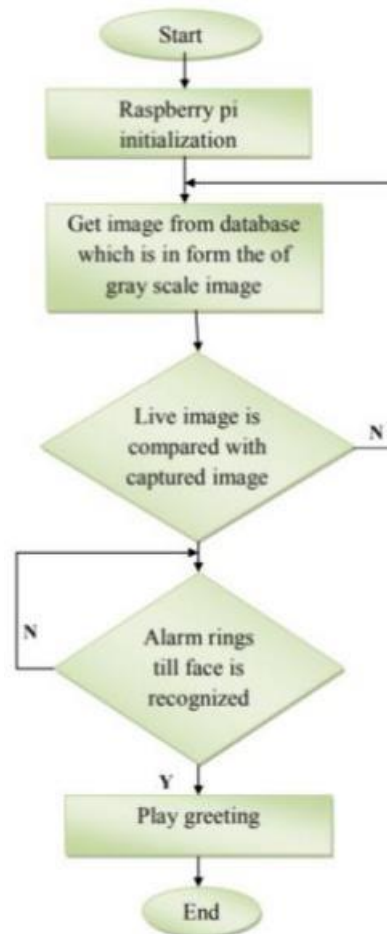


Fig: 3.5: Face recognition flow chart

source [1]

Smart mirror speech synthesis module using the SYN6288 speech synthesis chip. SYN6288 speech synthesis module converts text to speech. The text output on Raspberry Pi will be converted to speech and the speaker is connected as an out. Here speech input taken from the microphone will be converted to text and fed as input to Raspberry Pi. It has a standard 3.5mm standard audio interface. Input voltage can choose 3-5 arbitrary power input,

serial communication operation is simple. Baud rate can be selected 3 communication level: 9600, 19200, 38400 bit/s. Transceiver module is also used which is composed of sending and receiving modules. The transmitting module is controlled by an external STM32 single-chip microcomputer, and the receiving module is controlled by the STM32 microcontroller inside the mirror.

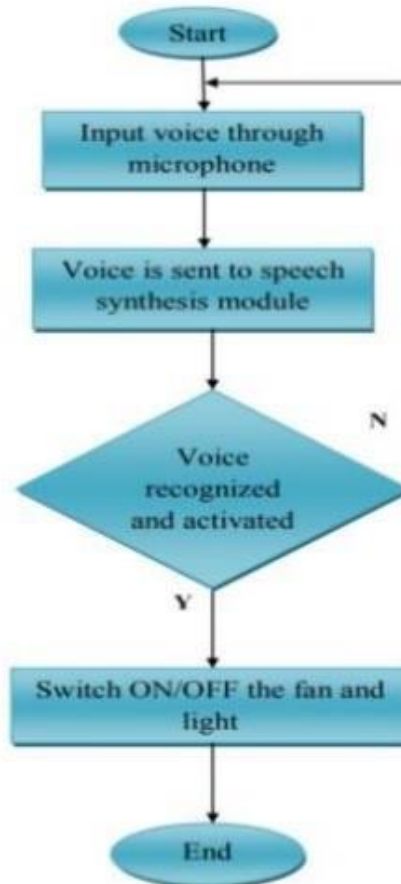


Fig: 3.6: Home Automation flow chart

source [1]

The main advantage is the interaction of the build prototype mirror with the user. The system as in the name itself indicates, SMART [to make the work easier and self-initiative] it accesses the “Voice-based home automation” it involves in planning the control of home applications through voice commands and Raspberry Pi as a server system. By using voice control access, users can control the on and off of lights and fan control and customized alarm. With play music and news feed for entertainment purposes.

3.1.4 Existing System Block Diagram

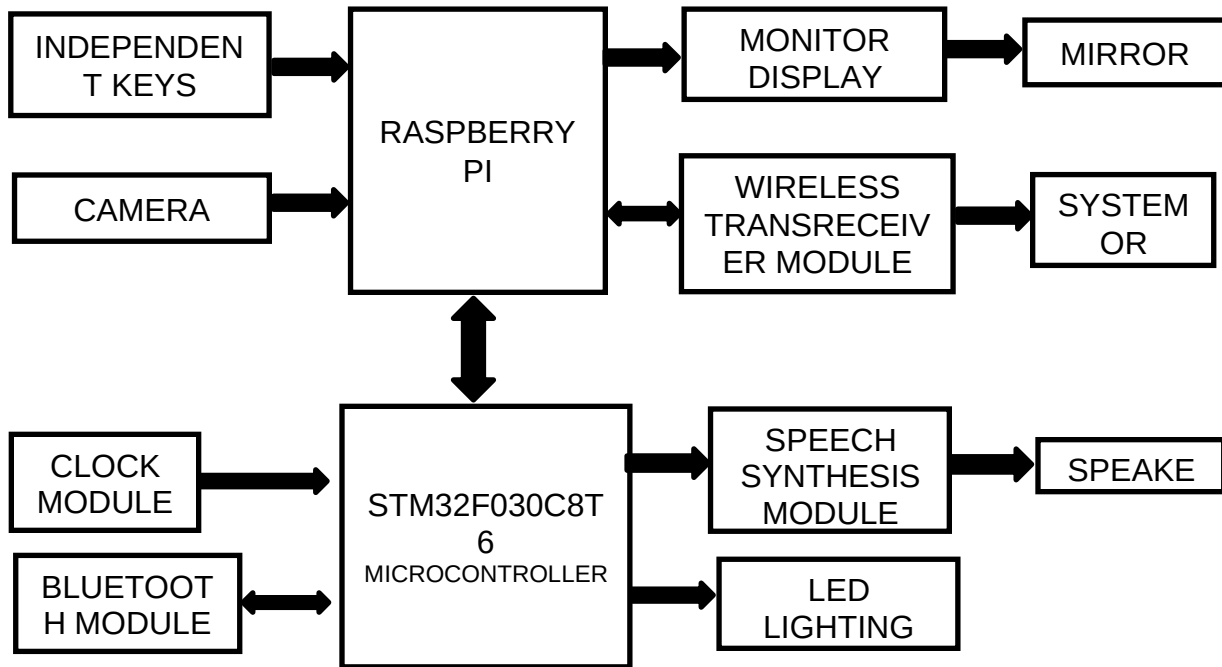


Fig: 3.7: Block Diagram of Existing System

source [1]

The Block Diagram represents working of Smart mirror, developed by Raspberry Pi as the host controller, and SMT32F030C8T6 microcontroller as the core control chip. Raspberry Pi is connected to the network via WIFI, and the weather information, clothing index, time, date, and other information are obtained by the API interface designated by the extranet. At the same time, the relevant information is displayed on the monitor display which is at the backend mirror.

The user can interact with the mirror through the mobile APP, and can communicate with the mirror through the speech synthesis module SYN6288. The system realizes the functions of face recognition, speech recognition, voice playback, control of fan and room light.

3.1.5 Limitations of Existing System

- The device is not portable.
- It can be only used to manage basic information like weather, time, date and calendar.
- It does not provide flexibility in home monitoring and controlling system.

3.2 PROPOSED METHODOLOGY

The proposed smart gadget is used to monitor and control devices in home remotely. The gadget is having different modes for various applications like:

The gadget displays calendar, time and whether forecast in it. It is also used to control the electrical appliances of various kinds (like bulbs, fans etc.) inside the house. A microphone is preinstalled in the device so that the electrical appliances can be also controlled with voice commands.

It also monitors the temperature and humidity with the help of sensors in the house or kitchen and displays the data on the screen in real time, and when the temperature and humidity increases, a dc fan acts as exhaust and sends the hot air outside.

The gadget monitors the water level in the tank with the help of a water level detecting sensor and displays it on the screen and when water level reaches minimum immediately the motor powers on to fill the water tank, and also when the water level reaches maximum the motor stops pumping of the water.

A gas leakage sensor (MQ2) is installed in kitchen and the gas level is monitored by the device in real time. When the gas level increases beyond the threshold the alert displays on screen and a speaker which is preinstalled in the gadget, sounds "Alert! gas leakage detected".

CHAPTER 4

PROPOSED SYSTEM

This chapter describes about the Proposed Smart Gadget System and its function in detailed with hardware description, block diagram, circuit diagram and flowchart.

4.1 PROPOSED SMART GADGET

The smart gadget proposed is used to monitor and control devices in home remotely. The gadget is having different modes for various applications like:

The gadget displays calendar, time and whether forecast in it. It is also used to control the electrical appliances of various kinds (like bulbs, fans etc.) inside the house. A microphone is preinstalled in the device so that the electrical appliances can be also controlled with voice commands.

It also monitors the temperature and humidity with the help of sensors in the house or kitchen and displays the data on the screen in real time, and when the temperature and humidity increases, a dc fan acts as exhaust and sends the hot air outside.

The gadget monitors the water level in the tank with the help of a water level detecting sensor and displays it on the screen and when water level reaches minimum immediately the motor powers on to fill the water tank, and also when the water level reaches maximum the motor stops pumping of the water.

A gas leakage sensor (MQ2) is installed in kitchen and the gas level is monitored by the device in real time. When the gas level increases beyond the threshold the alert displays on screen and a speaker which is preinstalled in the gadget, sounds “Alert! gas leakage detected”.

4.1.1 Proposed System Advantages

- The GUI is user friendly.
- Easy to communicate because of voice interaction.
- Helpful for physically challenged and elder people.
- Home automation can be implemented so that children need not go to the switchboard to control electronic appliances.
- Low power consumption.

Reducing time consumption because all the basic needs and information will be displayed in the device so that multiple work can be done at a time.

4.2 BLOCK DESIGN OF PROPOSED SYSTEM

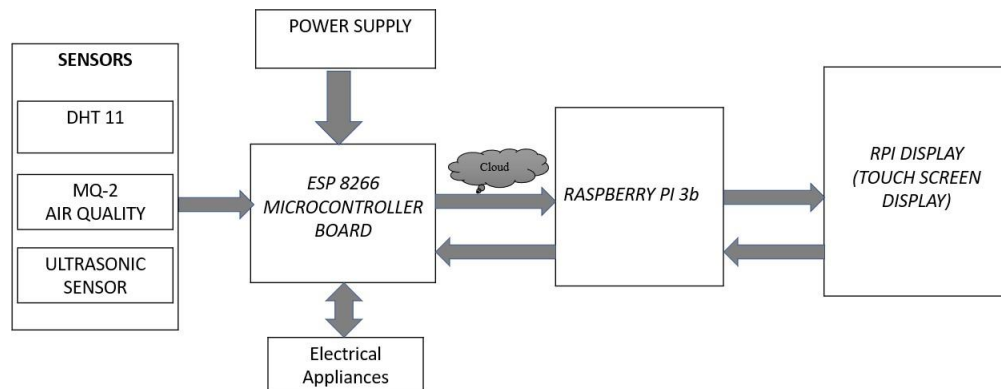


Fig: 4.1: Block Diagram of Proposed System

The Block Diagram in figure 4.1 represents working of Smart gadget system, developed by Raspberry Pi 3B as central processing unit for the gadget and NodeMCU ESP8266 microcontroller as the core control chip. Raspberry Pi 3B is connected to the network via WiFi, and collects the sensors data which is used for home monitoring and controlling appliances with a single touch control.

4.3 HARDWARE DESCRIPTION

In the proposed smart gadget the hardware component used for

monitoring and controlling entire home are:

4.3.1 Raspberry Pi 3B

A development board in the PI series is the RASPBERRY PI 3. It is a single-board computer running the LINUX operating system. The board is appropriate for complex applications because it offers a tonne of features and excellent processing speed. The PI board is especially made for engineers and hobbyists interested in LINUX systems and the Internet of Things. (Internet of Things). The 2016 Raspberry Pi 3 B was equipped with a CPU, GPU, USP ports, and I/O pins. Both variants are essentially identical in terms of functionality and technical requirements, but the B+ model differs in that it has features like USB boot, network boot, and Power over Ethernet that the B model does not.

4.3.1.1 Raspberry Pi 3 b Pin out

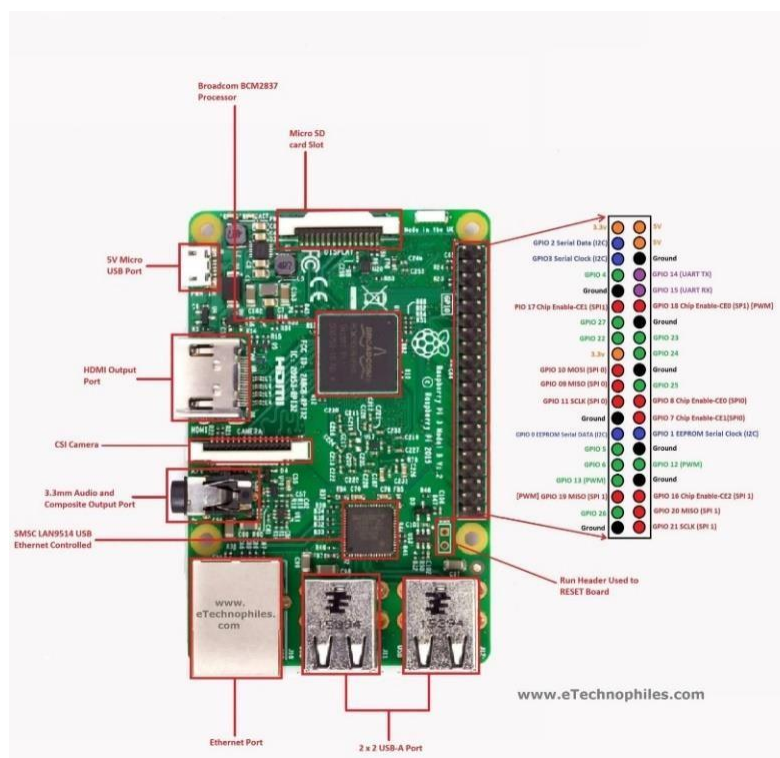


Fig: 4.2: Raspberry pi 3b pinout

source [13]

4.3.1.2 Hardware Specifications

- Processor: Broadcom BCM2837 64-bit quad-core ARM Cortex-A53 CPU
- running at 1.2GHz
- Memory: 1GB LPDDR2 SDRAM
- Connectivity:
- 10/100Mbps Ethernet (RJ-45)
- 802.11n Wireless LAN
- Bluetooth 4.1 (Bluetooth Classic and BLE)
- Video and Audio:
- HDMI output (up to 1080p60)
- Composite video output (PAL/NTSC)
- 3.5mm jack for audio output
- HDMI and 3.5mm jack for audio input
- CSI camera port for connecting a Raspberry Pi camera
- DSI display port for connecting a Raspberry Pi touchscreen display
- Storage: MicroSD card slot for loading operating system and data storage
- GPIO: 40-pin GPIO header compatible with Raspberry Pi 2/3
- USB: 4 USB 2.0 ports
- Power: 5V/2.5A DC power input
- Dimensions: 85 x 56 x 17mm
- Weight: 45g

- These specifications may vary depending on the model and manufacturer

4.3.1.3 Technical Specifications

- CPU is 64 bit with 1GB RAM (random access memory)
- Contains Broadcom BCM2837B0 chipset
- Comes with 1.4GHz Quad-Core ARM Cortex-A53, 4 cores
- Consists of 40 pin header (26 GPIOs)
- Stereo audio and composite video is supported by 3.5mm jack connector
- Four USB 2.0 ports
- Gigabit Ethernet
- Micro SD socket, used to enhance the memory capacity of the board
- MicroUSB power connector, used for transferring power to the device
- HDMI
- CSI camera interface comes with WiFi and Bluetooth facility that were not present in previous Raspberry Pi 1 and 2 versions

4.3.1.4 Applications

Raspberry Pi comes with a wide range of applications and works as a regular computer in some cases.

- Tablet Computer
- Home Automation
- Controlling Robots
- Media Streamer

- Internet Radio
- Retro gaming console
- Internet of Things (IoT)
- Network monitoring

4.3.2 RPI DISPLAY

RPI Display is a term that refers to a range of displays that are compatible with Raspberry Pi (RPI) computers. Raspberry Pi is a series of small, low-cost computers that were originally designed to help teach computer science in schools. Since then, they have become increasingly popular among hobbyists, tinkerers, and makers who use them for a variety of projects.

One of the great things about Raspberry Pi is that it is incredibly versatile and can be used in many different ways. One common use case is to use it as a mini computer to drive a display. This is where RPI Display comes in. RPI Displays are screens that can be connected to a Raspberry Pi and used to display images, videos, and other content.

There are many different types of RPI Displays available, ranging from small LCD screens that are designed to be used with the Raspberry Pi Zero to larger displays that can be used with more powerful Raspberry Pi models. Some RPI Displays are designed to be used as touchscreens, while others are not. Some have high resolutions and are great for displaying detailed images, while others are more basic and are better suited for displaying simple text or graphics.

In general, RPI Displays are relatively easy to use and can be a great way to add a visual component to a Raspberry Pi project. They can be used for a wide range of applications, from creating a digital photo frame to building a portable gaming console.

4.3.2.1 Specifications of RPI display

Here are some specifications for a typical 7-inch RPI display:

- Resolution: 800x480 pixels
- Size: 7 inches
- Type of display: TFT LCD display
- Interface: The display connects to the Raspberry Pi using a ribbon cable that plugs into the Pi's DSI (Display Serial Interface) port.
- Touchscreen: The display may come with a resistive or capacitive touchscreen option, allowing users to interact with the display using touch.
- Viewing angle: Typically, the viewing angle for this type of display is around 70 degrees in all directions.
- Power consumption: Depending on the manufacturer and specific model, the power consumption for this display can vary, but it typically falls within the range of 3-5 watts.

It's important to note that specifications may vary slightly depending on the manufacturer and specific model of the 7 inch RPI Display.

4.3.3 VNC Server

VNC (Virtual Network Computing) is a graphical desktop sharing system that allows user to remotely control the desktop interface of one computer (running VNC Server) from another computer or mobile device (running VNC Viewer). VNC Viewer transmits the keyboard and either mouse or touch events to VNC Server, and receives updates to the screen in return. User will see the desktop of the Raspberry Pi inside a window on computer or mobile device.

User will be able to control it as though user working on the Raspberry Pi

itself. VNC Connect from RealVNC is included with Raspbian. It consists of both VNC Server, which allows user to control the Raspberry Pi remotely, and VNC Viewer, which allows user to control desktop computers remotely from Raspberry Pi. It is must to enable VNC Server before user can use it: instructions for this are given below. By default, VNC Server gives user remote access to the graphical desktop that is running on Raspberry Pi, as though user sitting in front of it. However, user can also use VNC Server to gain graphical remote access to the Raspberry Pi if it is headless or not running a graphical desktop. User will see the desktop of the Raspberry Pi inside a window on computer or mobile device.

4.3.3.1 Operation

VNC Server captures the desktop of the computer in real-time and sends it to VNC Viewer for display. VNC Viewer gathers the input (mouse, keyboard, or touch) and sends it for VNC Server to inject and actually achieve remote control.

VNC is a graphical desktop sharing system that allows user to remotely control the desktop interface of one computer (running VNC Server) from another computer or mobile device (running VNC Viewer). VNC Viewer transmits the keyboard and either mouse or touch events to VNC Server, and receives updates to the screen in return. User will see the desktop of the Raspberry Pi inside a window on computer or mobile device. User will be able to control it as though the working of Raspberry Pi itself.

4.3.3.2 Creating a virtual desktop

If the Raspberry Pi is headless is not plugged into a monitor or controlling a robot, it is unlikely to be running a graphical desktop. VNC Server can create a virtual desktop for giving user a graphical remote access on demand. This virtual desktop exists only in Raspberry Pi memory. Fig 4.4 explains how to Create a virtual desktop.

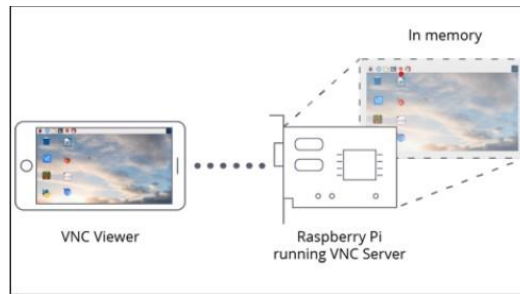


Fig: 4.3: VNC Viewer source [1]

4.3.4 Sensors and Electrical appliances

Sensors and Electrical appliances plays a major role for home monitoring and controlling smart gadget as follows

4.3.4.1 Types of Sensors

- **MQ2 GAS Sensor:** Gases including LPG, alcohol, propane, hydrogen, carbon monoxide, and even methane may all be detected or measured by the MQ-2 Gas sensor. When user just need to detect one specific gas, the module version of this sensor's inclusion of a Digital Pin makes it possible for it to function without a microcontroller. The analogue pin, which is likewise TTL driven and operates on 5V and can be used with the majority of popular microcontrollers, must be used to measure the gas in ppm.
- **DHT11 Sensor:** A typical temperature and humidity sensor is the DHT11. The sensor includes a dedicated NTC for temperature measurement and an 8-bit microprocessor for serial data output of temperature and humidity information. Additionally factory calibrated, the sensor makes it simple to integrate with other microcontrollers. The sensor has an accuracy of 1°C and 1% and can measure temperature from 0°C to 50°C and humidity from 20% to 90%. Therefore, if user want to measure in this range, this sensor might be the best option.
- **HC-SR04 Ultrasonic Sensor:** The ultrasonic transmitter and receiver

are formed by two projects that resemble eyeballs on the front of the module. When an object in the air causes the ultrasonic wave being transmitted by the ultrasonic transmitter to be reflected back towards the sensor, the ultrasonic receiver module can view this reflected wave. The four pins on the HC-SR04 Ultrasonic (US) sensor are labelled Vcc, Trigger, Echo, and Ground, respectively. This sensor is fairly common and is utilised in many applications where sensing objects or measuring distance is necessary.

4.3.4.2 Principle of Working

- The MQ2 sensor contains a sensing element made of a thin film of metal oxide, which is heated to a high temperature using a small heating element. When a gas molecule comes in contact with the sensing element, it undergoes a chemical reaction with the metal oxide, which changes the electrical conductivity of the sensing element. The magnitude of this change in conductivity is proportional to the concentration of the gas in the environment. It works on the principle of gas sensing using a metal oxide semiconductor. The MQ2 sensor has a variable resistance output that changes in response to changes in gas concentration. The output of the sensor is connected to an analog-to-digital converter (ADC), which converts the analog voltage output of the sensor into a digital signal that can be read by a microcontroller. The sensitivity of the MQ2 sensor varies depending on the type of gas it is designed to detect. The sensor can be calibrated to detect specific gases by adjusting the heating temperature of the sensing element, or by using a pre-programmed calibration curve.
- The DHT11 sensor works by sensing changes in capacitance and resistance in the humidity and temperature sensing elements, respectively. The humidity sensing element consists of a thin layer of polymer that absorbs moisture from the air, changing its capacitance. The temperature sensing element is a thermistor that changes its

resistance as the temperature changes. The DHT11 sensor has a digital output and communicates with the host microcontroller using a single-wire digital interface. The sensor provides a 40-bit data stream, with the first 16 bits representing the relative humidity, the next 16 bits representing the temperature, and the last 8 bits representing a checksum to ensure data integrity. To use the DHT11 sensor, the host microcontroller sends a start signal to the sensor, and then waits for the sensor to respond with the 40-bit data stream. The microcontroller then decodes the data stream to extract the temperature and humidity values.

- Ultrasonic sensors use sound waves to detect the presence of objects or measure distance. The working principle of an ultrasonic sensor involves transmitting high-frequency sound waves towards a target object, and then detecting the reflected sound waves that bounce back from the object. The sensor has two main components: a transmitter and a receiver. The transmitter sends out a burst of high-frequency sound waves, typically in the range of 20kHz to 200kHz. These sound waves travel through the air and bounce off any object in their path. The receiver picks up the reflected sound waves and converts them into electrical signals. By measuring the time delay between the transmission and reception of the sound waves, the ultrasonic sensor can calculate the distance to the object using the speed of sound in air (which is approximately 343 meters per second at room temperature).

4.3.5 NodeMCU Board

The NodeMCU ESP8266 development board included with the ESP-12E module containing the ESP8266 chip having Tensilica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor has an adjustable clock frequency range of 80 MHz to 160 MHz and supports RTOS. To store data and programs, NodeMCU contains 4MB of Flash memory and 128 KB of RAM. It is perfect for IoT projects thanks to its high processing power, built-in Wi-Fi and Bluetooth,

and Deep Sleep Operating capabilities. With the help of a Micro USB jack and VIN pin, NodeMCU may be powered. (External Supply Pin). The interfaces UART, SPI, and I2C are supported.

4.3.5.1 Operation

- **Powering the Board:** The NodeMCU ESP8266 board can be powered using a USB cable connected to a computer or USB power adapter. The board also has a built-in voltage regulator, which means it can be powered using a wide range of voltages (typically 5-12V). **Programming:** The NodeMCU ESP8266 board can be programmed using the Arduino IDE or other programming environments that support the ESP8266 platform. To program the board, install the ESP8266 board package in the Arduino IDE, connect the board to computer using a USB cable, and select the correct board and port in the IDE.
- **Wi-Fi Connectivity:** One of the key features of the NodeMCU ESP8266 board is its built-in Wi-Fi connectivity. The board has an ESP8266 chip that supports 802.11 b/g/n Wi-Fi standards, which means it can connect to most Wi-Fi networks. User can use the board's Wi-Fi capabilities to create Internet of Things (IoT) projects, such as controlling lights or monitoring sensors. **GPIO Pins:** The NodeMCU ESP8266 board has a number of General Purpose Input/Output (GPIO) pins that can be used to connect to sensors, actuators, or other electronic components. These pins can be programmed using the Arduino IDE to perform a wide range of functions, such as reading analog or digital signals, controlling motors or LEDs, or communicating with other devices.
- **Serial Communication:** The NodeMCU ESP8266 board also supports serial communication via a USB port or the GPIO pins. User can use serial communication to send data to and from the

board, or to communicate with other devices, such as sensors or displays.

4.3.5.2 ESP8266 Module

The ESP8266 WiFi module on the NodeMCU board is a popular and powerful development platform for creating internet-connected projects. The ESP8266 chip is a low-cost, low-power, and highly integrated WiFi module that allows for easy connectivity to the internet. When combined with the NodeMCU board, the ESP8266 chip provides a wide range of features and capabilities, such as GPIO pins, analog inputs, and a built-in voltage regulator. The NodeMCU board also includes a USB interface for programming and power, making it a convenient and easy-to-use platform for creating IoT projects. With its compact size, low power consumption, and affordable price, the ESP8266 WiFi module on the NodeMCU board has become a popular choice for hobbyists and professionals alike who want to build innovative and connected projects.

4.3.5.3 Specifications

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1
- UARTs: 1
- SPIs: 1
- I2Cs: 1
- Flash Memory: 4 MB
- SRAM: 64 KB

- Clock Speed: 80 MHz
- USB-TTL based on CP2102 is included onboard, Enabling Plug n Play
- PCB Antenna
- Small Sized module to fit smartly inside IoT projects

4.3.5.4 Applications

- Prototyping of IoT devices
- Low power battery operated applications
- Network projects
- Projects requiring multiple I/O interfaces with Wi-Fi and Bluetooth
- Functionalities.

4.3.6 Advanced IPE Scanner

Advanced IPE Scanner is a free, fast and powerful network scanner with a user-friendly interface shown in Fig 4.8. The app scans all network devices, and gives the access to shared folders and FTP servers. It provides remote control of computers (via RDP and Radmin) and can even remotely switch computers off.

4.3.7 Power Supply

This is desired is to convert the pulsating output of the rectifier to a constant DC supply. Thus, it is likely to 'filter' the pulsating input signal. It can be done by plitting the input waveform into AC (high frequency) and the DC components (very low frequency) and by then 'rejecting' the high frequency components. In this proposed smart gadget system different voltages for sensors and home appliances is used. Low voltage is used for working of sensors.

4.4 CIRCUIT DIAGRAM OF PROPOSED SYSTEM

The Figure 4.5 shows the circuit diagram of proposed home monitoring and controlling system

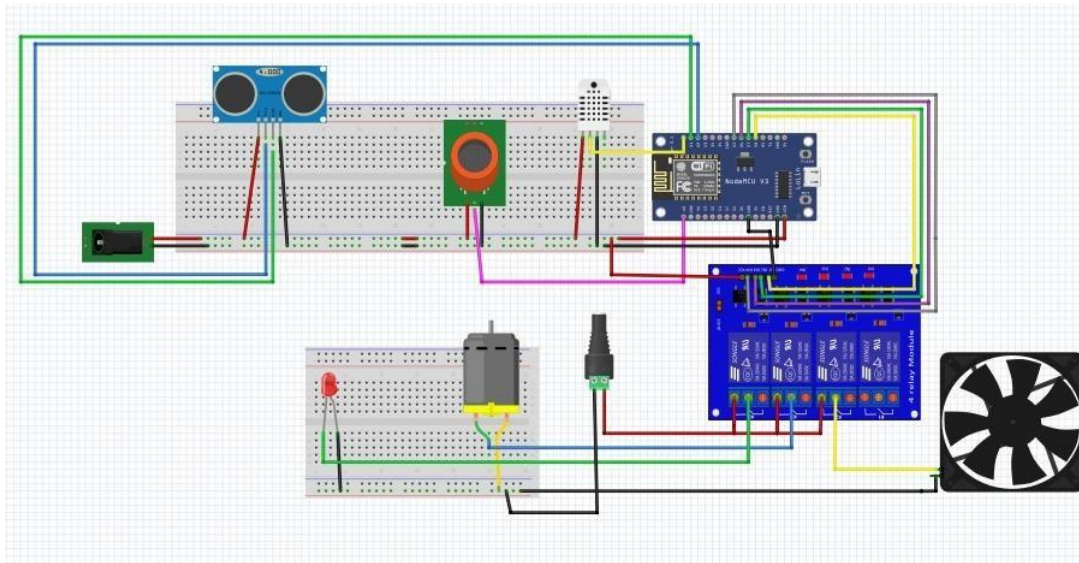


Fig: 4.4: Circuit Diagram of Proposed System

The sensors and electrical appliances are wired to NodeMCU microcontroller, it was connected with Wi-Fi by which the data is sent to cloud for monitoring several parameters and controlling appliances. The wiring of sensors and electrical appliances is mentioned below:

- HC-SR04 Ultrasonic sensor is wired to ESP8266: trig pin is connected to D2 and echo pin is connected to D1.
- MQ-2 Gas sensor is wired to ESP8266: A0 pin is connected to A0 pin of NodeMCU ESP8266.
- DHT11 sensor is wired to ESP8266: data pin is connected to D0 pin.
- The 4-channel relay module is connected to NodeMCU: R1,R2,R3 and R4 are connected to D5, D6, D7, and D8 pins respectively

4.5 SOFTWARE ALGORITHM-FLOW CHART

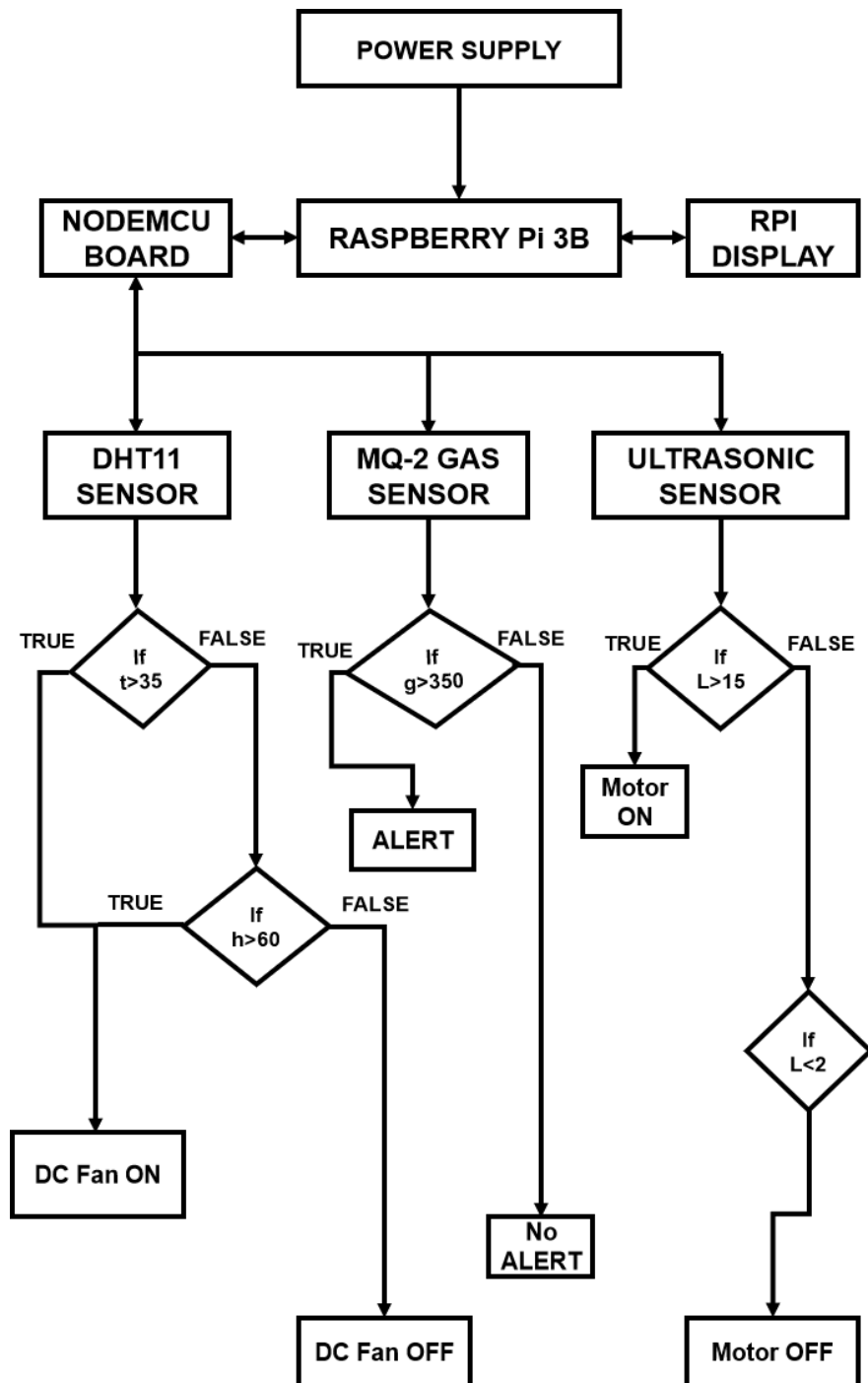


Fig: 4.5: Flowchart of Proposed System

In the Flowchart given below the letters t,h,g,and l are the keys of DHT11 (t, h), MQ-2 (g) and Ultrasonic sensors(l) respectively which is included in code provided for raspberry pi for helping in monitoring and controlling the entire substation.

STEPS:

- Step 1: If temperature (t) is higher than 35-degree Celsius then, the dc fan is turned on.
- Step 1: If temperature (t) is less than 35-degree Celsius then, the dc fan is turned off.
- Step 2: If humidity (h) is higher than 60 percentage then, the dc fan is turned on.
- Step 3: If humidity(h) is less than 60 percentage then, the dc fan is turned off
- Step 4: If gas levels in air is greater than 350 ppm (parts per million) then, the text alert warning is implemented.
- Step 5: If gas levels in air is less than 350 ppm (parts per million) then, the text alert warning is not implemented.
- Step 6: If the water level distance from top of the tank(l) is greater than 15 cm then, water motor is turned on.
- Step 7: If the water level distance from top of the tank(l) is less than 2cm then, water motor is turned off.
- Step 8: If the water level from the top of the water tank is in between 2cm to 15 cm then the motor is still working if it started at 15cm water level from top of the tank, which can be also stopped by Smart GUI Interface.

4.6 DEVICE SETUP

In the proposed Smart Gadget, we connected it with Wi-Fi by which we monitored several parameters and controlling the house appliances, thus is portable and easy to manage the entire substation.

4.6.1 Implementation of proposed system

The proposed Smart Gadget will display the data collected from NodeMCU ESP8266 board by using a Graphical User Interface (GUI). Here the Raspberry pi 3b is connected to the Touchscreen display, it acts as the CPU of the Smart Gadget which is very essential for the operation.

We have connected Raspberry Pi to local connection and can remotely access the controlling of electrical appliances. Commands are given initially and Buttons are created for the controlling the appliances in home. For example, Load 1 and Load 2, is used to control the electrical bulbs, Load 3 is used to control the dc fan and Load 4 is used to control the water motor. The picture display aside is the proposed smart gadget.

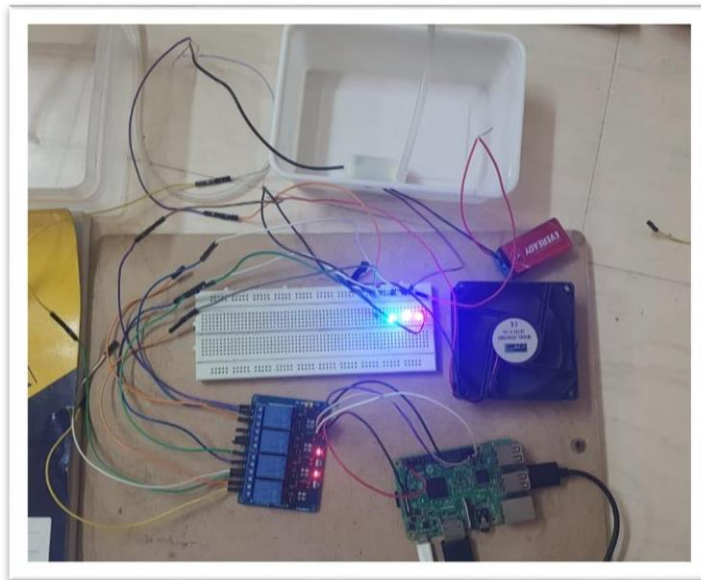


Fig: 4.6: Implementation model of the proposed system

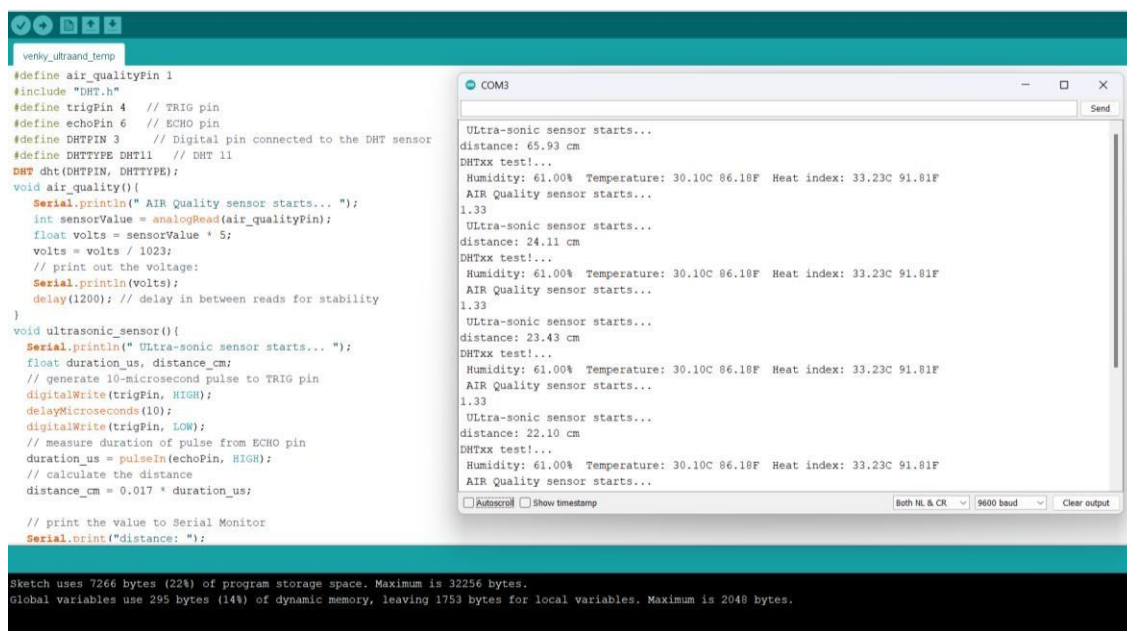
CHAPTER 5

RESULTS AND DISCUSSION

This chapter describes about the results and detailed discussion on proposed home monitoring and controlling smart gadget system.

5.1 MONITORING SENSOR DATA IN SERIAL MONITOR

By giving the code in the Arduino IDE, the sensors data is obtained in a serial monitor in Arduino IDE. The data is ungrouped. The picture displayed aside 5.1 is the obtained sensor data from serial monitor.



The screenshot displays the Arduino IDE interface. On the left, the code for 'venky_ultraand_temp' is visible, defining pins and functions for an air quality sensor and an ultrasonic sensor. The 'air_quality()' function reads an analog sensor value, converts it to volts, and prints it. The 'ultrasonic_sensor()' function sends a 10-microsecond pulse to the trig pin, measures the echo pulse, and calculates the distance in cm. The serial monitor on the right shows the output of these functions, including distance measurements (e.g., 65.93 cm, 24.11 cm, 23.43 cm, 22.10 cm) and DHT11 sensor data (Humidity: 61.00%, Temperature: 30.10C 86.18F, Heat index: 33.23C 91.81F). The bottom status bar indicates the sketch uses 7266 bytes (22%) of program storage space and 295 bytes (14%) of dynamic memory.

```
#define air_qualityPin 1
#include "DHT.h"
#define trigPin 4 // TRIG pin
#define echoPin 6 // ECHO pin
#define DHTPIN 3 // Digital pin connected to the DHT sensor
#define DHTTYPE DHT11 // DHT 11
DHT dht(DHTPIN, DHTTYPE);
void air_quality(){
  Serial.println(" AIR Quality sensor starts... ");
  int sensorValue = analogRead(air_qualityPin);
  float volts = sensorValue * 5;
  volts = volts / 1023;
  // print out the voltage:
  Serial.println(volts);
  delay(1200); // delay in between reads for stability
}
void ultrasonic_sensor(){
  Serial.println(" Ultra-sonic sensor starts... ");
  float duration_us, distance_cm;
  // generate 10-microsecond pulse to TRIG pin
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  // measure duration of pulse from ECHO pin
  duration_us = pulseIn(echoPin, HIGH);
  // calculate the distance
  distance_cm = 0.017 * duration_us;
  // print the value to Serial Monitor
  Serial.print("distance: ");
}
```

Sketch uses 7266 bytes (22%) of program storage space. Maximum is 32256 bytes.
Global variables use 295 bytes (14%) of dynamic memory, leaving 1753 bytes for local variables. Maximum is 2048 bytes.

Fig: 5.1: Sensor Data in Serial Monitor

As shown in the fig 5.1 the data of temperature (both in Celsius and Fahrenheit), Humidity (in relative humidity %), Heat Index, Gas levels (ppm) and distance (in cm) from DHT11, MQ-2 gas sensor and Ultrasonic Sensor respectively is obtained.

5.2 PROPOSED OUTPUTS

Initially the DHT11, MQ-2 and Ultrasonic sensors are interfaced with NodeMCU board. And bulb, dc fan and water motor are interface with a 4 channel relay.

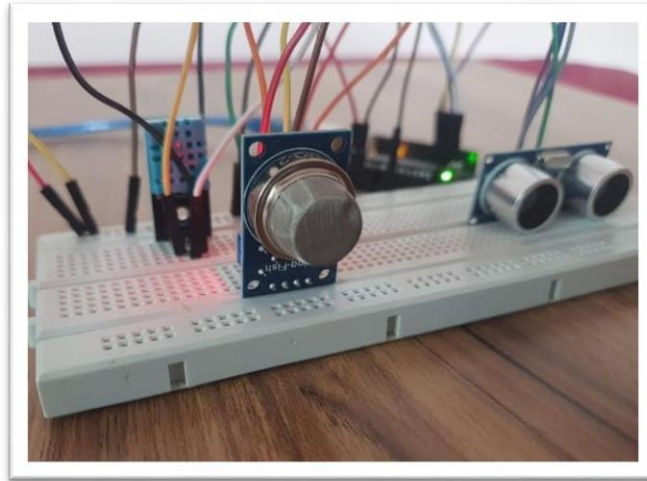


Fig: 5.2: Interfacing sensors

The water motor is placed at the top of the water tank so that the distance from the top is measured to the water level, so that the water motor is turned on or off accordingly.

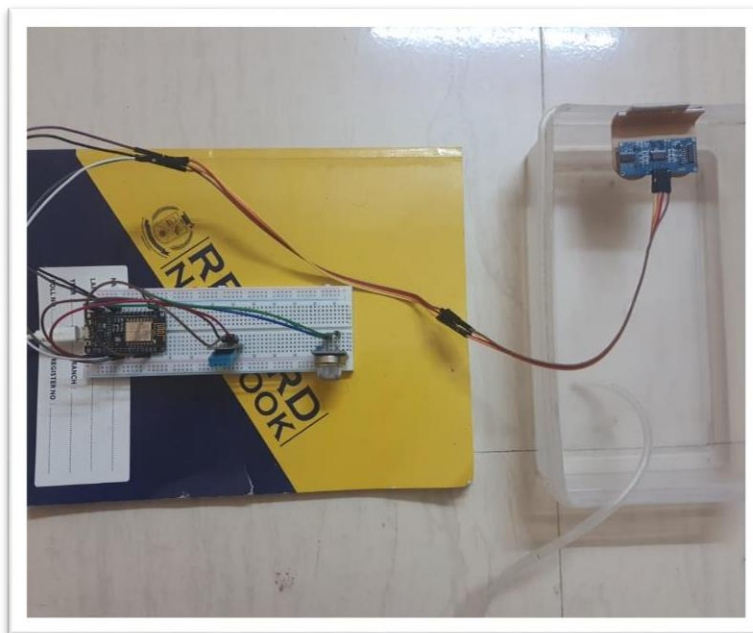


Fig: 5.3: Sensors connected to NodeMCU

Initially the Smart Gadget is interfaced with a 4-channel relay module in order to control the appliances with Qt-5 designer interface.



Fig: 5.4: Controlling with Smart Gadget Output 1

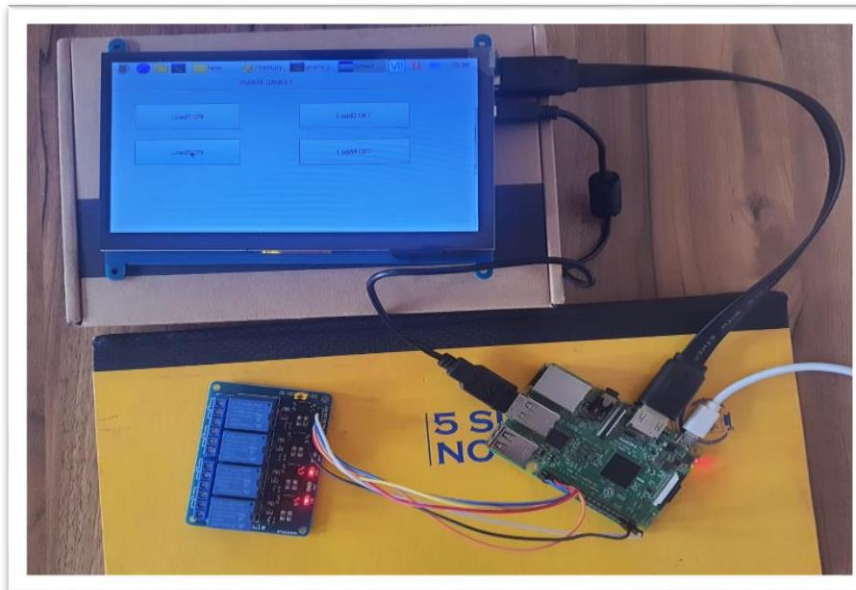


Fig: 5.5: Controlling with Smart Gadget Output-2

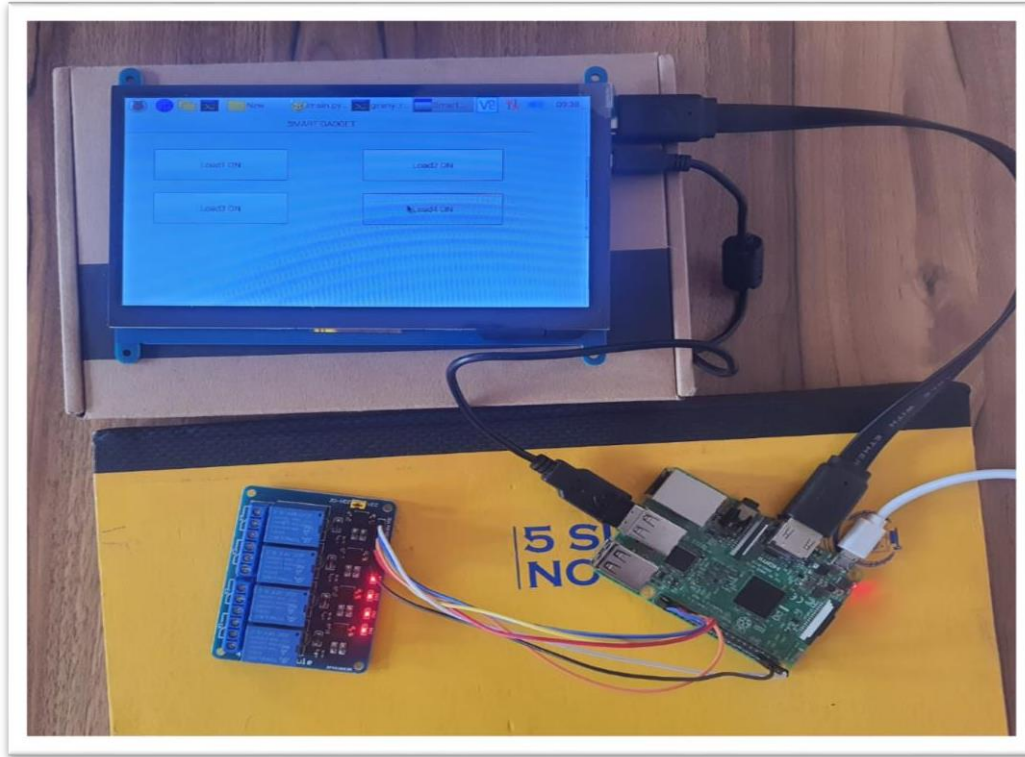


Fig: 5.6: Smart Gadget for Controlling Appliances

The entire setup of the proposed system is demonstrated in the figure 5.8. The proposed system is displayed aside of the figure and the outputs are obtained like controlling the bulbs, dc fan and water motor by using a smart gadget interface with raspberry pi 3b.

We can control lights with the Load 1 and Load 2 buttons in GUI. And Dc fan controlled with Load3 button in GUI mentioned in figure 5.6. The water motor is controlled when the water level was critical and threshold levels by using Load 4 button in the GUI.

The figure 5.4 shows the Smart Gadget with all the Loads in OFF condition which means, all the home appliances are turned off. In figure 5.5 Load 1 and Load 3 are turned on thus lights and dc fan are in ON condition. The figure 5.6 shows all the Loads are in ON condition it results that all the appliances like lights, fan, water motor are turned on with the Smart Gadget.

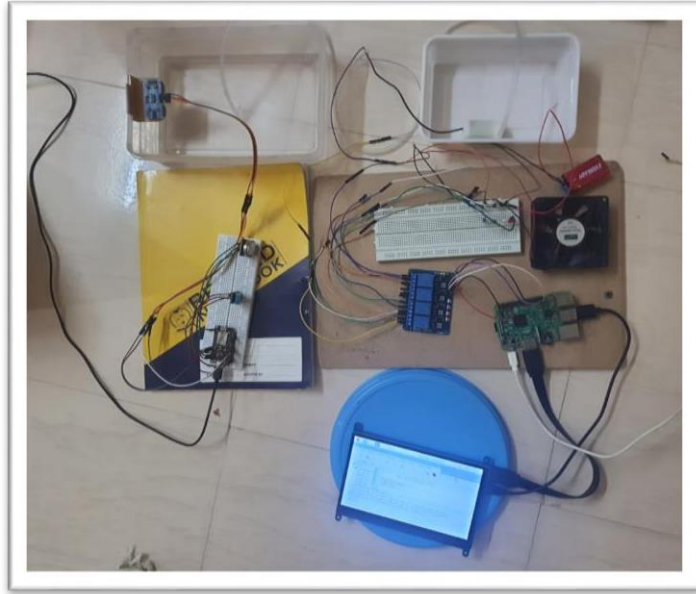


Fig: 5.7: Demonstration of Proposed System

It provides the users with a seamless and intelligent home automation experience, making their lives more comfortable, safe, and energy-efficient.

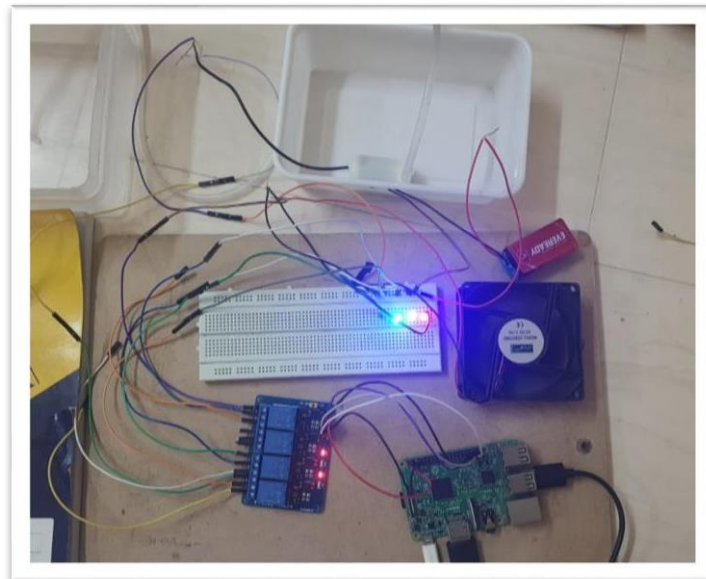


Fig: 5.8: Working Model of Proposed System

5.3 GUI OF SMART GADGET

Cayenne IoT provides a user-friendly platform that enables easy monitoring and control of IoT devices. With Cayenne IoT, users can monitor a wide range of data points from their IoT devices, including temperature, humidity, pressure, and more. This information can be viewed in real-time on a dashboard, allowing users to stay on top of their IoT devices' performance and quickly respond to any issues. Cayenne IoT also enables users to set up rules and triggers to automate the monitoring and control of their devices. For example, users can set up a rule to turn on a fan when the temperature increases above a certain threshold.

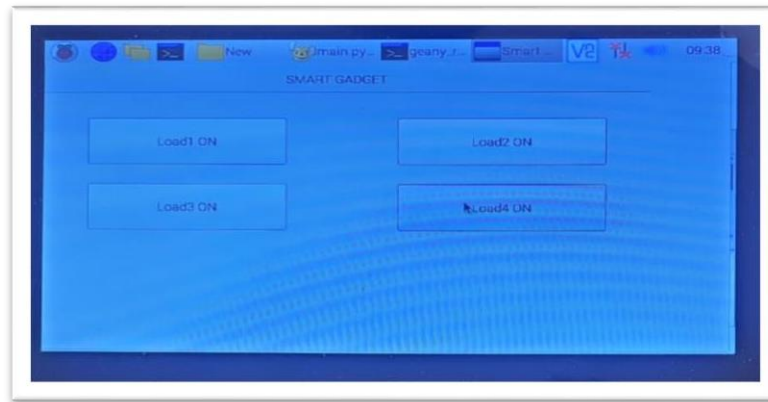


Fig: 5.9: Proposed Smart Gadget GUI

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

This chapter describes about the detailed conclusion and future scope of proposed home monitoring and controlling smart gadget system.

6.1 CONCLUSION

The Smart Gadgets are important in providing the flexibility in remote monitor and control of home system that the public expects. Home monitoring and controlling system is limited with present devices available in market. Demand for Smart Gadget is increasing rapidly to meet this demand. Although in the existing technologies the Smart Mirror is available for managing daily activities but limited by: control of lights and fans with voice commands and also the Smart mirror is fixed i.e. It is not portable device. Smart Gadget solves the problem of Smart Mirror System by enabling the entire sub-station equipment. Smart Gadget has a small size, simple operation, low cost, high degree of user-friendly interface, and other advantages, it also assists the user for controlling devices. It is suitable for families, and has broad application prospects and this will be very useful in future years as the IoT devices are becoming more important in this era.

6.2 FUTURE SCOPE

The future scope of this model offers:

- **Integration with Artificial Intelligence:** Smart gadgets can be integrated with AI to learn user references and automate home appliance control. For example, the device can learn when a person wake up and turn on the coffee maker automatically.
- **Enhanced Security Features:** As IoT devices become more popular, security threats also increase. Future smart gadgets will have enhanced security features to ensure that user data is protected from unauthorized access.
- **Interoperability:** Future smart devices will be designed to communicate with other IoT devices seamlessly. This will allow users to control all their home

appliances from a single device, even if they are from different manufacturers.

- Remote Access: Smart gadgets will allow users to access and control their home appliances from anywhere in the world. This will give users the ability to monitor their homes remotely and adjust appliance settings as needed.
- Energy Management: Smart gadgets will also help users manage their energy consumption. The device can suggest ways to reduce energy consumption, such as turning off lights when not needed, and monitor energy usage to identify areas where users can save money.
- Integration with Smart Grids: Future smart gadgets will be able to integrate with smart grids, allowing users to optimize their energy usage based on the current energy demand and pricing.

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