ABSTRACT

The Medicare Health System is an IoT-driven solution designed to revolutionize real-time health monitoring and improve patient care. Utilizing a suite of sensors, including temperature, heart rate, MEMS, and Glucose level sensors, the system continuously gathers critical health metrics. Data is processed by an at mega 328 microcontroller and securely transmitted to the Thing Speak cloud via Wi-Fi for storage, analysis, and visualization. Integrated with user-friendly interfaces such as an LCD display, Buzzer, and speaker, the system provides immediate feedback, ensuring timely alerts for patients and caregivers. This innovative approach offers a scalable, cost-effective solution tailored for both personal and clinical healthcare needs, addressing modern challenges in healthcare accessibility and efficiency.

By leveraging IoT technologies, the Medicare system enhances the reliability and accessibility of health data, enabling timely diagnosis and intervention. Its cloud-based architecture facilitates remote monitoring, making it particularly valuable in underserved areas. While the system demonstrates the transformative potential of IoT in healthcare, future iterations will prioritize data security through robust encryption and scalability to support larger networks. The Medicare Health Care System exemplifies how IoT integration can bridge gaps in healthcare delivery, reduce costs, and improve patient outcomes in an increasingly connected world

CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

Healthcare is one of the most critical domains where technological innovation can profoundly impact lives. As the demand for effective and efficient healthcare solutions grows, the integration of advanced technologies, such as the Internet of Things (IoT), has emerged as a transformative approach. IoT technologies enable the seamless collection, analysis, and transmission of data, making real-time health monitoring a reality. This capability is especially valuable in addressing the challenges posed by the increasing prevalence of chronic diseases, aging populations, and the need for continuous patient care. The Medicare Health Care System is a comprehensive IoT-based solution developed to meet these growing demands, offering advanced tools for health monitoring and management.

The Medicare system combines cutting-edge IoT technologies to create a robust framework for health monitoring. It employs an array of sensors—temperature, heart rate, MEMS (Microelectromechanical Systems)—that work together to gather vital health metrics. These sensors are connected to an at mega 328 microcontroller, which processes the collected data. By leveraging Wi-Fi connectivity, the system transmits this data to the Thing Speak cloud platform, where it is securely stored, visualized, and analysed. This real-time flow of information provides healthcare professionals and caregivers with the tools needed to monitor patient conditions effectively, regardless of physical proximity. Such innovations hold immense promise for enhancing the quality of care in rural and remote areas where access to healthcare facilities is limited.

In addition to its technical sophistication, the Medicare Health System prioritizes usability. It incorporates an LCD display, Buzzer, and speaker to deliver real-time alerts and feedback to users. For instance, an abnormal heart rate or temperature triggers immediate notifications, ensuring swift action by caregivers or medical professionals. This feedback mechanism enhances the system's reliability, making it indispensable for both personal and clinical use. Patients with chronic illnesses can rely on it for daily health tracking at home, while hospitals and clinics can utilize it to provide continuous monitoring for their patients. This dual functionality highlights the system’s versatility in addressing diverse healthcare scenarios. The IoT-based architecture of the Medicare system ensures scalability and cost-efficiency, making it an attractive solution for modern healthcare challenges. The ability to remotely

In summary, the Medicare Health Care System exemplifies the potential of IoT to revolutionize healthcare delivery. By integrating advanced sensors, real-time monitoring, and cloud connectivity, it provides a practical solution for improving patient outcomes and reducing healthcare costs. Its ability to adapt to various settings, coupled with its user-friendly design, makes it a versatile tool for both individuals and medical professionals. As technology continues to advance, systems like Medicare will play an increasingly vital role in shaping the future of healthcare, ensuring that quality care is accessible to all.

1.2 Motivation

The integration of IoT into healthcare systems is driven by the urgent need to address critical challenges in the sector, such as delayed diagnoses, insufficient access to medical facilities, and the rising burden of chronic diseases. Traditional healthcare models often rely on periodic visits and manual monitoring, which can lead to missed early warning signs and delayed interventions. This issue is especially pronounced in remote or underserved areas where access to healthcare providers is limited. The Medicare Health Care System aims to bridge this gap by leveraging IoT technologies to create a robust, real-time health monitoring solution. By enabling continuous tracking of vital health metrics and seamless data transmission to healthcare professionals, the system ensures that patients receive timely and accurate care, ultimately improving outcomes and saving lives.

Another key motivation behind the development of the Medicare system is the potential to make healthcare more cost-effective and efficient. The increasing costs of healthcare services and hospitalizations necessitate solutions that can reduce the financial burden on both patients and healthcare providers. Real-time monitoring systems like Medicare minimize the need for frequent hospital visits, allowing patients to manage their health from the comfort of their homes. Moreover, the scalable and adaptable design of the system makes it suitable for deployment in various healthcare settings, from personal use to clinical applications. By addressing both accessibility and affordability, the Medicare Health Care System highlights

CHAPTER 2

OBJECTIVES

Objectives

Primary Objective

To design and develop an IoT-based healthcare system integrated with Medicare services that enables real-time remote monitoring, diagnosis, and management of patients' health conditions, ensuring timely medical intervention and improved quality of care.

Specific Objectives

1. To implement IoT-enabled medical devices that continuously collect patients' vital parameters such as heart rate, blood pressure, glucose levels, oxygen saturation, and temperature.
2. To establish secure data transmission and storage mechanisms using cloud computing and encryption techniques to ensure patient privacy and HIPAA compliance.
3. To develop a centralized monitoring platform (web or mobile-based) that allows healthcare professionals to view, analyze, and respond to patient health data remotely.
4. To integrate Medicare functionalities for automated health record management, claim processing, and compliance with Remote Patient Monitoring (RPM) reimbursement models.
5. To apply data analytics and AI algorithms for predicting health risks, detecting anomalies, and generating early warnings for potential medical emergencies.
6. To enhance patient engagement and self-management through real-time feedback, alerts, and health insights delivered via mobile applications.
7. To evaluate system performance and reliability in terms of accuracy, latency, scalability, and user satisfaction under real-world healthcare scenarios.
8. To demonstrate cost-effectiveness and preventive healthcare benefits by reducing hospital readmissions and optimizing Medicare resource utilization.

CHAPTER 3
LITERATURE SURVEY

Elena-Anca Paraschiv : Dramatic increase of senior population has brought serious challenges to the healthcare domain, imposing changes of the traditional care patterns. Emerging digital healthcare technologies (as Artificial Intelligence (AI), remote monitoring) provide solutions for early detection and prevention of many diseases. This paper aims to present how the functionalities of the RO-Smart ageing remote healthcare monitoring system can be enlarged with support healthcare services provided by a conceptual model based on AI. Based on Machine Learning and Deep Learning models, the new functionality allow an early detection of certain cardiac issues, highlighting the preventative approach that is compulsory as heart diseases are closely associated with the elderly.

During the last decades, more and more demographic, social and economic changes have influenced the percentage of the ageing population, leading thus to an increasing number of elderly people, correlated with a direct and dramatic influence on the healthcare and social services. Furthermore, the grown longevity of the elderly, the shortage of an appropriate number of caretakers and the raising empowerment of the seniors regarding the self-management of their health status, have led to the stringent necessity of implementing smart environments inside their homes in order to benefit of a prolonged independent, active, healthy and secure life. The Internet of Things (IoT) technology has gained a lot of attention due to its strong potential for supporting these smart environments through devices that can remotely monitor elderly's health and daily activities, without the need to be constantly assisted by a medical .

The constant improvements in life expectancy have led to a considerable growth in the ageing population which significantly impacts the deliver of healthcare services and costs as well as an increase the medical professionals' burden. However, the most recent digital progresses have revealed a tremendous use of Internet of Things (IoT), Big Data and Artificial Intelligence (AI) towards the development of complex systems that can facilitate and support the elderly and the medical staff. In this context, the purpose of this paper is to firstly present the capability IoT can provide in order to ease the remotely monitoring of the healthcare status, the Big Data and AI developments for early disease detection and the enlarged capacity of integrating IoT, Big Data and AI in the healthcare sector. Secondly, the paper discusses RO-Smart ageing, a remote healthcare monitoring system which aims to support and offer a good …

Schizophrenia is a complex neuropsychiatric disorder characterized by disruptions in brain connectivity and cognitive functioning. Continuous monitoring of neural activity is essential, as it allows for the detection of subtle changes in brain connectivity patterns, which could provide early warnings of cognitive decline or symptom exacerbation, ultimately facilitating timely therapeutic interventions. This paper proposes a novel approach for detecting schizophrenia-related abnormalities using deep learning (DL) techniques applied to electroencephalogram (EEG) data. Using an openly available EEG dataset on schizophrenia, the focus is on preprocessed event-related potentials (ERPs) from key electrode sites and applied transfer entropy (TE) analysis to quantify the directional flow of information between brain regions. TE matrices were generated to capture neural connectivity patterns, which were then used as input for a hybrid DL model, combining convolutional neural networks (CNNs) and Bidirectional Long Short-Term Memory (BILSTM) networks. The model achieved a performant accuracy of 99.94% in classifying schizophrenia-related abnormalities, demonstrating its potential for real-time mental health monitoring. The generated TE matrices revealed significant differences in connectivity between the two groups, particularly in frontal and central brain regions, which are critical for cognitive processing. These findings were further validated by correlating the results with EEG data obtained from the Muse 2 headband, emphasizing the potential for portable, non-invasive monitoring of schizophrenia in real-world settings.

Eleonora Tudora : The rapidly expanding field of Big Data is a result of the data deluge generated by the rapid increase in the use of mobile devices and social media. It has provided tools to collect, store, manage, and analyze huge volumes of data (either structured, semi-structured or unstructured) produced by current healthcare systems. Big Data Analytics has started to play a crucial role in the evolution of healthcare practices and research, being now applied towards aiding the process of care delivery and disease exploration. Cloud computing enables all Big Data operations through the provision of large storage and processing power. This paper introduces all of these notions in the context of healthcare. It discusses the advantages, but also challenges brought by Big Data to this field. It also proposes a Big Data Architecture for healthcare. Finally, it presents some of the areas of application of Big Data to healthcare in Romania.

In the context of a fast aging population and of its increasing need for healthcare and assistance, ubiquitous usage of Internet of Things (IoT)-based smart applications can mitigate the consequential social burden. Connected sensors and devices inside the seniors' home produce a significant amount of data about them and their daily activities. IoT and Big Data Analytics (BDA) are an important mean to derive knowledge and support for improving the life conditions for the older adults by increasing the role of Information and Communication Technology (ICT) for accomplish this goal. IoT analytics can aid in personalizing applications that benefit both elderly people and the ever-growing industries that need adapt their offer to the consumer's profiles. This paper presents a new platform that enables innovative analytics on IoT captured data from smart residences of elderly people. A solution based on the use of fog …

Number of people 65+ is increasing all over the word, accompanied by illness, disability, vulnerability and dependence, thus potentially putting enormous stress on healthcare and long-term care costs. Creating an enabling environment that allows people with care needs to live at their homes as long as possible remains the main challenge of the long-term care system. Our paper presents RO-Smart Ageing system, an IoT-based system for remote monitoring of older people heath. Its functions and advantages for elderly are underlined.

Internet of Medical Things (IoMT) has already proved to support a proper evaluation of the medical status and living conditions of a patient by gathering a large variety of data. For a personalized health management of an older patient, IoMT provides the capacity for sustaining the transformation the patient-physician relationship by enabling a real-time and continuous remote monitoring of the health status, activities and well-being of the senior, especially in a residential environment. Thus, a new collaborative solution between the patient and the physician and the enhancement of their involvement and shared decision-making are provided. Health remote monitoring systems in smart environments are able to be a viable alternative to traditional healthcare solutions. The ongoing “Non-invasive monitoring and health assessment of the elderly in a smart environment (RO-Smart Ageing)” project aims to a complete and …

A. Muges Khann : Healthcare is one of the largest sector in India, telemedicine services is a component of healthcare that is evolving in recent days. This has drawn considerable interest to develop a smart and credible health care monitoring system that can be utilized by the front end health care professionals to monitor a patient’s health. This lead to the employment of

Internet of Things (IOT) in booming health care sector wherein remote monitoring of a patient's health can be facilitated. Hence we develop an IOT dependent health observing system that uses at mega 328 microcontroller, heartbeat, temperature and accelerometer sensor along with GSM module. The sensor's data is gathered and is then transferred to a could based server (Thing speak), Healthcare professionals can retrieve the patient's information from the server via an application. Further more our proposed model also uses Global System for Mobile (GSM) module to convey patient's information to parent's and doctors in case of any emergency. Hence this system improves the operating efficiency, lessons the time and cost of support.

S. Udaykumar Reddy : The health care checking system is one of the most crucial systems that became high-tech over history. In the contemporary world, it is very challenging to carry patients to hospitals for a regular checkup. People are facing an issue of sudden demise because of different types of diseases or viruses and also due to the absence of required treatment to the suffered victims on time. It is very difficult for the patients to stand in a queue for taking treatment. so 'this research intends to develop a novel framework to detect the patient's health parameters like temperature, oxygen levels in the blood, and pulse rate. We are developing this framework based on the IOT and things peak database. This proposed system provides a piece of information about the mental and emotional conditions of a victim. We are using Arduino and programmed with software (Arduino IDE). In this proposed work we are detecting the patient health parameters with their respective sensors. If any abnormal parameters are detected automatically LED will turn on indicating caution and also a SMS is sent to the victim's relatives or doctor by the GSM module. And also, the observed parameters are graphically seen in the things peak database. All the collected information regarding health is stored in the database. Thus, the proposed work based on the Internet of Things effectively monitors the patient health parameter status every second to second and saves the life of a patient by taking suitable steps when their health parameters are in an abnormal condition..

N. Sai Chaitanya : Nowadays, Health care is considered as an important aspect of our everyday lives. To address the emerging health-related challenges, this research work has utilized the advanced digital technologies to develop a health tracking analyzer. Recently, the use of mobile phones and other gadgets has increased unprecedentedly by creating a significant impact on the mobile health care. Mobile Health applications serve a large number of consumers. The main aim of this research work is to create a health tracking analyzer so that any patient or anybody who is concerned about their health may be readily tracked by their doctors or health care providers. This lot -based device aids in critical situations by avoiding illness transmission and providing health diagnoses even when the doctor is at a considerable distance away from the patient. Many people are receiving therapy for a variety of issues, including heart disease. The proposed model plays a vital role in checking and storing the healthcare-related data in server by using a Wi-Fi Module. Furthermore, the proposed device tracks the heartbeat and temperature by using the detectors and also a microcontroller is attached to the sensor. To frequently update the condition of patient's, the microcontroller is linked with LCD display and Wi-Fi to transfer the information to the database. By employing an inter connection, the pulse rate and temperature can also be analyzed. The gadget will exchange the readings from the sensor to the cloud and the information gathered will also remain accessible. The proposed database analyzes the received information and alerts the patient through buzzer.

3. Methodology

1. Project Consists of Temperature sensor, heartbeat sensor, MEMS sensor, and Glucose bottle level sensors to collect health metrics.
2. At mega 328 microcontroller to process data from Sensors .Wi-Fi module for transmitting data to the cloud. LCD display, Buzzer, and speaker for real-time feedback.
3. Program the sensors to collect real-time patient data, including vital signs such as temperature, heart rate, and Body Position via MEMS sensor.
4. Configure the Wi-Fi module to connect to the **Thing Speak Cloud** for data transmission.

- Create a Thing Speak channel to:
  - Store collected health data .
  - Visualize the data using real-time graphs and analytics.

5. Program the system to provide immediate alerts based on predefined health thresholds:
   a. Display alerts on the **LCD screen** for visual feedback.
   b. Use the **Buzzer** to deliver verbal warnings or alarms and **alert message** is message is displayed in LCD, ensuring instant awareness of critical condition.

CHAPTER 4

COMPONENTS REQUIREMENTS

ARDUINO

Arduino Uno is a microcontroller board based on the ATmega328P data sheet . It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

Specifications

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader

SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
LED_BUILTIN	13
Length	68.6 mm
Width	53.4 mm
Weight	25 g

PIEZO BUZZER

fig :piezo Buzzer

Piezoelectricity is the ability of some materials (notably crystals and certain ceramics, including bone) to generate an electric field or electric potential[1] in response to applied mechanical stress. The effect is closely related to a changeof polarization density within the material's volume. If the material is not short-circuited, the applied stress induces a voltage across the material. The word is derived from the Greek piezo or piezein, which means to squeeze or press.A buzzer or beeper is a signalling device, usually electronic, typically used in automobiles, household appliances such as microwave ovens, or game shows.

It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound.

Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise). Often these units were anchored to a wall or ceiling and used the ceiling or wall as a sounding board. Another implementation with some AC-connected devices was to implement a circuit to make the AC current into a noise loud enough to drive a loudspeaker and hook this circuit up to an 8-ohm speaker. Nowadays, it is more popular to use a ceramic-based piezoelectric sounder which makes a high-pitched tone. Usually these were hooked up to "driver" circuits which varied the pitch of the sound or pulsed the sound on and off.

Embedded C

An example of the limitations, function recursion is not allowed. This is due to the fact that the PIC has no stack to push variables onto, and also because of the way the compilers optimize the code. The compilers can efficiently implement normal C constructs, input/output operations, and bit twiddling operations. All normal C data types are supported along with pointers to constant arrays, fixed point decimal, and arrays of bits.

Introduction to Embedded C

Looking around, we find ourselves to be surrounded by various types of embedded systems. Be it a digital camera or a mobile phone or a washing machine, all of them has some kind of processor functioning inside it. Associated with each processor is the embedded software. If hardware forms the body of an embedded system, embedded processor acts as the brain, and embedded software forms its soul. It is the embedded software which primarily governs the functioning of embedded systems.

During infancy years of microprocessor based systems, programs were developed using assemblers and fused into the EPROMs. There used to be no mechanism to find what the program was doing. LEDs, switches, etc. were used to check correct execution of the program. Some 'very fortunate' developers had In-circuit Simulators (ICEs), but they were too costly and were not quite reliable as well.

As time progressed, use of microprocessor-specific assembly-only as the programming language reduced and embedded systems moved onto C as the embedded programming language of choice. C is the most widely used programming language for embedded processors/controllers. Assembly is also used but mainly to implement those portions of the code where very high timing accuracy, code size efficiency, etc. are prime requirements.

Initially C was developed by Kernighan and Ritchie to fit into the space of 8K and to write (portable) operating systems. Originally it was implemented on UNIX operating systems. As it was intended for operating systems development, it can manipulate memory addresses. Also, it allowed programmers to write very compact codes. This has given it the reputation as the language of choice for hackers too.

Embedded systems programming

Embedded systems programming is different from developing applications on a desktop computers. Key characteristics of an embedded system, when compared to PCs, are as follows:

- Embedded devices have resource constraints(limited ROM, limited RAM, limited stack space, less processing power)
- Components used in embedded system and PCs are different; embedded systems typically uses smaller, less power consuming components.
- Embedded systems are more tied to the hardware.

Features of Embedded Programming

- **Code Speed**

Code speed is governed by the processing power, timing constraints.

- **Code Size**

Whereas code size is governed by available program memory and use of programming language. Goal of embedded system programming is to get maximum features in minimum space and minimum time.

Embedded systems are programmed using different type of

Languages

- Machine Code.
- Low level language, i.e., assembly.
- High level language like C, C++, Java, Ada, etc.

- Application level language like Visual Basic, scripts, Access, etc.

Assembly language maps mnemonic words with the binary machine codes that the processor uses to code the instructions. Assembly language seems to be an obvious choice for programming embedded devices. However, use of assembly language is restricted to developing efficient codes in terms of size and speed. Also, assembly codes lead to higher software development costs and code portability is not there. Developing small codes are not much of a problem, but large programs/projects become increasingly difficult to manage in assembly language. Finding good assembly programmers has also become difficult nowadays. Hence high level languages are preferred for embedded systems programming.

Use of C in embedded systems is driven by following advantages

- It is small and reasonably simpler to learn, understand, program and debug.
- C Compilers are available for almost all embedded devices in use today, and there is a large pool of experienced C programmers.
- Unlike assembly, C has advantage of processor-independence and is not specific to any particular microprocessor/ microcontroller or any system. This makes it convenient for a user to develop programs that can run on most of the systems.
- As C combines functionality of assembly language and features of high level languages, C is treated as a ‘middle-level computer language’ or ‘high level assembly language’
- It is fairly efficient.

Many of these advantages are offered by other languages also, but what sets C apart from others like Pascal, FORTRAN, etc. is the fact that it is a middle level language; it provides direct hardware control without sacrificing benefits of high level languages. Compared to other high level languages, C offers more flexibility because C is relatively small, structured language; it supports low-level bit-wise data manipulation.

Compared to assembly language, C Code written is more reliable and scalable, more portable between different platforms (with some changes). Moreover, programs developed in C are much easier to understand, maintain and debug. Also, as they can be developed more quickly, codes written in C offers better productivity. C is based on the philosophy ‘programmers know what they are doing’; only the intentions are to be stated explicitly. It is easier to write good code in C & convert it to an efficient assembly code (using high quality compilers) rather than writing an efficient code in assembly itself. Benefits of assembly language programming over C are negligible when we compare the ease with which C programs are developed by programmers.

Difference between C and Embedded C

Though C and embedded C appear different and are used in different contexts, they have more similarities than the differences. Most of the constructs are same; the difference lies in their applications. C is used for desktop computers, while embedded C is for microcontroller based applications. Accordingly, C has the luxury to use resources of a desktop PC like memory, OS, etc.

While programming on desktop systems, we need not bother about memory. However, embedded C has to use with the limited resources (RAM, ROM, I/Os) on an embedded processor. Thus, program code must fit into the available program memory. If code exceeds the limit, the system is likely to crash.

Compilers for C (ANSI C) typically generate OS dependent executable. Embedded C requires compilers to create files to be downloaded to the microcontrollers/microprocessors where it needs to run. Embedded compilers give access to all resources which is not provided in compilers for desktop computer applications. Embedded systems often have the real-time constraints, which is usually not there with desktop computer applications. Embedded systems often do not have a console, which is available in case of desktop applications.

So, what basically is different while programming with embedded C is the mindset; for embedded applications, we need to optimally use the resources, make the program code efficient, and satisfy real time constraints, if any. All this is done using the basic constructs, syntaxes.

EMBEDDED C

WHY EMBEDDED C?

The C programming language is a popular and widely used programming language for creating computer programs. Programmers around the world Embrace C because it gives maximum control and efficiency to the programmer. And most of the time its not easy to build an application in assembly language which instead you can make easily in C. So its important that you know C language for ARM controller which is commonly known as Embedded C. As we use Kiel c51. Embedded C is designed for programmers with desktop experience in C,C++ or Java who want to learn the skills required for the unique challenges of embedded systems. If you are a programmer, or if you are interested in becoming a programmer, there are a couple of benefits you gain from learning C.

When designing software for a smaller embedded system with the LPC2148, it is very common place to develop the entire product using assembly code. With many projects, this is a feasible approach since the amount of code that must be generated is typically less than 8 kilobytes and is relatively simple in nature. If a hardware engineer is tasked with designing both the hardware and the software, he or she will frequently be tempted to write the software in assembly language. The trouble with projects done with assembly code can be difficult to read and maintain, especially if they are not well commented. Additionally, the amount of code reusable from a typical assembly language project is usually very low. Use of a higher-level language like C can directly address these issues.

A program written in C is easier to read than an assembly program. Since a C program possesses greater structure, it is easier to understand and maintain. Because of its modularity, a C program can better lend itself to reuse of code from project to project. The division of code into functions will force better structure of the software and lead to functions that can be taken from one project and used in another, thus reducing overall development time. A high order language such as C allows a developer to write code, which resembles a human's thought process more closely than does the equivalent assembly code. The developer can focus more time on designing the algorithms of the system rather than having to concentrate on their individual implementation. This will greatly reduce development time and debugging time since the code is more understandable. By using a language like C, the programmer does not have to be intimately familiar with the architecture of the target processor.

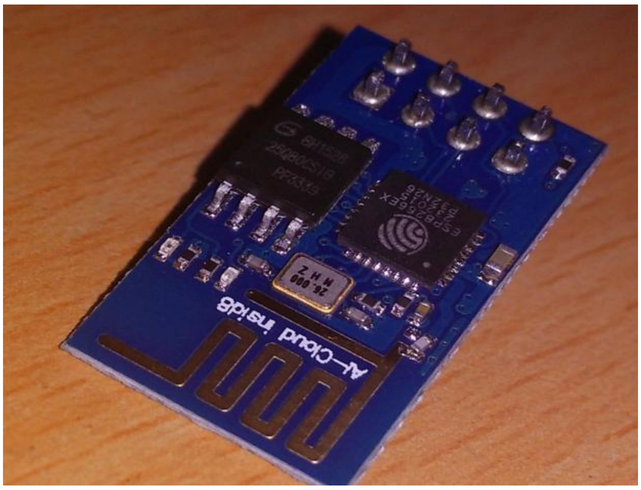
characteristics

- **Register Definitions, Initialization and Startup Code – C is a** high level programming language that is portable across many hardware architectures. This means that architecture specific features such as register definitions, initialization and startup code must be made available to your program via the use of libraries and include files. .

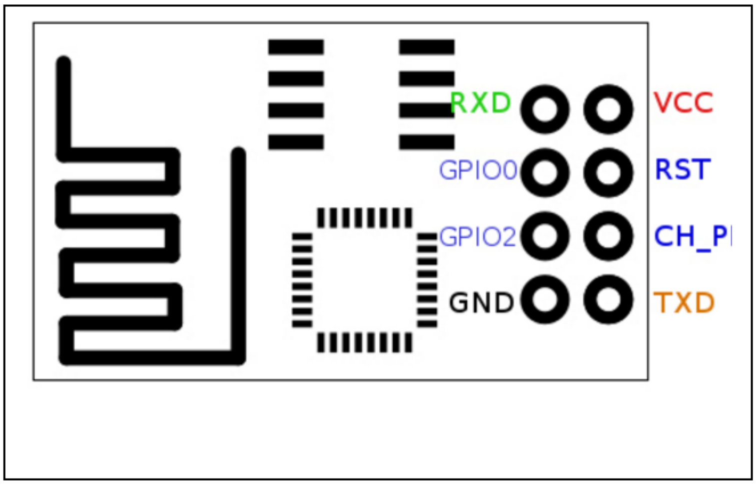
- **Basic C program structure –** all the programs you will write will have this basic structure. All variables must be declared at the start of a code block, you cannot declare variables among the program statements.
- **Programming memory models** The keil C compiler has two main C programming memory models, SMALL and LARGE which are related to this two types of memory. In the SMALL memory model the default storage location is the bytes of internal memory while in the LARGE memory model the default storage location is the externally addressed memory.
- **Special function registers –**. The value in the declaration specifies the memory location of the register: Extensions of the LPC2148 often have the low byte of a bit register preceding the high byte. In this scenario it is possible to declare a bit special function register, SFR , giving the addresses of the low byte: the memory location of the register used in the declaration must be a constant rather that a variable are expression.
- **Memory model used for a function –** The memory model used for a function can override the default memory model with the use of the small, compact are large keywords.

ESP8266

ESP8266 is a UART to WiFi module which provides an easy way to connect any small Microcontroller platform like Arduino/PIC/8051/ARM/RENESAS to Internet wirelessly. Since ESP8266 super cheap, and super easy to work with it become one of the leading platforms for the Internet of Things. You can use AT commands to connect to WiFi networks and open TCP connections without running TCP/IP stack. It also includes 32Bit Microcontroller which can be programmed to act as a standalone WiFi connected Embedded Platform.



so far there are different variants of ESP-x modules are available, Where x can be 1 to 1.We are going to use the ESP-1 module with the new firmware which is set at 115200 baud.



ESP8266 requires 3.3v device, it can't tolerate 5V so do not power it with 5Volts. We have to make sure that CH_PD pin is pulled up, the module will not give any response until you make this connection. This can be done either directly connecting CH_PD to VCC or you can also use the 3.3K resistance to pull up. The current rating of this Module is 80mA in idle and 300mA during operation.

Here we are using USB to TTL converter for connecting the Module with the PC. The 3.3V output of the converter is used to power the module.

The connection details are as below:

WIFI Module	USB-TTL
Vcc	3.3v
Gnd	Gnd
TX	RX
RX	TX
CH_PD	Connected to 3.3v to enable chip firmware boot

Don’t forget to pull up CH_PD HIGH, you won’t get a response from the module if it is not done.

You can also use Arduino UNO by uploading empty setup() and loop() functions, if you don’t have a USB-TTL converter.

Type in AT and press Enter. If you do not get any response, Reset the module by momentarily connecting the RST pin to GND and close the Serial window & again open it. Now type in AT and press Enter. The module will respond with OK.

To know the current mode of operation you can use AT+CWMODE?

CWMODE returns an integer which corresponds the mode of operation.

1 - Station mode (client)

2 - AP mode (host)

3 - AP + Station mode (Dual mode)

To get the list of available WiFi access points you can use the command AT+CWLAP.

The Access Points are listed in the format which consists four parameters

+CWLAP: ecn, ssid, rssi, mac

The Parameter are

ecn: It is a number denoting the security of the Access point

0 - OPEN

1- WEP

2 - WPA_PSK

3 - WPA2_PSK

4 - WPA_WPA2_PSK

ssid: Denotes the SSID name of the Access point.

mac: It gives the MAC Address in a String value.

rssi: Gives the numerical value of the Signal Strength.

Use the command AT+CWMODE=1 to configure the module as STA or WiFi client that will connect to the router or Access Point. The module should be restarted to activate this selection.

AT+CWJAP="yourSSID","yourWifiPassword"

This command is used to connect to your Access point, change your SSID and Password.

ESP module has the special property to remember the joined AP and it will reconnect to it after every successful Boot. AT+CWQAP command can be used to forget it.

To know the IP address of the module after the successful connection, use the command AT+CIFSR it will give the IP address

<u>AT commands to send data from controller to wifi</u>

AT

AT+GMR

AT+CWMODE=3

AT+CWQAP

AT+RST

AT+CIPMUX=1

AT+CWJAP=_”wifi_username”,”wifi_password”_

AT+CIFSR

AT+CIPSTART=4,"TCP","45.56.78.84",8080

AT+CIPSEND=4,82

//GET /def/deforest/getTemp?field1=245&field2=382.00&field3=382.00&field4=382.00

AT+CIPCLOSE=0

Working Explanation:

First of all we need to connect our Wi-Fi module to Wi-Fi router for network connectivity. Then we will Configure the local server, Send the data to Web and finally Close the connection. This process and commands have been explained in below steps:

1. First we need to test the Wi-Fi module by sending *AT* command, it will revert back a response containing *OK*.

2. After this, we need to select mode using command *AT+CWMODE=mode_id* , we have used Mode id =3. Mode ids:

1 =Station mode(client)
2 =AP mode(host)
3 = AP + Station mode (Yes, ESP8266 has a dual mode!)

3. Now we need to disconnect our Wi-Fi module from the previously connected Wi-Fi network, by using the command *AT+CWQAP,* as ESP8266 is default auto connected with any previously available Wi-Fi network

4. After that, user can Reset the module with *AT+RST* command. This step is optional.

5. Now we need to connect ESP8266 to Wi-Fi router using given command

AT+CWJAP=”wifi_username”,”wifi_password”

6. Now get IP Address by using given command:

AT+CIFSR

It will return an IP Address.

7. Now enable the multiplex mode by using *AT+CIPMUX=1* (1 for multiple connection and 0 for single connection)

8. Now configure ESP8266 as server by using *AT+CIPSERVER=1,port_no* (port may be 80). Now your Wi-Fi is ready. Here '1' is used to create the server and '0' to delete the server.

9. Now by using given command user can send data to local created server:

AT+CIPSEND =id, length of data

Id = ID no. of transmit connection

Length = Max length of data is 2 kb

10. After sending ID and Length to the server, we need to send data like

11. After sending data we need close the connection by given command:

AT+CIPCLOSE=0

Now data has been transmitted to local server.

12. Now type IP Address in Address Bar in web browser and hit enter. Now user can see transmitted data on webpage.

HEART BEAT SENSOR

Heartbeat sensor provides a simple way to study the function of the heart which can be measured based on the principle of psycho-physiological signal used as a stimulus for the virtual- reality system. The amount of the blood in the finger changes with respect to time.

The Sensor is Based IR moulded in silicon , So Once the Finger is inserted Heart Beat will not miss t. In order to calculate the heart rate based on the blood flow to the fingertip, a heart-rate sensor is assembled with the help of OP-AMP for monitoring the heartbeat pulses.

Input Voltage - 5 Volts / Digital Output

Initialization:

The LCD can be configured in 4-bit mode by sending appropriate instruction which is called "Function set" to it. The Function set is hexadecimal instruction for LCD MPU unit, which selects working modes of LCD. The "Function Set" is mentioned in following table:

Instruction	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Function Set	0	0	0	0	1	DL	N	F	-	-

Description:

DL - Data Length (DL = 1 8bit, DL = 0 4bit)

N - No. of Lines (N = 1 2Lines, N = 0 1Lines)

F - Fonts (F = 1 5x10 dots, F = 0 5x7 dots)

According to table, the value of Function Set for 4 –bit mode will be 0010 0000(0x20) because DL=0. The value "Function Set" for the LCD configuration 2 line (N=1), 5X7 dots (F=0) and 4-bit (DL=0) mode will be 0010 1000(0x28).

When the power supply is given to LCD, it remains in 8-bit mode. Now, if 0x20 is sent, lower nibble will not be received by LCD because four data lines (D4-D7) are connected, so 0x02 is sent instead of 0x20.

Programming Steps:

Step1: Initialization of 4-bit mode.

void lcd_init() // fuction for intialize

{

LCD_cmd(0x02); // to initialize LCD in 4-bit mode.

LCD_cmd(0x28); //to initialize LCD in 2 lines, 5X7 dots and 4bit mode.

}

5 2 x 16 PARALLEL LCD

The 2 X16 Parallel LCD is an 8 bit or 4 bit parallel interfaced LCD. This unit allows the user to display text, numerical data and custom created characters. The LCD uses the HD44780 series LCD driver from Hitachi, or equivalent controller. The LCD is connected to a female 14-pin connector for easy interface with the BS2p24/40 Demo Board (#45187) and the Professional Development Board (#28138).Many manufacturers of displays integrated the controller with their product making it the informal standard for this type of displays.[1] The device can display ASCII characters, JapaneseKana characters, and some symbols in two 28 character lines. Using an extension driver, the device can display up to 80 characters

Though the device has the ribbon cable and 14-pin connector it may also be hooked up manually.

TECHNICAL SPECIFICATIONS

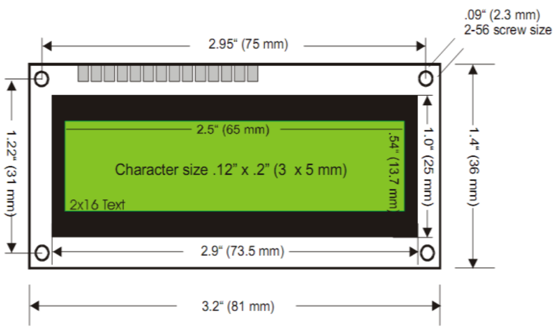


Fig 3.10 : Specifications of 16 x 2 LCD.

FEATURES

- 5× 8 and 5 × 10 dot matrix possible .
- Low power operation support 2.7 to 5.5V .
- Wide range of liquid crystal display driver power .
- Liquid crystal drive waveform .
- A (One line frequency AC waveform).
- Correspond to high speed MPU bus interface.
- 4-bit or 8-bit MPU interface enabled.
- 80 × 8-bit display RAM (80 characters max.) .
- Automatic reset circuit that initializes the controller/driver after power on.
- Internal oscillator with external resistors.
- Low power consumption.

GENERAL EXPLANATION

We have to prepare an LCD properly before the character we need, has to be displayed. For this a number of commands have to be provided to the LCD before inputting the required data.

RS- Register Select

There are 2 very important registers in LCD

- Command Code register
- Data Register

If RS=0 $\longrightarrow$ Instruction command Code register is selected, allowing user to send command

RS=1 $\longrightarrow$ Data register is selected allowing to send data that has to be displayed.

R\W- Read\Write

R\W input allows the user to write information to LCD or read information from it. How do we read data from LCD????? The data that is being currently displayed will be stored in a buffer memory DDRAM. This data could be read if necessary.

If R\W=1 → Reading

R\W=0 → Writing

E- Enable

The enable Pin is used by the LCD to latch information at its data pins. When data is supplied to data pins, a high to low pulse must be applied to this pin in order for the LCD to latch the data present in the data pins.

E Toggle.

Data Bus- D0-D7 .

VDD-Power 5V .

Vss- GND .

VEE- LCD Contrast Adjustment .

LCD [Liquid Crystal Display]

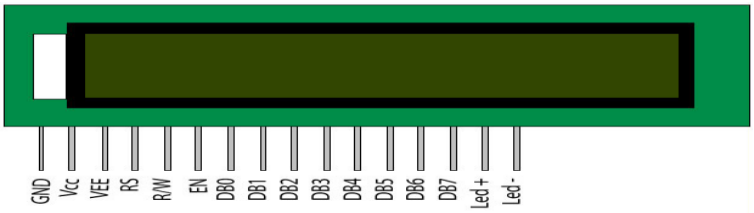
LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

16*2 LCD

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

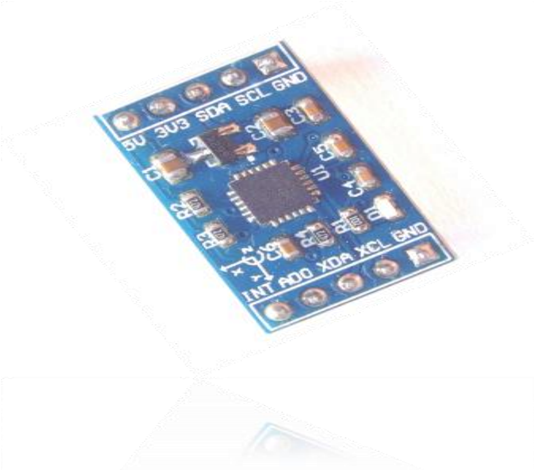
Pin Diagram:



Pin Description

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

Triple Axis Accelerometer/MEMS Sensor



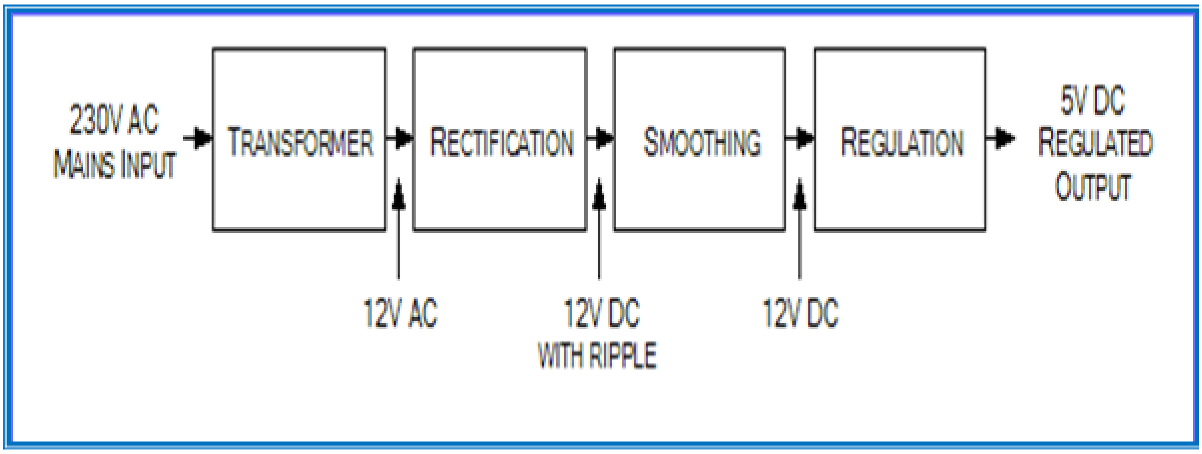
Triple Axis Accelerometer and Gyro Breakout - MPU-6050

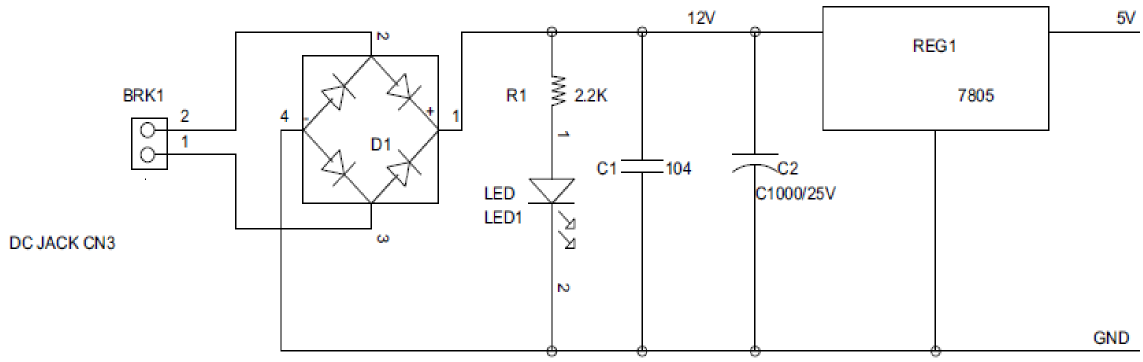
Description: The MPU-6050 is a serious little piece of motion processing tech! By combining a MEMS 3-axis gyroscope and a 3-axis accelerometer on the same silicon die together with an onboard Digital Motion Processor™ (DMP™) capable of processing complex 9-axis Motion Fusion algorithms, the MPU-6050 does away with the cross-axis alignment problems that can creep up on discrete parts.

- On-board MPU - 6050 integrated 6 axis motion processing chip
- On-board LDO chip, support 5 V / 3.3 V voltage input
- Commonly used pin have eduction, pin for the standard 2.54 mm
- Module support IIC standard communication protocol, with 16 bit AD converter, 16 bits of data output
- Users can control program of the accelerator full grid sensor in the range of 2 g 4 g 8 g and 16 g
- Angular velocity full case sensing range for 250 500 1000 and 2000 / SEC (DPS
- PCB size: 22.1 (mm) x13.6 (mm)

POWER SUPPLY UNIT

A power supply is a device or system that supplies electrical or other types of energy to an output load or group of loads. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.



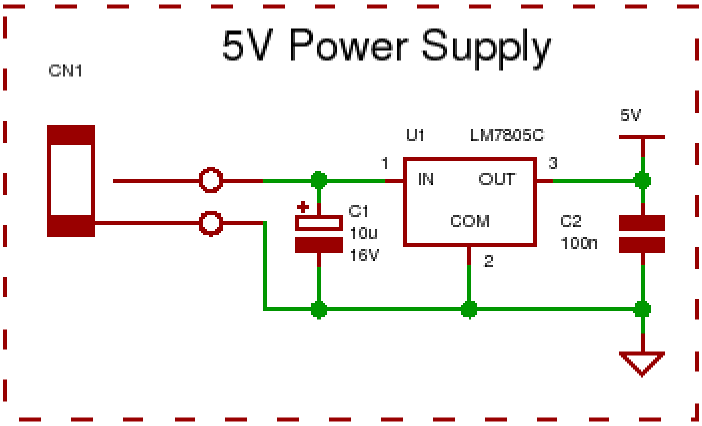


Power supply unit consists of following units

1. Step down transformer
2. Rectifier unit
3. Input filter
4. Regulator unit
5. Output filter

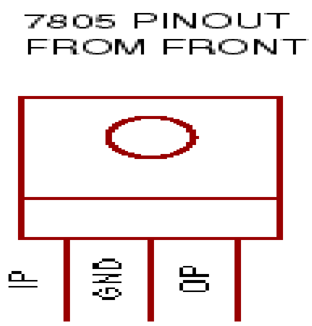
Microcontroller Power Supply

If you don't have a power supply then you should use the following standard circuit. All you will need is a wall power supply block with dc output (greater than 8V and no more than 35V) or a 9V battery to plug into CN1.



Note: It is best to use the 5V power supply circuit as it not only correctly regulates the dc voltage but it protects your PIC chip. The input voltage can go up to 35V without damaging the 7805.

You would not want to use that high voltage for very long if using reasonable current as the 7805 would have to get rid of the excess power as heat. Say you used 100mA dropping 35V to 5V gives P=VxI = 30 *0.1 = 3W - a huge power output - the 7805 would get very hot and go into thermal shutdown!



7805 is a voltage regulator integrated circuit. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The voltage regulator IC maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide.

7805 provides +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels.

PINS OF 7805 IC

Pin No	Function	Name
1	Input voltage (5V-18V)	Input
2	Ground (0V)	Ground
3	Regulated output; 5V (4.8V-5.2V)	Output

Simple 5V power supply for digital circuits

- Brief description of operation: Gives out well regulated +5V output, output current capability of 100 mA
- Circuit protection: Built-in overheating protection shuts down output when regulator IC gets too hot
- Circuit complexity: Very simple and easy to build
- Circuit performance: Very stable +5V output voltage, reliable operation
- Availability of components: Easy to get, uses only very common basic components
- Design testing: Based on datasheet example circuit, I have used this circuit successfully as part of many electronics projects
- Applications: Part of electronics devices, small laboratory power supply
- Power supply voltage: Unregulated DC 8-18V power supply
- Power supply current: Needed output c

Rectifier

A **rectifier** is a circuit which converts AC to DC. It is made up of diodes. There are three types of rectifier circuit half wave, full wave and bridge rectifier. A rectifier is generally followed by a filter circuit to improve the quality of output. Rectifiers play an important part of the power supplies for electronic appliances operating at DC voltages. The half wave rectifier uses only one diode whereas the full wave and bridge uses two and four diodes respectively.

Insight - How Diode Works

This component needs no introduction. One of the first semiconductor based engineering components, diodes are an indispensible necessity for any current modern gadget or circuit. They are the basic logic block – the most fundamental unit.

These two terminal-ed nonlinear passive elements ideally conduct only one way and hence protect the circuit as well as the source from any damage. Diodes are widely used in rectifier circuits, limiters, communication circuits, multiplier circuits and signal clippers as well as clamper circuits. This Insight will give an in depth view of a diode's physicality.

Outer Structure

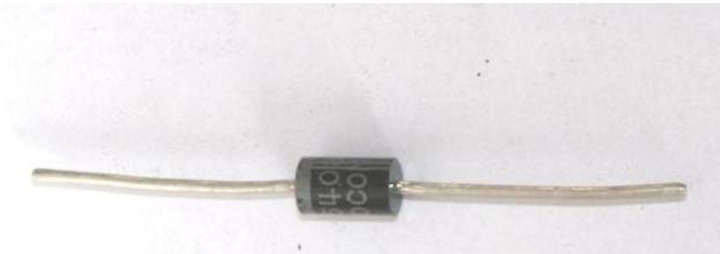


Image01

The diode that is explored in this Insight is IN4007, which is a type of power diode. The core of the diode is enclosed in an epoxy that protects the semiconductor from ambient adversities. This epoxy molding is black colored, marked with the diode number on the center and a silver colored band at one end – the band labeling that end to be the diode's cathode. Connected to the epoxy at both the ends are two electroplated leads. These leads are able to withstand high temperatures and provide good soldering properties.

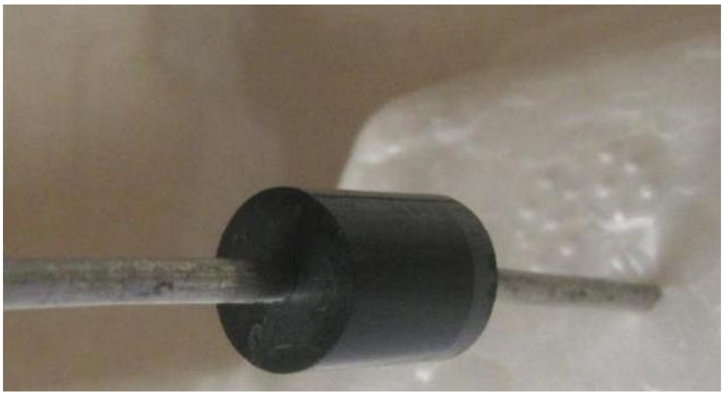


Image02

It can be noticed that the manner in which connecting leads are placed inside the epoxy is interesting and shows precision in the manufacturing process. The leads are 0.048 to 0.052 inches thick and fit in the center of the 0.190 to 0.210 inches thick shell.

Soldering Iron and Soldering wire

Soldering Iron:

A soldering iron is a hand tool used in soldering. It supplies heat to melt the solder so that it can flow into the joint between two work pieces. A soldering iron is composed of a heated metal tip and an insulated handle. Heating is often achieved electrically, by passing an electric current (supplied through an electrical cord or battery cables) through a resistive heating element. Cordless irons can be heated by combustion of gas stored in a small tank, often using a catalytic heater rather than a flame. Simple irons less commonly used than in the past were simply a large copper bit on a handle, heated in a flame.

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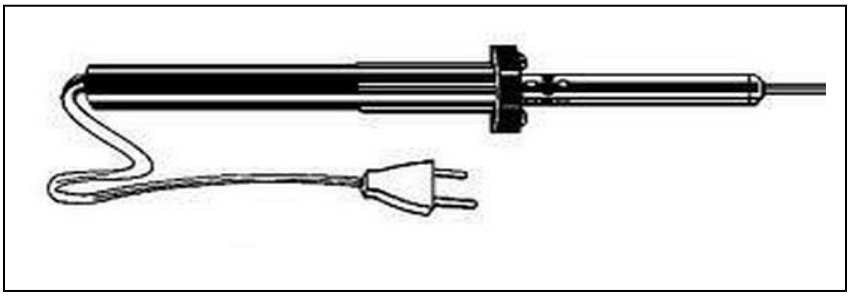


Fig: - 2.5. Soldering Iron

Soldering Wire:

Solder is basically metal wire with a "low" melting point, where low for our purposes means low enough to be melted with a soldering iron. For electronics, it is traditionally a mix of tin and lead. Lead has a lower melting point than tin, so more lead means a lower melting point. Most common lead-based solder you'll find at the gadget store will be 60Sn/40Pb (for 60% tin, 40% lead). There are some other minor variations you're likely to see, such as 63Sn/37Pb. Now, molten metal is a tricky beast, because it behaves a bit like water: Of particular interest is its surface tension. Molten metal will ball up if it doesn't find something to "stick" to.

That's why solder masks work to keep jumpers from forming, and why you see surface-mount soldering tricks. In general, metal likes to stick to metal, but doesn't like to stick to oils or oxidized metals. By simply being exposed to air, our parts and boards start to oxidize, and through handling they get exposed to grime (such as oils from our skin). The solution to this is to clean the parts and boards first. That's where flux cores come in to solder. Flux cores melt at a lower temperature than the solder, and coat the area to be soldered. The flux cleans the surfaces, and if they're not too dirty the flux is sufficient to make a good strong solder joint (makes it "sticky" enough).

Fig: - Soldering Wire

The above discussed elements are used to design the display board. After designing the display board we need to design the circuit having the shift registers and the decade counter in order to reduce the pins used in microcontroller and to create the moving effect. Now this time we will discuss the elements which are used to design this circuit.

Breakaway Headers and jumper wires

We used the breakaway headers to connect the circuit board with the microcontroller; the main aim of using this is to make our circuit free from any permanent connection. These are the pointed metallic pin like structure which is connected with each other by the means of the plastic and in a single strip we can have 40 headers.

Fig : Jumping Wire And Breakaway

CHAPTER 5

BRIEF DESCRIPTION OF OTHER COMPONENT

1. RESISTOR

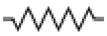
Resistor

Three resistors

Type Passive

Electronic symbol

 (Europe)

 (US)

A resistor is a two-terminal electronic component that produces a voltage across its terminals that is proportional to the electric current through it in accordance with Ohm's law:

$V = IR$

Resistors are elements of electrical networks and electronic circuits and are ubiquitous in most electronic equipment. Practical resistors can be made of various compounds and films, as well as resistance wire (wire made of a high-resistivity alloy, such as nickel/chrome).The primary characteristics of a resistor are the resistance, the tolerance, maximum working voltage and the power rating. Other characteristics include temperature coefficient, noise, and inductance. Less well-known is critical resistance, the value below which power dissipation limits the maximum permitted current flow, and above which the limit is applied voltage. Critical resistance depends upon the materials constituting the resistor as well as its physical dimensions; it's determined by design.Resistors can be integrated into hybrid and printed circuits, as well as integrated circuits. Size, and position of leads (or terminals) are relevant to equipment designers; resistors must be physically large enough not to overheat when dissipating their power.

2. CAPACITOR

Content

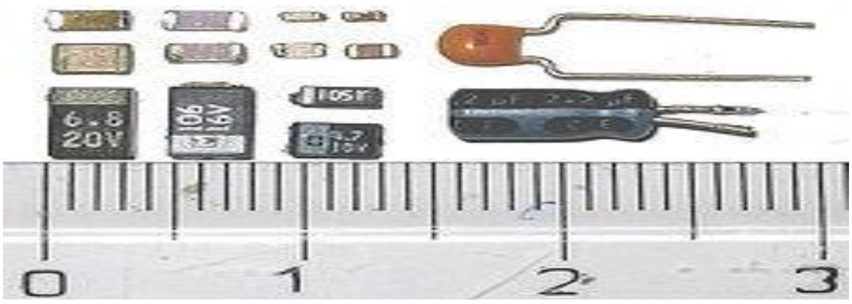
*Capacitor

*capacitance

*Energy stored in capacitor

* Discharge of Capacitor

Capacitor



Modern capacitors, by a cm rule.

Type Passive

Invented Ewald Georg von Kleist (October 1745)

Electronic symbol

A capacitor or condenser is a passive electronic component consisting of a pair of conductors separated by a dielectric. When a voltage potential difference exists between the conductors, an electric field is present in the dielectric. This field stores energy and produces a mechanical force between the plates. The effect is greatest between wide, flat, parallel, narrowly separated conductors.

An ideal capacitor is characterized by a single constant value, capacitance, which is measured in farads. This is the ratio of the electric charge on each conductor to the potential difference between them. In practice, the dielectric between the plates passes a small amount of leakage current. The conductors and leads introduce an equivalent series resistance and the dielectric has an electric field strength limit resulting in a breakdown voltage.

Capacitors are widely used in electronic circuits to block the flow of direct current while allowing alternating current to pass, to filter out interference, to smooth the output of power supplies, and for many other purposes. They are used in resonant circuits in radio frequency equipment to select particular frequencies from a signal with many frequencies.

(1)Ceramic capacitor

In electronics ceramic capacitor is a capacitor constructed of alternating layers of metal and ceramic, with the ceramic material acting as the dielectric. The temperature coefficient depends on whether the dielectric is Class 1 or Class 2. A ceramic capacitor (especially the class 2) often has high dissipation factor, high frequency coefficient of dissipation.

ceramic capacitors

A ceramic capacitor is a two-terminal, non-polar device. The classical ceramic capacitor is the "disc capacitor". This device pre-dates the transistor and was used extensively in vacuum-tube equipment (e.g., radio receivers) from about 1930 through the 1950s, and in discrete transistor equipment from the 1950s through the 1980s. As of 2007, ceramic disc capacitors are in widespread use in electronic equipment, providing high capacity & small size at low price compared to other low value capacitor types.

Ceramic capacitors come in various shapes and styles, including:

- disc, resin coated, with through-hole leads
- multilayer rectangular block, surface mount
- bare leadless disc, sits in a slot in the PCB and is soldered in place, used for UHF applications
- tube shape, not popular now

(2) Electrolytic capacitor

Axial lead (top) and radial lead (bottom) electrolytic capacitors .An electrolytic capacitor is a type of capacitor that uses an ionic conducting liquid as one of its plates with a larger capacitance per unit volume than other types. They are valuable in relatively high-current and low-frequency electrical circuits. This is especially the case in power-supply filters, where they store charge needed to moderate output voltage and current fluctuations in rectifier output. They are also widely used as coupling capacitors in circuits where AC should be conducted but DC should not.Electrolytic capacitors can have a very high capacitance, allowing filters made with them to have very low corner frequencies.

Transistor

A transistor is a semiconductor device commonly used to amplify or switch electronic signals. A transistor is made of a solid piece of a semiconductor material, with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals changes the current flowing through another pair of terminals. Because the controlled (output) power can be much more than the controlling (input) power, the transistor provides amplification of a signal. Some transistors are packaged individually but most are found in integrated circuits.

The transistor is the fundamental building block of modern electronic devices, and its presence is ubiquitous in modern electronic systems.

Usage

clock analog circuits, voltage regulators, amplifiers, power transmitters, motor drivers, etc. The bipolar junction transistor, or BJT, was the most commonly used transistor in the 1960s and 70s. Even after MOSFETs became widely available, the BJT remained the transistor of choice for many analog circuits such as simple amplifiers because of their greater linearity and ease of manufacture. Desirable properties of MOSFETs, such as their utility in low-power devices, usually in the CMOS configuration, allowed them to capture nearly all market share for digital circuits; more recently MOSFETs have captured most analog and power applications as well, including modern **Advantages**

The key advantages that have allowed transistors to replace their vacuum tube predecessors in most applications are

- Small size and minimal weight, allowing the development of miniaturized electronic devices.
- Highly automated manufacturing processes, resulting in low per-unit cost.
- Lower possible operating voltages, making transistors suitable for small, battery-powered applications.
- No warm-up period for cathode heaters required after power application.
- Lower power dissipation and generally greater energy efficiency.
- Higher reliability and greater physical ruggedness.
- Extremely long life. Some transistorized devices have been in service for more than 30 years.

- Complementary devices available, facilitating the design of complementary-symmetry circuits, something not possible with vacuum tubes.
- Insensitivity to mechanical shock and vibration, thus avoiding the problem of microphonics in audio applications.

Limitations

- Silicon transistors do not operate at voltages higher than about 1,000 volts (SiC devices can be operated as high as 3,000 volts). In contrast, electron tubes have been developed that can be operated at tens of thousands of volts.
- High power, high frequency operation, such as used in over-the-air television broadcasting, is better achieved in electron tubes due to improved electron mobility in a vacuum.
- On average, a higher degree of amplification linearity can be achieved in electron tubes as compared to equivalent solid state devices, a characteristic that may be important in high fidelity audio reproduction.
- Silicon transistors are much more sensitive than electron tubes to an electromagnetic pulse, such as generated by an atmospheric nuclear explosion.

Bipolar junction transistor

The bipolar junction transistor (BJT) was the first type of transistor to be mass-produced. Bipolar transistors are so named because they conduct by using both majority and minority carriers. The three terminals of the BJT are named emitter, base, and collector.

The BJT consists of two p-n junctions: the base–emitter junction and the base–collector junction, separated by a thin region of semiconductor known as the base region (two junction diodes wired together without sharing an intervening semiconducting region will not make a transistor).

"The [BJT] is useful in amplifiers because the currents at the emitter and collector are controllable by the relatively small base current”. In an NPN transistor operating in the active region, the emitter-base junction is forward biased (electrons and holes recombine at the junction), and electrons are injected into the base region.

Because the base is narrow, most of these electrons will diffuse into the reverse-biased (electrons and holes are formed at, and move away from the junction) base-collector junction and be swept into the collector; perhaps one-hundredth of the electrons will recombine in the base, which is the dominant mechanism in the base current. By controlling the number of electrons that can leave the base, the number of electrons entering the collector can be controlled.

Collector current is approximately β (common-emitter current gain) times the base current. It is typically greater than 100 for small-signal transistors but can be smaller in transistors designed for high-power applications.

Unlike the FET, the BJT is a low–input-impedance device. Also, as the base–emitter voltage (V_{be}) is increased the base–emitter current and hence the collector–emitter current (I_{ce}) increase exponentially according to the Shockley diode model and the Ebers-Moll model. Because of this exponential relationship, the BJT has a higher transconductance than the FET.

Bipolar transistors can be made to conduct by exposure to light, since absorption of photons in the base region generates a photocurrent that acts as a base current; the collector current is approximately β times the photocurrent. Devices designed for this purpose have a transparent window in the package and are called phototransistors.

CHAPTER 6

OUTCOME

1. The system will enable continuous, real-time tracking of vital health metrics such as temperature, heart rate, and body position, providing valuable insights into a patient's condition.
2. The integration of LCD displays and alerts will ensure that patients and caregivers receive instant notifications of critical health conditions, enabling prompt intervention.
3. Health data will be securely stored in the Thing Speak Cloud, providing easy access for remote monitoring and real-time data visualization.
4. The system is designed to be both affordable and scalable, making it suitable for individual home healthcare as well as clinical environments with multiple devices.
5. By automating health monitoring and providing real-time alerts, the system will improve the efficiency of healthcare delivery, reducing the burden on healthcare professionals.
6. The system will contribute to improved patient care by enabling continuous monitoring and early detection of health anomalies, leading to timely interventions and better health outcomes.

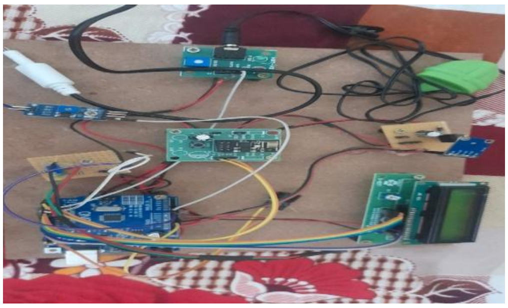


Fig. Circuit diagram

CHAPTER 7

REFERENCES

Several studies and articles have highlighted the importance of IoT in transforming healthcare systems for remote patient monitoring. According to **Gubbi et al. (2013)**, IoT enables the integration of smart devices and cloud computing to create an intelligent healthcare environment that supports continuous data collection and analysis. Similarly, **Islam et al. (2015)** emphasized that IoT-based healthcare frameworks significantly enhance the quality of medical services by providing real-time health status updates to physicians.

Research by **Kodali and Sarika (2018)** demonstrated how wearable sensors and IoT platforms allow for accurate tracking of patient vitals such as heart rate, blood pressure, and glucose levels, leading to timely medical interventions. Additionally, **Sundaravadivel et al. (2018)** discussed how IoT-driven systems improve chronic disease management through efficient data transmission and remote diagnosis, particularly in rural and underdeveloped areas.

In another study, **Almotiri, Khan, and Alghamdi (2016)** explored the role of cloud-based IoT systems in improving data accessibility and scalability within healthcare environments. Their research showed that IoT-based remote monitoring not only improves patient care but also reduces hospital admissions and healthcare costs. Furthermore, **Akhter and Sofi (2019)** highlighted the importance of security and privacy in IoT healthcare applications, ensuring that sensitive patient data remains protected.

The work of **Bashir et al. (2020)** discussed the integration of artificial intelligence with IoT healthcare systems to enhance predictive analysis and early disease detection. This combination has paved the way for intelligent and personalized medical solutions. Moreover, **Rajput et al. (2021)** described how IoT in healthcare promotes interoperability and seamless communication between different medical devices and systems.

Overall, previous research strongly supports the implementation of IoT-driven healthcare systems as asustainable and effective approach to remote patient monitoring. These studies collectively demonstrate that IoT not only improves patient outcomes and clinical efficiency but also contributes to the evolution of smart healthcare technologies for the future.

CHAPTER 8

CONCLUSION

The Medicare Health System using IoT provides an efficient and scalable solution for real-time health monitoring. By leveraging sensors and cloud integration, it ensures continuous tracking of vital health metrics, offering immediate feedback to users and healthcare providers. The system's use of IoT technology makes it cost-effective and adaptable for both personal and clinical applications. While the current system offers valuable health insights, future improvements could focus on enhancing data security and expanding sensor capabilities. The integration of real-time alerts further enhances patient care by enabling timely interventions. Ultimately, Medicare demonstrates the potential of IoT in revolutionizing healthcare monitoring. The Internet of Things (IoT) has revolutionized the healthcare industry by enabling continuous and remote monitoring of patients. Through interconnected devices and smart sensors, healthcare professionals can collect real-time data about patients' vital signs, activities, and health conditions without requiring them to be physically present in hospitals. This technological advancement ensures that patients receive personalized and timely care.

Moreover, IoT-driven healthcare systems enhance efficiency and reduce the workload of medical staff. Automated data collection and analysis minimize human error and allow doctors to focus more on treatment rather than routine monitoring. Hospitals and clinics can also optimize resource allocation and improve patient management through connected health devices.

For patients, IoT-based monitoring offers greater convenience, comfort, and independence. Individuals with chronic diseases or those in remote areas can be monitored from their homes, ensuring early detection of potential health issues. This reduces hospital visits, lowers healthcare costs, and provides peace of mind to both patients and their families.

In addition, the integration of cloud computing and data analytics with IoT devices enhances decision-making in healthcare. The collected data can be analyzed to predict health trends, detect abnormalities, and support preventive care strategies. This data-driven approach promotes proactive healthcare rather than reactive treatment.