A PROJECT REPORT

On

VERACIOUS BOX

Submitted in partial fulfillment of the requirement for the degree of

Bachelor of Technology

In

Electronics and Communication Engineering

Submitted By: **Under the Supervision of:**

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CERTIFICATE

This is to certify that the work titled "**Veracious Box**" submitted by **Archit Garg (15102148)** and **Yash Ratan (15102200)** in partial fulfillment for the award of degree of B. Tech of Jaypee Institute of Information Technology, Noida has been carried out under my supervision. This work has not been submitted partially or wholly to any other University or Institute for the award of this or any other degree or diploma.

Signature of Supervisor   ……………………..

Name of Supervisor   Mrs. Ruby Beniwal

Designation   ……………………..

Date   / 05 /2019

DECLARATION

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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<u>ABSTRACT</u>

We live in a country where more than a quarter of its population is illiterate. Thus, we have come up with a device, Veracious Box, which assists home-makers and elderly patients in easing their lives. This device speaks nothing but the truth. The device gives the accurate data of our surroundings. The main part of the system is microcontroller based, owing to the requirement to communicate intelligently with the person. A reasonably powerful system is chosen to perform the task competently. Negligence in proper medication leads to worsening of health and hence, the MedAssist box comes handy. It is fed with medicines and the dosage can be calculated accordingly. Interacting efficiently with the patient with the help of a LED, the box also comprises of LCD and a keypad, the input module of the system.

Besides easing our lives, it can also be remotely controlled with the help of a beacon. Not only it helps the user to monitor their medicine status but also their home status like humidity, temperature, front door status, roof status etc. on the same device monitor. This device helps the user to access the particular portion of their home by clicking some simple buttons on the keypad and the LCD shows the sensors' readings.

For doing so, we place some sensors in our home according to our requirements like PIR sensor in front of the main door, Rain sensor on the roof, humidity and temperature sensor in the hall or may be in the particular room, relay to control the electrical appliances etc.

<u>ACKNOWLEDGEMENT</u>

We would like to express our deepest and sincere gratitude to the department head Dr. Shweta Srivastava and our supervisor Mrs. Ruby Beniwal for her immense help and guidance throughout the duration of our project. Her insightful and discerning ideas helped in the successful completion of this project. The constant support and motivation helped us steer through challenging and difficult phases of our project.

The facilities provided by the department and our college are also acknowledgeable. We would also take this opportunity to thank our families for their perpetual encouragement throughout the project period.

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LIST OF ACRONYMS

AUDA	**Australian Domain-name Administrator**
BER	**Bit Error Rate**
ESP	**Espressif Wi-Fi Module**
HTML	**Hyper Text Mark-up Language**
IOT	**Internet of Things**
LCD	**Liquid Crystal Display**
NRF	**Nordic Radio Frequency**
PHP	**Personal Home Page**
PIR	**Passive Infrared**
JS	**JavaScript**
UC	**Microcontroller**

CHAPTER 1

Introduction and Setup

Medication non-adherence can have severe negative consequences for the patient. It may lead to adverse outcomes like health related problems, and even increased duration of treatment with higher cost.

The available solutions can be divided into Software based and Hardware based methods. The majority of the software based solutions comprises of various medication reminder applications for several mobile based platforms which cannot be used by illiterate and elderly rural Indians in its native form. The device proposed in this paper is a hardware based solution. It is required to be fed in with the medication pills and their schedule by the doctor, the doctor's assistant or some literate family member (hereby referred collectively as the "caretaker"). The device then notifies the patient at the required time.

As cited in the paper, "The Design and Implementation of Wireless Temperature and Humidity Control System Based on nRF24L01", the nRF module (nRF24L01) is a single chip radio transceiver for the 433/868/915 MHz ISM band, consisting a fully integrated frequency synthesizer, receiver chain with demodulator, a power amplifier, a crystal oscillator, and a modulator.

MedAssist is made up of two major components: MedAssist Box and User-Tag. The box contains multiple small compartments in which only one particular medicine will be kept in each. The box has an LCD and a Keypad to interact with the user and has LED's, vibrators and buzzers for notifications. It is connected via NRF transmission to the User-Tag which is a small device to be kept by the patient at all times.

The schedule of each medicine for the patient needs to be programmed into the MedAssist Box by the caretaker. It tracks the schedule, notifies the patient, and all the patient has to do is take the medicine kept in the box indicated by a light/vibrator. Apart from time of the medicine, it stores information like number of pills to be taken and for how many days the medicine is to be taken.

The product also helps us to know the status of our home. It includes the status of i) Your main door, ii) Electrical appliances, iii) Weather, and iv) Water levels.

It is important for the owner to consider incorporating a home security framework as burglaries and trespassing have turned out to be normal in vast urban areas. Recent advancements in semiconductor technology have enabled cost-effective solutions to

seamlessly integrate wireless network connectivity in embedded systems and sensors, which in turn lead to securing your home smartly. The status of main door is known with the help of PIR sensor. According the Professor of School of EEE, Sathyabama University, and Research Scholar of EEE, Sathyabama University, Chennai, in their research paper, the power consumption due to PIR has greatly reduced and paved the way for smart technology in different fields. We are using PIR sensor to detect motion and it sends the details of intrusion to the microcontroller. The concept can be extended to street light sensing by making it sense the presence of a vehicle.

Nowadays, Real-time monitoring of temperature and humidity plays a vital role in many fields such as industry, agriculture and so on. It has been stated in the paper, "Design of Wireless Multi-point Temperature Transmission System Based on nRF905" that the accuracy of the acquired temperature is a very important index in the industrial production, and it is the decisive factor of product performance. In order to ensure the safety of production, the current temperature must be acquired and transmitted to the analysis platform for analyse and store. The technology trends should be considered when we select wireless chips, there are two main trends. On the one hand, the function index must be improved on the chip itself, such as anti-interference performance, power consumption, size, some interfaces and so on. On the other hand, the cost and development difficult should be reduced to improve the chip's compatibility and future production, which is a single chip radio transceiver. The receiving part is used to receive the temperature data and the processed data will be displayed on LCD screen. The system so obtained is therefore, less complex, easily implemented, low cost, and low power consumption. At the same time, it is a feasible reference solution for wireless data transmission.

In the past decade, there was an increase use of liquefied petroleum gases (LPG) and natural gas (consists mainly of methane) to meet the increasing demand for energy and replace oil or coal due to their environmental disadvantages. LPG and natural gas burn cleanly and are less harmful to the environment. They have been widely used in industry, heating, home appliances, and motor fuel. Nevertheless, the pose a serious threat if they leak, leading to suffocation in breathing air, due to the replacement of oxygen by LPG and natural gas. Therefore, household safety cannot be compromised when using gas cylinders at home. Most of the cooking is done using LPG, and more than 50% of the heaters use LPG. As a result, accidents from gas leakage increase each and every day. In 2007, the number of gas bottles that were destroyed as a result of gas leakage or fire exposure was 142 gas bottles. Table 1 shows the number of accidents related to the use of LPG reported by The Department

of Civil Defence in 2007 in New Delhi. The total number of accidents was 584 that caused 398 injuries and 15 deaths (the population of New Delhi is 5 millions). Moreover, the number of accidents per year keeps increasing; a percentage increase of 10% was reported from 2006 to 2007.

Nature of the accident	No. of accidents	Casualties	Deaths
Fire due to gas leak	359	135	6
Suffocation because of gas leak from heaters	85	209	7
Gas leak without fire in public places	24	54	2
TOTAL	584	398	15

Table 1. Accident statistics related to the use and storage
of LPG and natural gas in New Delhi in 2007

Owing to such nature of hazardous gases and harmful effects of concentrated acids on living beings, the proposed system attempts to build a safety device for detecting LPG and natural gas that leak at low levels to avoid any possible accidents. The proposed device monitors the levels of LPG and natural gas as well as other gases such as carbon monoxide. The device was intended for use in houses where leak of LPG and natural gas can pose a serious threat. It was built as a wireless system to increase the mobility of the alarm system within the premises of the house.

Objectives:

This project "**Veracious Box**" simply aims to adherence of medication. Medication adherence is the degree to which a patient correctly follows the medical advice. Medication non-adherence is referred to negligence and delays in taking your medicines, not following your prescriptions or even neglecting medication because of ethnicity and cultural influence. Apart from this, Medical Non-adherence also refers to unprescribed poly-pharmacy, altering medications, and taking medications in combinations. Studies show that in developed countries, medical adherence is about 50%. The situation in developing countries is even worse.

The problem of medication non-adherence is critical in case of our country, specifically in the rural areas because of

* Forgetfulness in the case of elders

* Inability to read and understand the prescription and the names on the medicines

* Lack of resources and knowledge to utilize the various mobile based medication reminder applications.

MedAssist is proposed as a device-based solution to the mentioned problem faced by rural Indians. It keeps your medicines as well as the schedule to take them. It tackles the problem of forgetfulness and memory loss in elderly people and efforts have been made to make this device usable for the differently abled. MedAssist is designed assuming no medical knowledge or literacy on the part of the patient. It assumes the presence of a Caretaker who could program the device using its simple interface for the use of the patient.

The intruders (here hackers) are sitting somewhere around the globe ready to attack our servers and it is very easy for them to do so. Once they intrude our servers, they can literally operate our systems remotely and can do anything from accessing our files and folders to placing order that are not true in nature. Hence, the security comes into question and which is something we cannot compromise and therefore it becomes primarily a task that needs to be considered right from the start.

BASICS OF THE WORK CARRIED

First things first, we started off with MedAssist. MedAssist is designed to help the elderly and the illiterate. Thus, solution to this problem is divided into Software and Hardware sections. Reminders in the form of alarms and LEDs help in communicating with the target problem, which is a hardware based solution provided.

As mentioned, MedAssist comprises of MedAssist Box. It has several small boxes to keep medicines, one for each day of the week, which is further divided into time of the day. The entire system can be controlled with the help of keypad that is used to switch the data we want to monitor, based on user's choice. For the output, the LCD comes handy, where we can visualise the data we wish to monitor. The user is also notified with the help of a LEDs, which are useful for the auditory impaired people.

Not only it helps the user to monitor their medicine status but also their home status like humidity, temperature, front door status, roof status etc. on the same device monitor. This helps the user to access the particular portion of their home by clicking some simple buttons on the keypad and the LCD shows the sensors' readings.

After assembling all the parts and interacting with each other we are able to accomplish our task and objectives. This helps the unprivileged to live their lives with ease and the illiterate to use the product with the help of a caretaker. In the case of elders who tend to forget things easily, this device proves to be useful to them. For the illiterate who are unable to read the prescription, the LED signals the particular box, thereby indicating the concerned medicine to be consumed.

They will further help us to interact with the website through the dedicated IP address. Henceforth, data regarding the home coming from various sensors like MQ3, PIR etc. Knowledge of the front end development is, however, required to build the website and let arduino interact with it efficiently. Languages like HTML, jQuery, PHP, JavaScript and CSS are included in front end development.

Tackling the problem forgetfulness and memory loss in elderly people, efforts have been made to make this device usable for the differently abled. This greatly reduces health related medication non-adherence that could have severe negative consequences otherwise.

1.2 List of Components:

- Arduino Uno

  It is an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public Licenses (LGPL) or the GNU General Public Licenses, permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form.

- Arduino Nano

  The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.
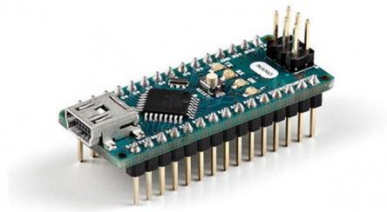

Fig. 1.2.1 Arduino Nano

- Arduino Mega

  It is a microcontroller board based on the ATmega2560, which has 54 digital I/O pins, 16 analog inputs, 4 UARTs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It is also compatible with most shields designed for the Uno and other boards.
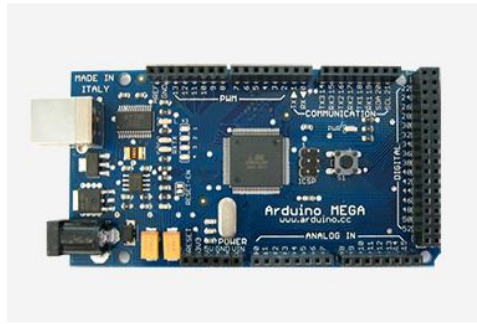
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Fig. 1.2.2 Arduino Mega board

- NRF Sensor

  It is a network layer for Nordic nRF24L01 radios running on Arduino-compatible hardware. Its goal is to have an alternative to Xbee radios for communication between Arduino units. It provides a host address space and message routing for up to 6,000 nodes. After having the connections made, our biggest task was to connect the 2 NRF sensors and let them interact among themselves successfully. With extensive testing and rigorous hard work, we made the better of the 2 sensors. Thus, data was sent swiftly from one arduino to another. The layer forms the background of a capable and scalable wireless sensor network system. Simultaneously, it makes communication between even two nodes. With a baseband protocol engine that is embedded in the nRF24L01+ module, it works at 2.4GHz trans-receiver. It is flexible for very low power without-wire applications (wireless). It works best in the ISM globe wide frequency band at 2.4 – 2.4836 GHz.
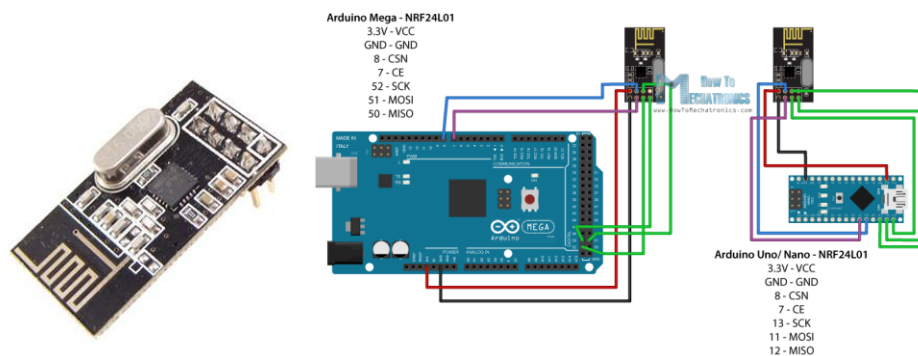

Fig. 1.2.3 a) NRF Sensor Fig.   Fig. 1.2.3 b) NRF pinout with Arduino Uno

- Arduino based Keypad

  Keypads are just like keyboards that are used to make inputs to the system. The only difference is the fact that it has 16 key (4*4) comprising of 0-9 numeric keys, A-D alphabets, and '*' and a hash (#). This is used in our product to switch between the outputs of data provided by the different sensors.
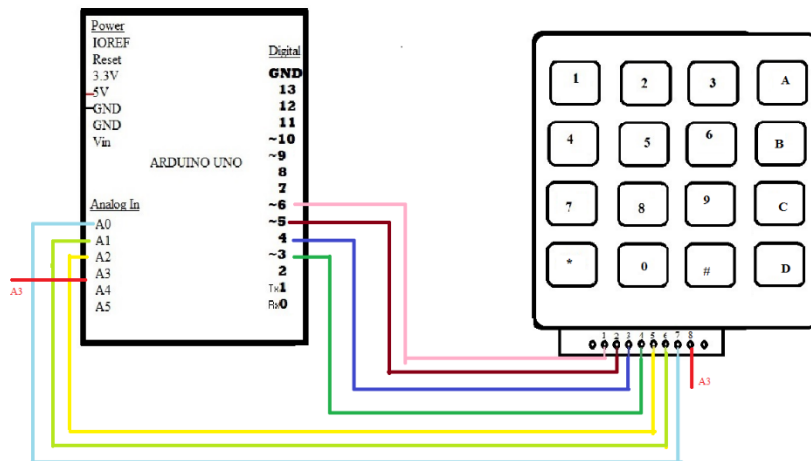
Fig. 1.2.4 4x4 Keypad with its connection

- PIR sensor

  It allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors.

Fig. 1.2.5 a) PIR sensor

Fig. 1.2.5 b) Pin layout of PIR

- MQ-3

  It is useful for gas leakage detection everywhere. It is suitable for detecting alcohol, benzene, CH_4, hexane, LPG, CO etc. Due to its high sensitivity and fast response time, measurements can be taken as soon as possible. The sensitivity of the sensor can be adjusted by using the potentiometer.
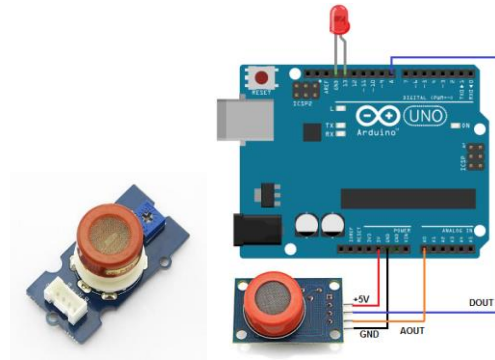
Fig. 1.2.6 MQ-3 sensor and its pinout (alcohol and gas detector)

- DHT11

  It is a humidity and temperature sensor that generates calibrated digital output, and gets instantaneous results. It is a low cost humidity and temperature sensor which provides high reliability and long term stability.
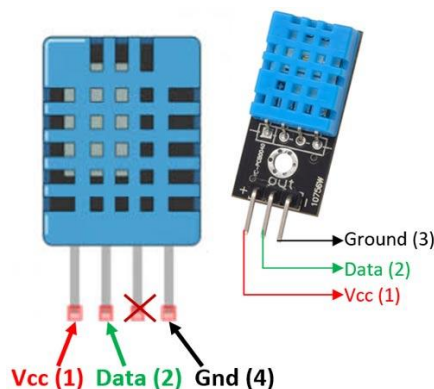

Fig. 1.2.7 Humidity and temperature sensor

- ESP8266 Wi-Fi Module

  To meet a constant and continuous, insistent and peremptory request, made as of right by the users is being delivered by the institution of Espressif ESP8266, that is highly desegregated, especially radically with Wi-Fi SoC (System on Chip) solution. For the starters, it consumes very less power, has a design that is dense and that is closely and neatly packed together. Moreover, it performs consistently well in quality and that can be easily trusted with the same. Ability to perform alone as an application or can also be used to host a microcontroller unit. It, upon request, helps and encourages to increases and improves the flash while it hosts the app. The performance of the system is enhanced by the super-fast cache that is in-built in the ESP8266 and comes integrated with the SoC. It is very flexible as it can be used as an adaptor for Wi-Fi via the interfaces designed for SPI/SDIO or UART. Switches for antennas, Radio Frequency balun (a type of electrical transformer used to connect an unbalanced

circuit to a balanced one), amplification of power systems, reduced noise receiving amplifiers, low pass filters and managing power modules are some of the key features that are inhibited and inducted within the Wi-Fi module. It also serves the purpose of optimizing the memory of the device. Following are the features of an ESP8266 -

◆ 802.11 b/g/n support

◆ Speeds up to 64 Mbps

◆ Locates noncontiguous fragments of data and defragments them

◆ Virtual Wi-Fi interfaces

◆ Spontaneous response for monitoring of beacon

◆ Diverse antenna

◆ Promotes Base Service Station mode

The applications of the Wi-Fi module are as follows -

◆ Appliances at house

◆ Automating at home

◆ Smart phones and switches

◆ A network of sensors
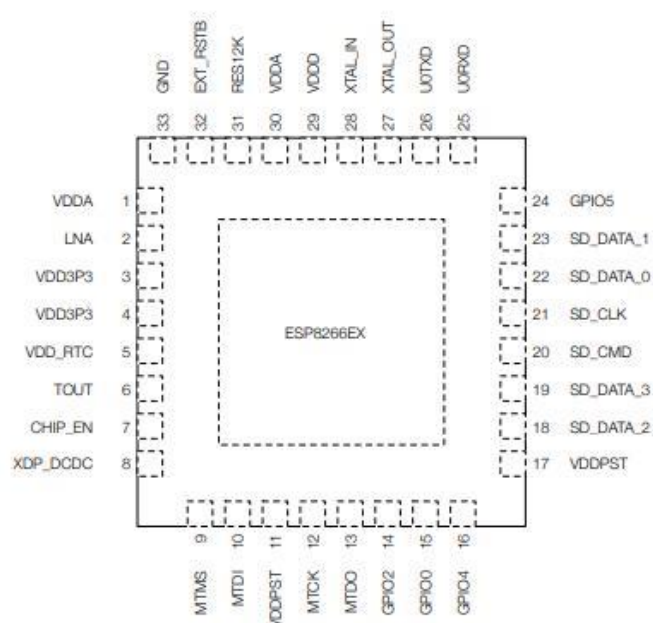
◆ Wearables

◆ GPS

Fig. 1.2.8 32-pin layout of ESP8266

- LCD

It is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light

directly, instead using a backlight or reflector to produce images in colour or monochrome. It is 16x2 display, which operates bit-by-bit and can be used to print pattern as well. It operates at 5V.
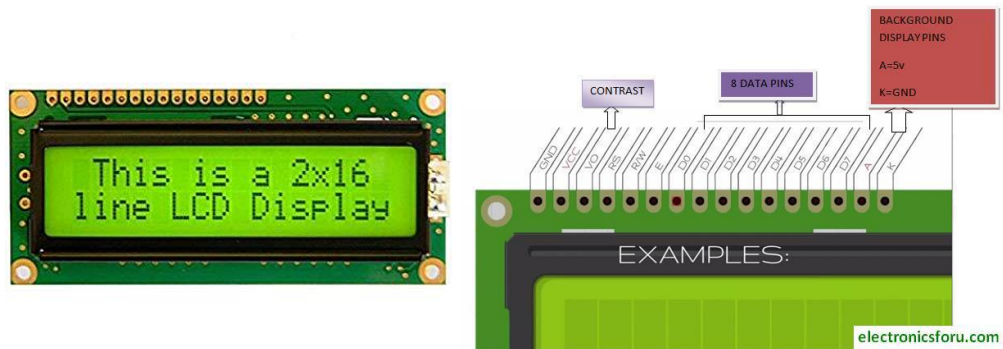

Fig. 1.2.8 2x16 LCD and its pin configuration

HARDWARE AND THEIR CONNECTIONS

The aforementioned components were collected and the schema of the circuit was prepared. Hence the circuit was made on arduino UNO and arduino MEGA. Other components included LCD, 4x4 keypad, 2 x NRF sensors, ESP8266 Wi-Fi module, wires and a 5V battery. After having the connections made, our biggest task was to connect the 2 NRF sensors and let them interact among themselves successfully. With extensive testing and rigorous hard work, we made the better of the 2 sensors. Thus, data was sent swiftly from one arduino to another.

1.3.1 NRF

With a baseband protocol engine that is embedded in the nRF24L01+ module, it works at 2.4GHz trans-receiver. It is flexible for very low power without-wire applications (wireless). It works best in the ISM globe wide frequency band at 2.4 – 2.4836 GHz.

Radio system with the nRF, it is can be designed very easily with the help of microcontroller and with the help of some extra non-active components. Further operation and configuration of this wireless module is done through an interface bus, commonly used to send data between microcontrollers and small peripherals such as shift registers, sensors and SD cards, commonly known as Serial Peripheral Interface (SPI). Then there is the register map, which is accessed with the help of the SPI, which comprises of all the configuration registers in the nRF24I01+ and can be accessed and operated in different modes of the chip. This engine that is embedded in the baseband protocol has its entire basis of communicating through packet and helps to support all the different modes from operation that is based on non-automatic, commonly known as manual operation to latest technology based advanced automatic protocol operation based on it. The FIFOs that are embedded in the system help to make certain of providing non-rough (smooth) flow of information and data betwixt the front end part of the radio and the MCU of the system base. Furthermore, cost can be reduced greatly by using intensified and improvised Burst mode which handles all the non-low speed link layer operations.

GFSK modulation is used by the front end part of the radio. There are parameters that can be configured by the end users, namely the channel meant to alter the frequency, power available at the output, and the rate of exchange of data in air. A rate of 250,000 bps for the exchange of data in air is supported by nRF module. The nRF module is moreover suitable

because of the fact that it has high rates of exchanging the data, and when clubbed with the different power saving modes, the efficiency of the nRF grows exponentially. However, new enhanced and improvised versions of nRF have been developed by the engineers. The concepts of i) Intermodulation and wideband blocking is improved, ii) Filter are improved internally, and iii) Margins for meeting RF regulatory standards have been enhanced.

1.3.2 GFSK Modulation

GFSK Modulation stands for Gaussian Frequency Shift Keying modulation. It is basically used in standard BLE (Bluetooth Low Energy) devices, Digital Enhanced Cordless Telecommunications (DECT) and Waveniss. This type of modulation is studied by EC engineers in Digital Communication, which helps translates symbols from a discrete alphabet into a signal. Here, the discrete alphabet is represented by binary numbers that is 0 and 1. This method of modulation simply shifts the frequency in the carrier domain and we get the output as GFSK. There are 3 basic working units in GFSK: i) Transmitter – with the help of a cosine function, the signal that needs to be transmitted is described, which depends on time and phase; ii) Noise, SNR, BER – Due to the noise and distortion, we receive a faint signal and thus we need to calculate some terms like noise, SNR (signal to noise ratio) etc. in order to extract the original signal that was meant to reach the end user. However, we cannot forget the BER (bit error rate) that is not at all associated with the SNR. It is defined as the rate at which error occurs in the transmission of digital data. It, basically, measures the quality of the data transferred. Our main aim is to design such a filter that reduces the cost of the system, and simultaneously satisfies the requirements as per the BER; iii) Receiver – By shifting the signal to the baseband (reducing frequency for carrier to 0), the signal can be filtered and hence, a delay is applied. Post this, the signal is transformed by multiplying it (margining the signal). This is a common procedure to receive the signal in its natural state.

1.3.3 ESP8266 (Wi-Fi module)

To meet a constant and continuous, insistent and peremptory request, made as of right by the users is being delivered by the institution of Espressif ESP8266, that is highly desegregated, especially radically with Wi-Fi SoC (System on Chip) solution. For the starters, it consumes very less power, has a design that is dense and that is closely and neatly packed together. Moreover, it performs consistently well in quality and that can be easily trusted with the same. Ability to perform alone as an application or can also be used to host a microcontroller unit. It, upon request, helps and encourages to increases and improves the flash while it hosts

the app. The performance of the system is enhanced by the super-fast cache that is in-built in the ESP8266 and comes integrated with the SoC. It is very flexible as it can be used as an adaptor for Wi-Fi via the interfaces designed for SPI/SDIO or UART. Switches for antennas, Radio Frequency balun (a type of electrical transformer used to connect an unbalanced circuit to a balanced one), amplification of power systems, reduced noise receiving amplifiers, low pass filters and managing power modules are some of the key features that are inhibited and inducted within the Wi-Fi module. It also serves the purpose of optimizing the memory of the device.

CHAPTER 2

LITERATURE REVIEW

Temperature transmission technology plays an important role in the industrial production, but the security and reliability of data cannot be guaranteed because of its difficult and complex wiring. As for these problems, paper [1] puts forward a wireless multi-point temperature transmission system with RF chip nRF24L01 for 2.4GHz band and high-precision 1-Wire bus digital temperature sensor DS18B20, and the system's hardware and software design is also discussed in paper [1]. The system can realize a real-time temperature transmission with C8051F340 microcontroller and the wireless transceiver nRF24L01.At the same time, the wireless transmission system can be achieved with low complexity and low cost. The test results show that the system has high accuracy and wide temperature range, which can reliably realize wireless data transmission.

In paper [2] wireless transceiver module nRF905 are used to build the wireless network transmission system hardware platform. The hardware interface and equipment performance of LPC2200 processor and nRF905 are introduced and the design is proposed. The architecture of hardware circuit between embedded processor and wireless module is given, the processor I / 0 pins control procedures is designed, SPI bus data transfer function, driver of nRF905 and wireless data transmission function are programmed . Paper [2] uses RFID technology to achieve a low rate of data transmission functions. This paper provides some reference for continue in-depth studying on wireless networks and realizing data communications in short distance.

The Internet of Things (IoT) system proposed in paper [3] is an advanced solution for monitoring the temperature at different points of location in a data centre, making this temperature data visible over internet through cloud based dashboard and sending SMS and email alerts to predefined recipients when temperature rises above the safe operating zone and reaches certain high values. This helps the datacentre management team to take immediate action to rectify this temperature deviation. Also this can be monitored from anywhere anytime over online dashboard by the senior level professionals who are not present in the data centre at any point in time. This Wireless Sensor Network (WSN) based monitoring system consists of temperature sensors, ESP8266 and Wi-Fi router. ESP8266 is a low power, highly integrated Wi-Fi solution from Espressif. The ESP8266 here, in this prototype, connects to 'Ubidots' cloud through its API for posting temperature data to the cloud dashboard on real time and the cloud event management

system generates alerts whenever the high temperature alert event is fired. Cloud events need to be configured for different alerts beforehand through the user friendly user interface of the platform. It's to be noted that the sensor used here can be leveraged to monitor the relative humidity of the data centre environment as well along with the temperature of the data centre. But for this prototype solution focus is kept entirely on the temperature monitoring.

In paper [4] wireless safety device for gas leakage detection is proposed. The device is intended for use in household safety where appliances and heaters that use natural gas and liquid petroleum gas (LPG) may be a source of risk. The system also can be used for other applications in the industry or plants that depend on LPG and natural gas in their operations. The system design consists of two main modules: the detection and transmission module, and the receiving module. The detection and transmitting module detects the change of gas concentration using a special sensing circuit built for this purpose. This module checks if a change in concentration of gas has exceeded a certain pre-determined threshold. If the sensor detects a change in gas concentration, it activates and audio-visual alarm and sends a signal to the receiver module. The receiver module acts as a mobile alarm device to allow the mobility within the house premises. The system was tested using LPG and the alarm was activated as a result of change in concentration.

In paper [8] an approach to fully integrate micro fabricated sensors into textiles. They first developed platinum resistance temperature sensors (RTDs) on 500 m-wide, 67.5 mm-long plastic stripes. After completing the sensor fabrication, they used a dicing saw to separate individual sensors by cutting the plastic foil into stripes, each containing an individual sensor and connecting lines. The resistance of the RTDs was 665 ohms +/- 10 % at room temperature. The temperature coefficient of the RTDs is 0.00223 K^{-1} with a sensitivity of 1.52 K/°C at a drive current of 500 mA. Cutting the substrate did not affect the sensor functionality. They then tested the influence of strain on the stripe RTDs signal using a pulling tester to apply tensile strain. Longitudinal strain resulted in metal line break after 2 N applied force (at an elongation of 5%) and in breaking of the Kapton stripe at 8 N applied force. Single sensor stripes spaced 10 mm apart were integrated into a textile band using a commercial band weaving machine.

The main objective of paper [5] is to save power in IT work spots, using a PIR sensor capable of detecting only human beings. It deals with the concept of office automation which will be very much helpful to save power in the time of power crisis. A PIR sensor is fixed to each and every computer in the work spot. The PIR sensor fixed in the

computer will sense its user for every 15 seconds as pre-programmed in the controller which is fixed to the sensor. In the case of absence of user, the monitor is programmed to turn off. All the PIR sensor are centralized by a PIC controller (PIC 18F4520) in the department. This is capable of interfacing multiple electronic devices. It interfaces the PIR sensors with the relays. If a whole row or continuous 4 system is seemed to have no user then PIC controller is programmed in such a way to switch off the respective lights and fans (or AC shutters) by an interface between switchboard of light and fan control and PIR sensor. A DC relay is used for the turn ON and turn OFF purposes of electrical appliances according to the output obtained from the PIC controller circuit. A relay driver circuit is used to drive the relay according to the output pulses from the PIC controller.

In paper [6] Internet of Things (IoT) is the set of technologies that can interconnect anything, from daily life objects to more sophisticated networked devices. The IoT paradigm is constantly increasing the number of devices owned by end-users. Following the social networks paradigm, IoT-centric social networks would allow sharing of devices between users that would provide useful information captured by sensor devices or giving ways to make remote actions on user devices. Also paper [6] proposes an IoT centric social device network based on a Cloud computing model which provides a virtual execution environment thanks to its decentralized nature, high reliability and accessibility from anywhere and at any time. The paper describes an approach that allows easily reusing highly distributed IoT resources by building services on top of them. Applications are built by composing those services and deploying into service platforms distributed and hosted in the Cloud that grants secure access to the data shared by these devices in compliance.

CHAPTER 3

CREATING WEBSITE

For making a website, there are 4 main tasks that need to be accomplished:

3.1 Registration of domain name –

For the easy service to the customers, we should set the domain name such that it reflects the content of the product/service made through the website. It will allow easy access to the customers via the search engines. Like the Gmail, for our email address, this domain name can also be used and solves the purpose for the same. It is, in fact, professional if one sends an email through the business email address.

Henceforth, we needed to find an *accredited registrar* and a small fees needs to be paid to them, for the successful registration of our domain. These organizations are, basically, given official permission/approval by AUDA (Australian Domain Name Administrator) to help their customers with the services that they have to offer, who are new into website making business and are yet to register a new domain name, or otherwise who intend to re-subscribe to their existing domain name, or make appropriate changes whatsoever.

3.2 Finding a web hosting company –

A web hosting company helps us to get our domain name online, on the internet. Web hosting services are often provided by majority of the leaders and the giants in the Internet Service Provider business. Depending upon the monthly traffic and the volume of the website, monthly fees varies significantly.

3.3 Content Preparation –

Knowing what the customers really expect from the website is the major part in website designing. Thus it will help us focus the exact area where our customers will benefit the most. Likewise we seek professional photographers or chefs, we need professional website designers and content writers who will help groom the website.

3.4 Build your website –

Since we needed a website only to display the data and access it worldwide, we didn't build a professional website but a basic one. There are several website development tools that help to build a website. They are namely: HTML (Hyper Text Markup Language), CSS (Cascade Style Sheets - for styling).

Furthermore, making a website mobile and smartphone-friendly and compatible with other mobile devices will further increase the customer size. This optimization will ensure flexibility to the customers and will be able to access it anywhere from around the globe.
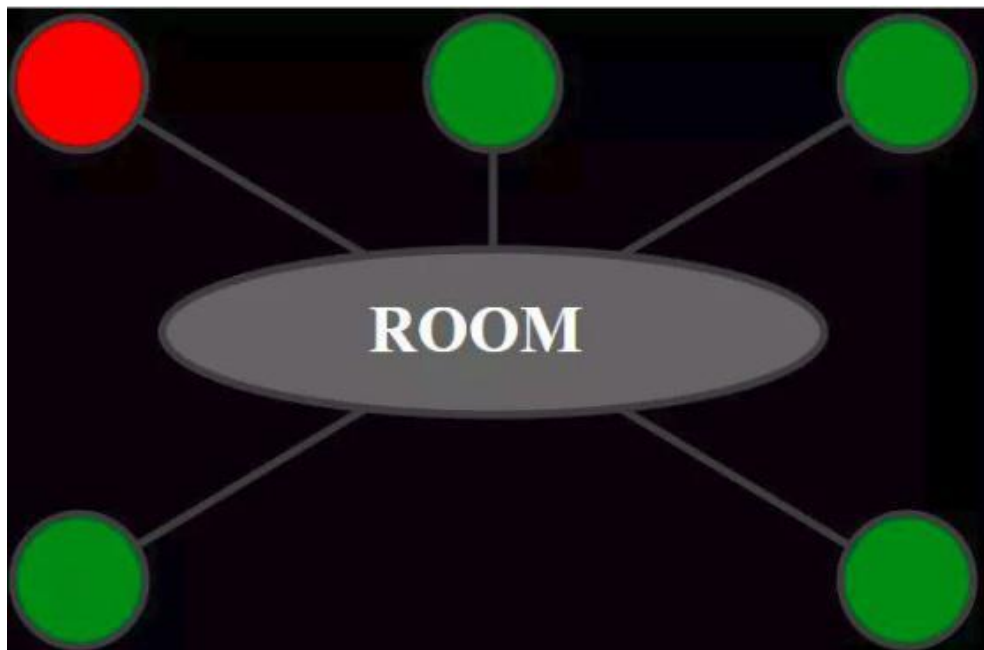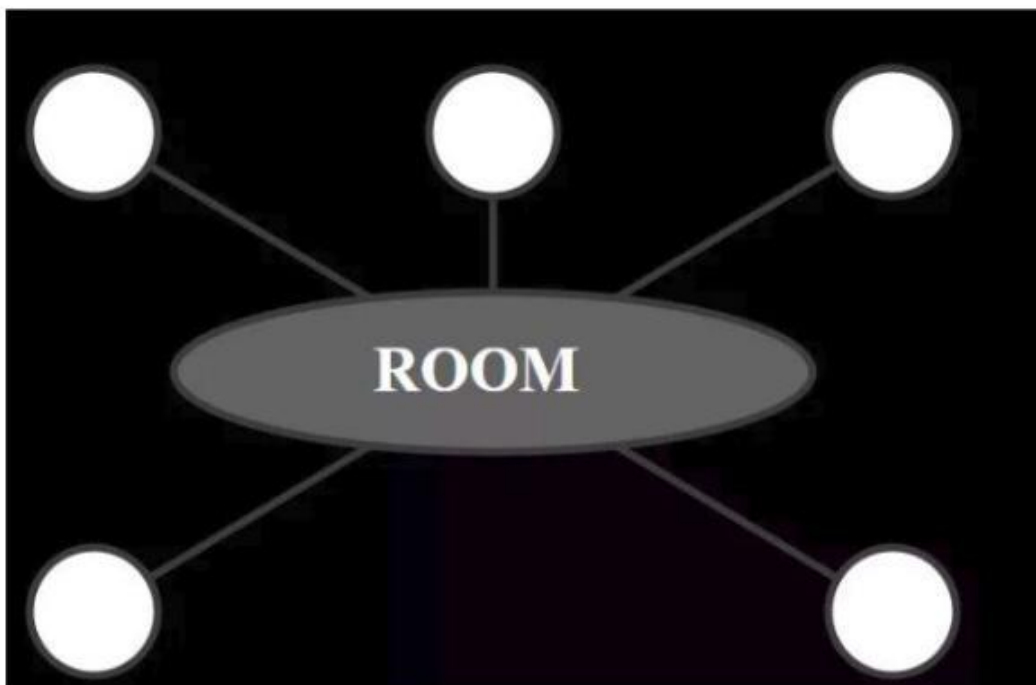

Fig. 3.1 Selection for the status of room
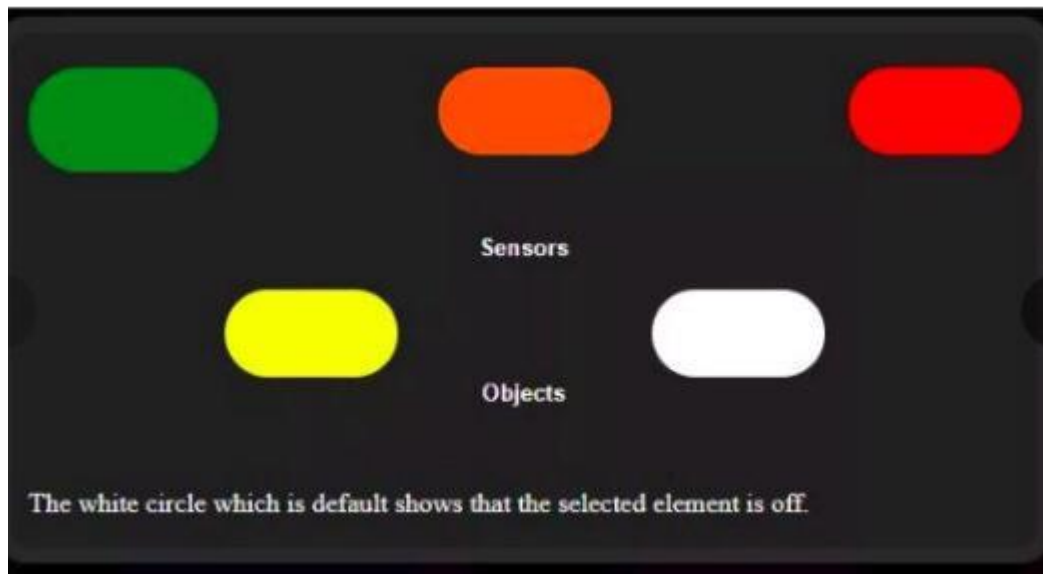

Fig. 3.2 Deselecting all modes

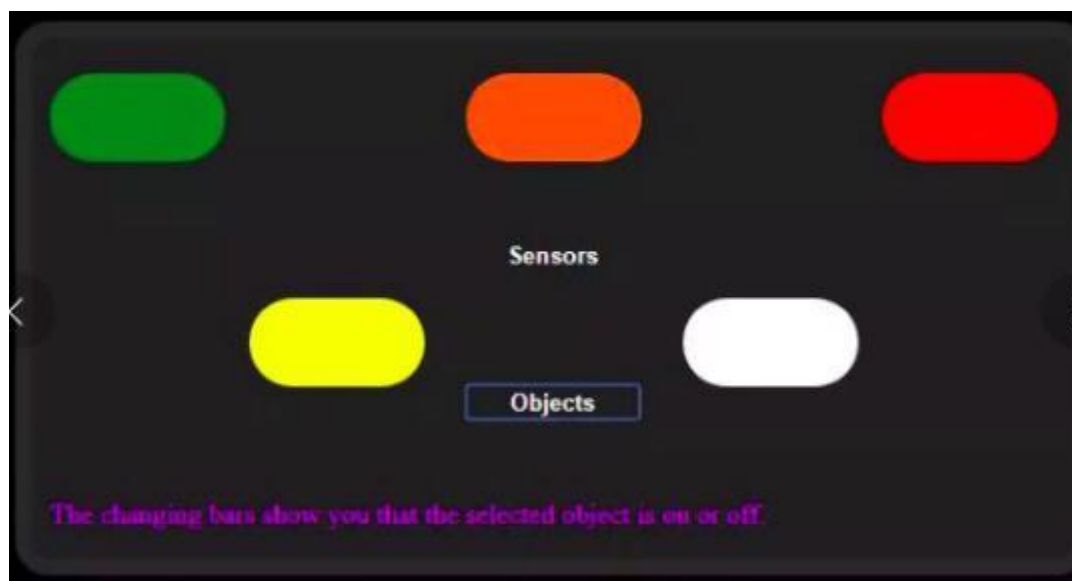Fig. 3.3 Different circles depict the different values of sensors

Fig. 3.4 Selecting different bubbles assign different values of sensors

CHAPTER 4

CONNECTING ARDUINO WITH WEBSITE

To successfully connect the arduino with the website, we need a working arduino, various sensors responsible to send the data. This is all for the hardware part. However, for the software part, we need Arduino IDE, The Apache HTTP Server, and Notepad++.

To achieve the desired goal, we need to build several (4 PHP pages) HTML pages, namely: i) inoautom.php, ii) inoautomctrl.php, iii) inoautomfrmval.php, and iv) inoautomcx.php in the localhost of the apache folder. Simultaneously, HTML pages on the web are hosted by the ESP8266 Wi-Fi module. They will further help us to interact with the inoautom website through the dedicated IP address. Henceforth, data regarding the home coming from various sensors like MQ3, PIR etc. Knowledge of the front end development is, however, required to build the website and let arduino interact with it efficiently. Languages like HTML, jQuery, PHP, JavaScript and CSS are included in front end development. Since it is just a showcase of the product, it can be simulated in any language. Hence, PHP is used all over in the designing.
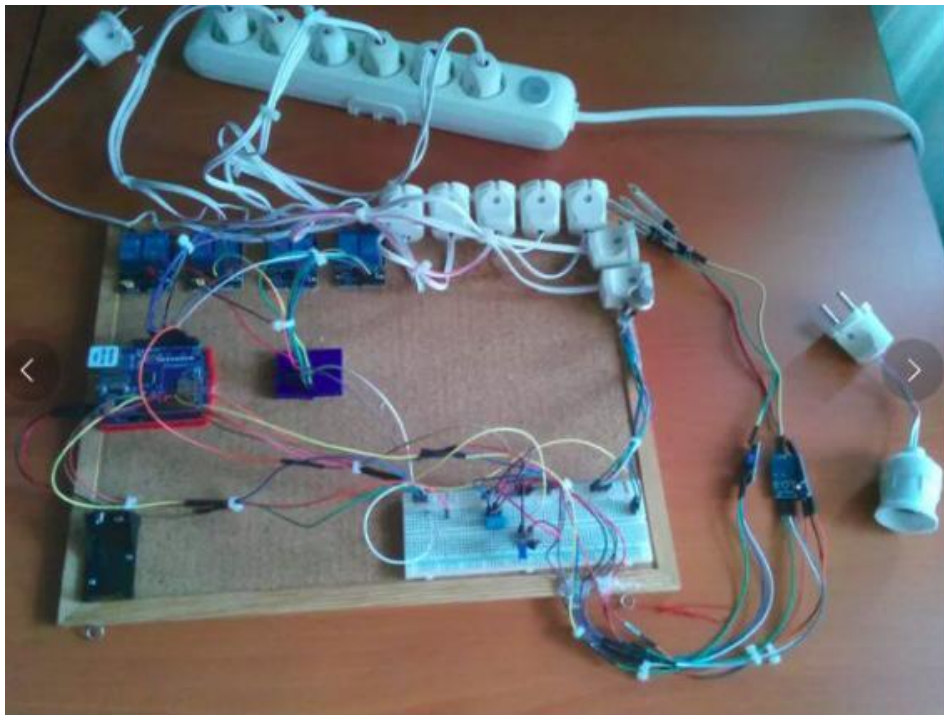

Fig. 4.1 Snapshot of hardware components connected coherently

4.1 Transfer data betwixt 2 web pages on PHP

To receive and send data betwixt 2 or more webpages, use of PHP $_sesssion, methods predefined in PHP and forms based out of HTML. If we talk about simplicity, GET method is more preferred rather than POST method. But if we talk a deal about security of the data transferred, we need POST method there. The latter one is used in cases where we need to send sensitive information like passwords or bank account details.
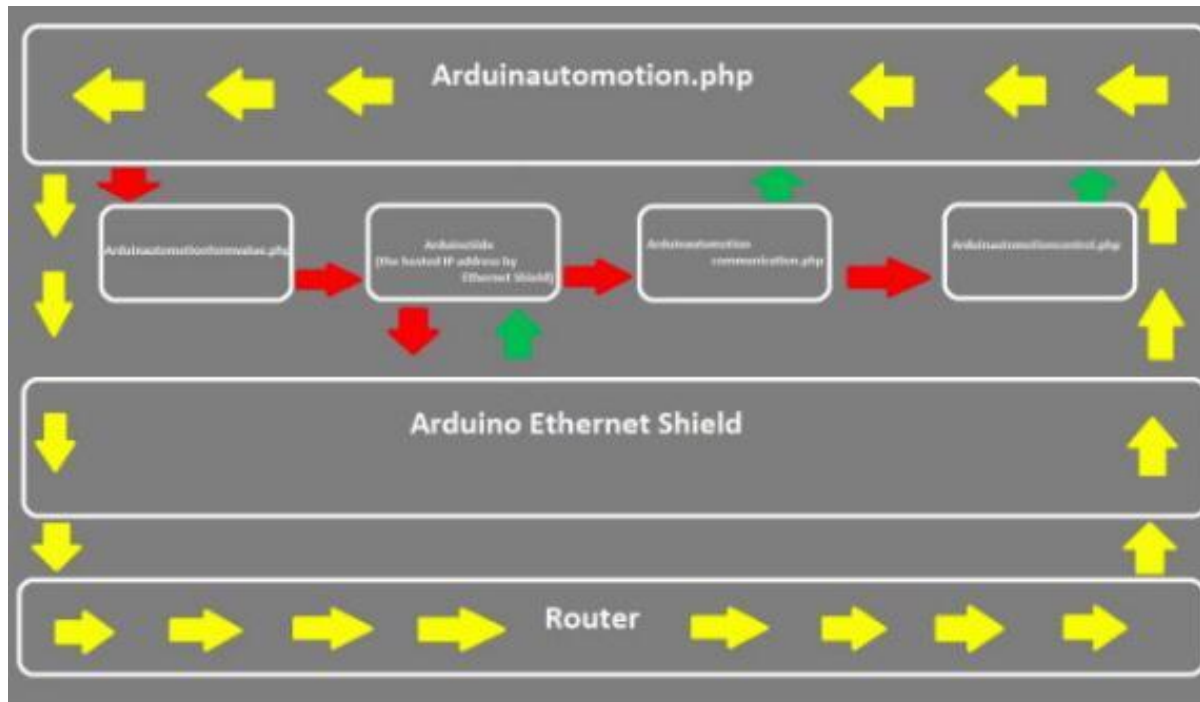

Fig. 4.2 Flow of data from router to Arduino

4.2 Setting up website on The Apache HTTP server

There are many hosting servers like XAMPP and The Apache HTTP server, but we used the latter one because of its high efficiency for that level of hosting. First of all, we need to download and install PHP from https://www.php.net/downloads.php. Post this, configuration of Apache to run PHP as a module needs to be figured. Lastly, restarting apache and running a test page on PHP will help in successful running and creation of PHP webpage.
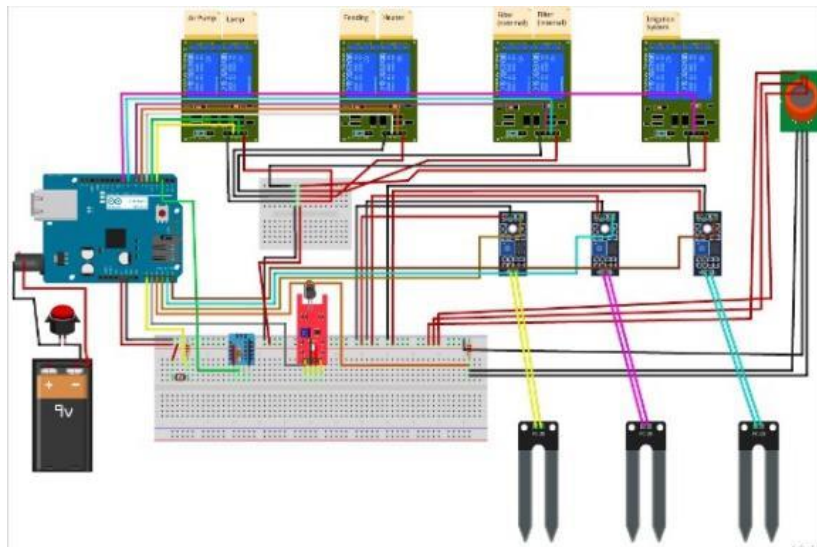
Fig. 4.3 Fritzing diagram of the circuit

CHAPTER 5

IoT

5.1 The role of Web Designing in the emerging age of IoT

The smooth functioning of devices that are smart where the role of websites is increasing exponentially, we are entering that age of web designing and development. The ecommerce website designing and development has reached new heights and levels after the IoT has come into picture. Now that the websites are designed that are compatible with mobile devises and tablets, their designing and development has become difficult and quite complex when compared to the ones before the era of IoT. The front end interfaces have to be taken into consideration while designing them. This makes the communication easy among all the devices. For the users to communicate easily with devices such as sensors, washing machines, refrigerators, cameras etc.; clean interfaces are needed. To thoroughly test the designs, configure the networks and management of the servers. Hence the flexibility of the designs should be kept in mind for easily adaptation of several devices connected through Internet of Things.
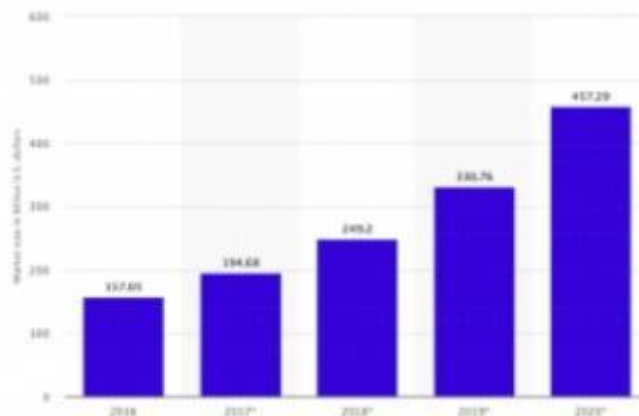

Fig. 5.1 Emergence of IoT in the world of technology

Moreover, there is an essential need for the framework to be strong enough for the communication happening at the back end of the databases. It is so because the data needs to be kept secured and should be accessible to all the needs, that is acquired from several Internet of Things (IoT) devices that correspond to each and every individual user. To help for a successful structure of and framework for foolproof and effective data, individual and system interactions, it is very vital to have a deep sense of understanding and knowledge of theory and practicality in the fields of The Physical Web, Open-Remote, Open Lab, Lelyan, NetBeans, KAB Internet of Things, ZETA and Open Founded Connections.

Since the invention of smartphones and the accessibility of web browsers like Google Chrome/Safari in mobile phones itself, the designing of websites for the desktop version would eventually die out, paving the path for interface for mobile-only designing. The state or quality of being simple would be the key as designs made would be simpler and easy for smartphones to load. Creating designs that will be accessed without any difficulty, that can be accessed remotely from anywhere in the world (just an internet connection will suffice), will be the sole of the designers and engineers. Not the security, not the interaction, but the speed of the website loading will play an important role because communication and interaction with systems involved in Internet of Things will be difficult and not easy, and this, takes a lot of time. The time for the page to get loaded will have to be kept as minimum as possible, so that there is time provided for system interaction and sharing of data in air. However, we cannot blindly ignore the part where security comes into picture. The intruders (here hackers) are sitting somewhere around the globe ready to attack our servers and it is very easy for them to do so. Once they intrude our servers, they can literally operate our systems remotely and can do anything from accessing our files and folders to placing order that are not true in nature. Hence, the security comes into question and which is something we cannot compromise and therefore it becomes primarily a task that needs to be considered right from the start. Following are the procedures step-by-step that help us to secure our website development -

- Pointing out all the point of contacts that are vulnerable to threats. There should be complete perfection while designing the idea of the website, where great importance is stressed on the definition of our goals that are relevant to the sketches of the website.

- Testing and running from the very novice stage to avoid any compilation or syntax errors, and that can be sorted then and there itself.

- For achieving maximum productivity with minimum waste experience that relates the individual interface to underlying models of data, a Model-View-Controller Framework needs to be adopted.
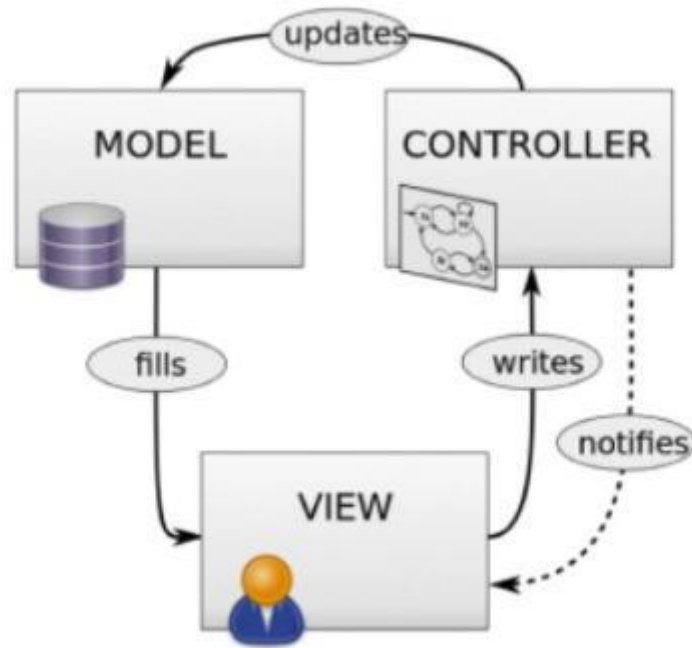
Fig. 5.2 A Framework characterized by Model-View-Controller

- The use of add-ons and plugins needs to be miniaturized and a very simplistic website needs to be designed.

- Moreover, focus should be laid on strengthening the security of our website at a very early stage, even when the site is not vulnerable and the attack has not started yet. Web application firewalls like cloud flare play an important role here.

- Building firm belief in the reliability, truth or ability of someone or something and to create secured/encrypted connections, we need SSL certificates. These are small data files that digitally bind a cryptographic key to an organizations' details. It activates the padlock and the HTTPs protocol by installing it on a webserver. It also allows the connections' security from a web server to a browser.

In addition to the back story of Javascript, professionals recommend it to be the most sophisticated and of high quality. It works in real time and is hence driven by events. This adds to our knowledge that it can be used to perform orders and commands that are supposed to happen in the exact time frame as of the communication betwixt smart phones and their respective devices. Thereby, we get our database management systems in check and comprises of fresh data.

5.2 Development Process

5.2.1 User Interface

The first and the foremost task is to build the user interface specifically for the website or the mobile application. Features like reliability, robustness, sophistication and, most importantly, speed comes into picture when we talk about the development of the systems using IoT. A logical cohesion and intuitive application makes sure a very interesting and awesome occurrence of events for the user. Such are the points and goals we need to keep in mind while we design and build user interface.

Fig. 5.2.1 User Interface Model

5.2.2 Speed and Reliability

Originally, to send a request to the servers on the web, it is first inspected and the data is checked and the relevant data is received. This has been the existing and long established tradition in the world of development and designing of websites. However, when Internet of Things comes into picture, the dependency on the time to load the page and data increases exponentially. Since the invention of smartphones and the accessibility of web browsers like Google Chrome/Safari in mobile phones itself, the designing of websites for the desktop version would eventually die out, paving the path for interface for mobile-only designing. The state or quality of being simple would be the key as designs made would be simpler and easy for smartphones to load. Creating designs that will be accessed without any difficulty, that can be accessed remotely from anywhere in the world (just an internet connection will

suffice), will be the only task for the designers. Hence implementation should be made according to the slow designs.

5.2.3 Privacy and Security

Prone to threats and vulnerability have always been the prime concern of the developers. Hence it becomes very important to add safety measures that ensure the security of the systems installed on the devices so that there is no loss or intervention in the communication of the data. Timely charging of the battery is of great concern as once the systems get exposed to the hackers, they can literally access the databases and interfere in order to cause damage or make unauthorized alterations.

Fig. 5.2.2 Importance of Privacy and Security

5.2.4 Power Management

Battery is the only source of power for these wireless devices and systems to run, and this happens quite often. Hence, the status of battery should be monitored at all times and if any drainage, should be charged immediately otherwise there will be a power shutdown. Apart from the fact that the power systems always need to be in check, we should also not forget the importance of saving the use of power. Hence it needs to be conserved.

Fig. 5.2.3 Applications of IoT

RESULTS

The system, in all, comprises of a microcontroller, some input devices (PIR sensor, temperature and humidity sensor, gas detection sensor) and output devices in the form of a LCD screen. These interact with each other with the help of varying Arduino development boards and nRF sensor and 4x4 keypad. The nRF sensor wirelessly switches between the MedAssist Box and the data of user's home.

In this wireless switching and wired data transmission, the entire product was tested in changing weathers and various possibilities were explored for the MedAssist box. Sensor characterization was done inside a closed room where we set up all the sensors to give data as per the weather information received online. Nevertheless, humidity could not be controlled, its values were almost constant due to the present weather in our city. However, the response of the temperature sensor is not influenced from the humidity cycles, while the humidity sensor shows the increasing and decreasing relative humidity in the room. Moreover, PIR sensor gave accurate data and could sense human activity for as long as 10 meters. The main objective of incorporating PIR sensor, to save power in the environment-degrading world, which is capable of detecting only human beings, was fulfilled. The gas leakage detection was also implemented that detects the aforementioned gases. The proposed system was tested by introducing low volumes of alcohol on the sensor. The sensor was able to detect small amounts of gases and the alarm was activated accordingly. Following snaps give a glimpse of the product and the code to implement the system.

Fig. 6.1 MedAssist Box

Fig. 6.2 Snapshot of code

CONCLUSION

The work done in the successful completion of the working model was divided into 2 main parts: The MedAssist Box and the Veracious Box. The main aim of the MedAssist box was to adhere to the proper medication while the incumbent is ill. The system was tested on a senior citizen, and positive feedback was received. The schedule for taking the right medicine at the right time is managed efficiently. In the latter part, the data of your home will be accurately available to you, and displayed on the LCD screen. The PIR sensor sensed the human activity with high accuracy, detecting the heat signatures. The temperature and humidity sensors accurately gave the weather report, wherein, the temperature sensors have a linear response to temperature with a temperature coefficient of 0.0028 $°C^{-1}$. The humidity sensor has a linear distribution till 60% RH and starts to saturate with higher humidity. The system can measure humidity and temperature and shows its potential use in monitoring the room weather.

Wirelessly switching between the 2 parts would not have been possible without the use of nRF sensors. Through this, the system realizes real-time temperature acquisition and transmission. It is also a feasible reference solution for wireless data transmission. In the gas leakage system, the sensitivity of the entire system was adjusted by changing the load resistor of the sensor which provides flexibility to externally calibrate the system to avoid any false alarms. This gives the system the advantage of detecting leaks of the gases that the sensor detects. Measuring the actual concentration of a certain gas cannot be easily done with this sensor, since it can detect many gases at the same time and has a non-linear sensitivity curve.

Future Scope:

Extensive user testing is required for the device to comment about its usability and reliability in the rural environment. With required changes, MedAssist can be mass produced for usage in rural India. Since we are using components like complete MCU's and Launchpad for simple operations, we argue that the device can be made feasible for poor people. There are also a couple of features that we plan to add to MedAssist. We plan to use a smaller RF module so as to make the User-Tag similar to a wrist-watch. Adding voice-based prompts such as 'Take this medicine after lunch' and 'Take this medicine before dinner' can increase the usability of the device as well. Also, a mobile based app instead of RF user tag can be developed targeting urban crowd in the country. This app can also be used to track the intake of medicines by the patient.

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