

AUTOMATED SPEECH RECOGNITION TECHNIQUE AND WIRELESS MONITORING SYSTEM FOR INDUSTRIAL APPLICATION

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

by

M. GNANESWAR (37130264)

M. SATYANARAYANA REDDY (37130232)



**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING**

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY (DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

MARCH 2021



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www.sathyabama.ac.in**

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION
ENGINEERING**

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **M.GNANESWAR** (37130264) and **M. SATYANARAYANA REDDY** (37130232) who carried out the project entitled “**AUTOMATED SPEECH RECOGNITION TECHNIQUE AND WIRELESS MONITORING SYSTEM FOR INDUSTRIAL APPLICATION**” under our supervision from December 2020 to March 2021.

Internal Guide

Mrs. VIJAYASHREE. T, M.E.,(PhD)
Assistant Professor, Department of ECE

Head of the Department

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

Submitted for Viva voce examination held on _____

Internal Examiner

External Examiner

DECLARATION

We, **M. GNANESWAR (37130264)** and **M. SATYANARAYANA REDDY (37130232)** hereby declare that the Project Report entitled “**AUTOMATED SPEECH RECOGNITION TECHNIQUE AND WIRELESS MONITORING SYSTEM FOR INDUSTRIAL APPLICATION**” done by us under the guidance of **Mrs. VIJAYASHREE. T, M.E.,(PhD)** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electronics and Communication Engineering.

DATE: 14-04-2021

PLACE: CHENNAI

1) M. GNANESWAR

2) M. SATYANARAYANA REDDY

SIGNATURE OF THE CANDIDATES

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ABSTRACT

Industrial automation is increasingly becoming more important in the industrialization phase in this day and age of computers because computerised machines can manage recurring tasks faster and more effectively. Every day, we strive for a more comfortable and laid-back home. This project is primarily concerned with minimising human effort and risk in hazardous circumstances such as high-voltage situations. Technology plays a significant role in making our homes more automated and, as a result, more relaxed. This study aims to develop and implement a low-cost industrial automation system that is also scalable, adaptable, and stable. It is a computer-based interactive system that uses speech recognition in order to monitor the power stations and also control the same. This project involves designing and prototyping a simple automation system based on SMS technology. In this day and age of computers, industrial automation is becoming increasingly necessary in the industrialization process because computerised machines can perform recurring tasks faster and more efficiently. Every day, we aspire to make our home more relaxing and comfortable. The primary goal of this project is to reduce human effort and danger in dangerous situations such as high-voltage situations. Technology is assisting in the simplification of our homes and, as a result, making us feel more at ease. This study's aim is to develop and implement a low-cost industrial automation system. It's a speech-recognition-based computer-based interactive interface. Recognized speech When automating an industrial load that is not apparent, the fault detection device in this design assists the consumer in ensuring that their industrial products have turned on or off

exactly as they should. Using wireless technology, the voltage is monitored and regulated from a distance. There will be two ON and OFF commands for each industrial load. Automation of 2 loads such as fan and light has been tested by giving 4 voice commands through personal computer. When user creates his own profile and automates the load speech recognition accuracy of more than is achieved. Other people who were allowed to automate the load by the user can use user profile and password and achieve a speech recognition accuracy of the same personal computer.

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CHAPTER-1

INTRODUCTION

Speech recognition is a technology that allows a device to use a microphone to record the words spoken by a person. These words are later recognized by a speech recognizer, and the machine then outputs the words that are being recognized. Vocabularies, Multiple users and a noisy environment are two of the most important variables that a speech recognition engine must consider. The physiological and behavioral features of the speaker are linked to their personality. These features can be found in both the spectral envelop and supra-segmental features. One of the most natural means of communication is speech. The role of speaker identification is to select the identity of the individual who created the speech from a population of speakers using a speech sample. The goal of speaker verification is to use a speech sample to determine whether an individual who claims to have delivered the speech actually did so. In this technique we use Bluetooth to recognize the voice and also, we use IOT techniqueto switch On and OFF automatically when the room is in low light.

1.1 EMBEDDED SYSTEM:

An embedded system is a set of computer hardware and software that is programmed to perform a specific function or set of functions within a larger system. It may be fixed or programmable. An embedded system could be used in industrial machinery, agricultural and process industry instruments, cars, medical equipment, cameras, household appliances, aircraft, vending machines and toys, as well as mobile devices.

Embedded systems are computer systems with no user interface (UI) — for example, on computers where the system is programmed to perform a single task to complex graphical user interfaces (GUIs), such as those used in mobile devices. Button, LED, and touchscreen sensing are all examples of user interfaces. Remote user interfaces are used by some applications.

1.2 Embedded system hardware (microprocessor-based, microcontroller-based)

Microprocessors or microcontrollers can be used in embedded systems. In any case, the product's core is an integrated circuit, which is typically designed to perform computation for real-time operations. Microprocessors and microcontrollers are similar in appearance, however the microprocessor still implements a central processing unit (CPU) and hence needs the inclusion of other components such as memory chips, while microcontrollers are built as self-contained devices.

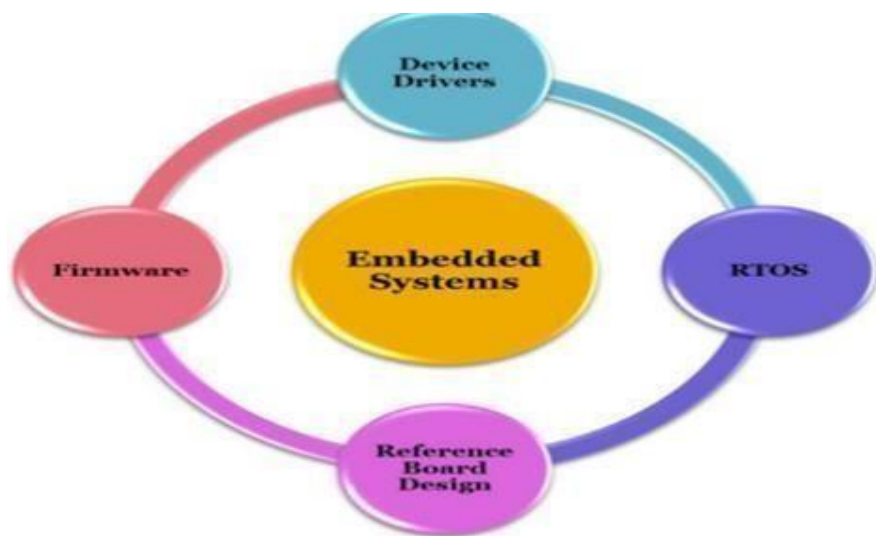


Fig 1.1 Embedded cycle

Microcontrollers include not only a CPU, but also memory and peripherals such as flash memory, RAM or serial communication ports. Because microcontrollers tend to implement full (if relatively low computer power) systems, they are frequently put to use on more complex tasks. For example, microcontrollers are used in the operations of vehicles, robots, medical devices and home appliances, among others. The term



Fig 1.2 Networking

"machine on achip" (SoC) is often used at the high end of microcontroller capability, but there is no precise delineation in terms of RAM, clock speed, and so on.

In 2013, the embedded market was projected to be worth more than \$140 billion, with several experts predicting that it would be worth more than \$20 billion by 2020. Many well-known names in the electronics industry produce chips for embedded systems.

Apple, IBM, Intel, and Texas Instruments, as well as a slew of other lesser-known firms, are among them. Arm has been a major player in this market for a long time. The business started as an offshoot of Acorn, a pioneering British PC manufacturer. Arm chips are based on the reduced instruction set computer (RISC) architecture and are often used in cell phones; they are now the most commonly used SoC in the embedded world, with billions of units deployed.

1.3 Embedded system software

In comparison to a traditional business desktop computer, an industrial microcontroller is less complex and relies on a simpler, less memory-intensive programme environment. The simplest devices run on bare metal and are programmed using the machine code language of the chip CPU.

Embedded systems often use embedded operating systems or language platforms, particularly when serving real-time operating environments. At higher levels of chip capability, such as those found in SoCs, designers have increasingly concluded that near-real-time approaches are appropriate because the devices are usually quick enough and the tasks are tolerant of minor variations in reaction time. In these cases, stripped-down versions of the Linux operating system are widely used, while other operating systems, such as Embedded Java and Windows IoT, have been pared down to run on embedded systems (formerly Windows Embedded).

Generally, storage of programs and operating systems on embedded devices make use of either flash or re-writable flash memory.

1.4 Embedded firmware

Embedded firmware, also known as embedded software, is specialised software written into the memory of a computer that serves the same function as ROM but is easier to upgrade. Non-volatile memory devices such as ROM, programmable ROM, erasable PROM, and flash memory can store firmware. Embedded firmware is used to monitor a variety of computer and machine features, such as communicating with other devices, performing basic functions, and providing input and output functionality.

The distinction between embedded firmware and embedded software is becoming increasingly blurred, but embedded software often refers to the only code running on a piece of hardware, while firmware may also refer to the chip that houses a device's basic input/output system (BIOS) or Unified Extensible Firmware Interface (UEFI), which connects software and a system's operating system.

1.5 Embedded systems vs. VLSI

The word "very-large-scale integration," or VLSI, refers to an integrated circuit's level of complexity. LSI (large-scale integration) microchips contain thousands of transistors, MSI (medium-scale integration) microchips contain hundreds of transistors, and SSI (small-scale integration) microchips contain tens of transistors, while VLSI (very large-scale integration) microchips contain hundreds of transistors. The term "ultra-large-scale integration," or "ULSI," refers to the placement of millions of transistors on a single chip.

Embedded systems frequently use VLSI circuits. Many VLSI ICs are used in embedded systems, and the acronym VLSI has generally fallen out of favour.

1.6 Debugging embedded systems

Debugging is one field where embedded systems differ from the operating systems and development environments of other, larger-scale computers. While programmers operating in desktop computer environments have devices that can run both the development code and separate debugger applications that track the development code's behaviors as it runs, embedded machine programmers do not.

Some programming languages are efficient enough on microcontrollers to allow for rudimentary interactive debugging right on the chip. Furthermore, several processors have CPU debuggers that can be managed, allowing programme execution to be controlled. -- via a JTAG or similar debugging port.

Embedded system programmers, on the other hand, often require tools that connect a separate debugging system to the target system via a serial or other port. The programmer will see the source code on the screen of a traditional personal computer in this situation, just as he or she might when debugging software on a desktop computer. A different, widely used solution is to run software on a PC that emulates the physical chip in software, allowing you to debug the software's output as if it were running on a real chip.

Because a large number of devices that use embedded controls are designed for use in situations where safety and reliability are top priorities, embedded systems have received more attention to testing and debugging.

The internet of things builds on an embedded systems base

While some embedded systems are basic, an increasing number of them either replace human decision-making or have functionality that a human cannot. For example, some aviation devices, such as those used in drones, can incorporate sensor data and act on it faster than a person, allowing for new kinds of operational features.

1.7 INTERNET OF THINGS:

The term Internet of Things generally refers to scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computers, allowing these devices to generate, exchange and consume data with minimal human intervention. There is, however, no single, universal definition.

Enabling Technologies: The concept of combining computers, sensors, and networks to monitor and control devices has existed for decades. The recent confluence of several technology market trends, however, is bringing the Internet of Things closer to widespread reality. These include Ubiquitous Connectivity, Widespread Adoption of IP-based Networking, Computing Economics, Miniaturization, Advances in Data.

Connectivity Models: IoT implementations use different technical communications models, each with its own characteristics. Four common communications models described by the Internet Architecture Board include: Device-to-Device, Device-to-Cloud, Device- to-Gateway, and Back-End Data-sharing.

These models highlight the flexibility in the different ways that IoT devices can connect and provide value to the user.

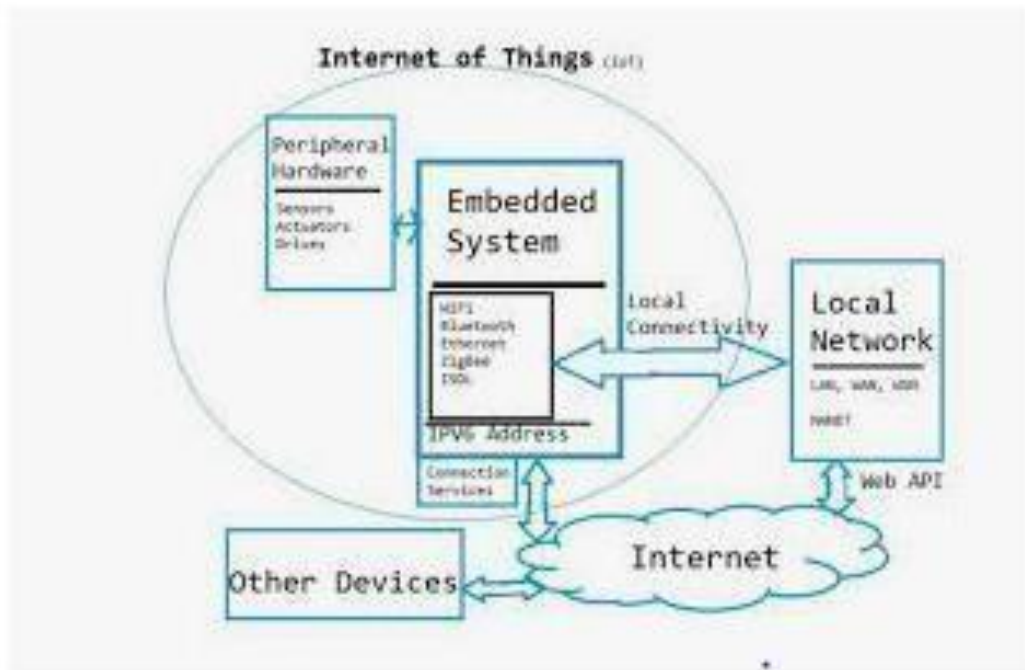


Fig 1.3 IoT

IoT devices are implemented using both hardware and software components. Dedicated hardware components are used to implement the interface with the physical world, and to perform tasks which are more computationally complex. Microcontrollers are used to execute software that interprets inputs and controls the system. This module discusses the roles of both the hardware and software components in the system. The functions of common hardware components are described and the interface between the software and hardware through the microcontroller is explained. IoT devices often use an operating system to support the interaction between the software and the microcontroller.

We will define the role of an operating system in an IoT device and how an IoT operating system differs from a standard one.

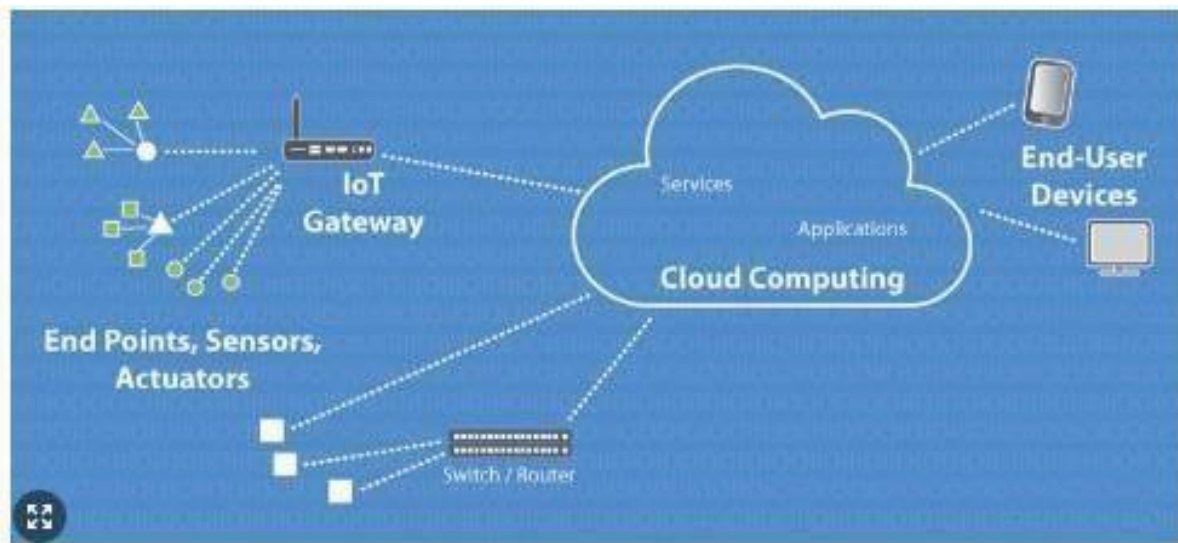


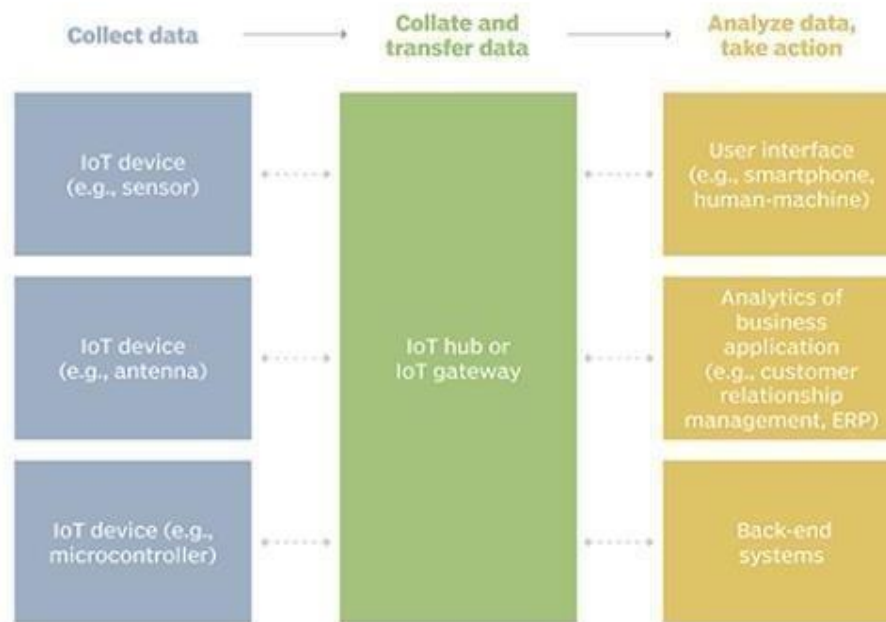
Fig 1.4 Functioning of IoT

How IoT works

An IoT ecosystem consists of web-enabled smart devices that use embedded processors, sensors and communication hardware to collect, send and act on data they acquire from their environments. IoT devices share the sensor data they collect by connecting to an IoT gateway or other edge device where data is either sent to the cloud to be analysed or analysed locally. Sometimes, these devices communicate with other related devices and act on the information they get from one another. The devices do most of the work without human intervention, although people can interact with the devices — for instance, to set them up, give them instructions or access the data.

The connectivity, networking and communication protocols used with these web-enabled devices largely depend on the specific IoT applications deployed

Example of an IoT system



Benefits of IoT

The internet of things offers a number of benefits to organizations, enabling them to:

- ☐ monitor their overall business processes;
- ☐ improve the customer experience;
- ☐ save time and money;
- ☐ enhance employee productivity;
- ☐ integrate and adapt business models;
- ☐ make better business decisions; and
- ☐ generate more revenue.

IoT encourages companies to rethink the ways they approach their businesses, industries and markets and gives them the tools to improve their business strategies.

Consumer and enterprise IoT applications are numerous real-world applications of the internet of things, ranging from consumer IoT and enterprise IoT to manufacturing and industrial IoT . IoT applications span numerous verticals, including automotive, telco, energy and more.

In the consumer segment, for example, smart homes that are equipped with smart thermostats, smart appliances and connected heating, lighting and electronic devices can be controlled remotely via computers, smartphones or other mobile devices.

Wearable devices with sensors and software can collect and analyse user data, sending messages to other technologies about the users with the aim of making users' lives easier and more comfortable. Wearable devices are also used for public safety — for example, improving first responders' response times during emergencies by providing optimised routes to a location or by tracking construction workers' or firefighters' vital signs at life-threatening sites.

In healthcare, IoT offers many benefits, including the ability to monitor patients more closely to use the data that's generated and analyse it. Hospitals often use IoT systems to complete tasks such as inventory management, for both pharmaceuticals and medical instruments.

CHAPTER-2

LITERATURE SURVEY

IOT BASED INDUSTRIAL AUTOMATION

IOT or internet of things is a technology that makes use of control systems such as machine to control the physical objects over the internet. Here we propose efficient industry automation framework that allows consumer to efficiently manage industry appliances/machines over the internet. We use three loads to represent industrial machinery or equipment, as well as a motor to represent an industrial motor.

2.1 APPLICABILITY OF LIFI TECHNOLOGY FOR INDUSTRIAL AUTOMATION SYSTEM

We propose a LIFI-based industrial field monitoring device that continuously measures industrial parameters in this article. It immediately sends a message to the administrator via LIFI communication if some irregular condition occurs. Data is transmitted by LIFI via an LED light bulb. It changes in strength more quickly than the human eye. The data can be encoded in light using the LED flicker-based technique. Temperature sensors, current sensors, voltage sensors, and gas sensors are used to measure industrial parameters. It reduces the amount of human labour required in the field of industrial monitoring by monitoring all industrial parameters from a single PC using the LIFI programme.

2.2 INTERNET OF THINGS ENABLED DEVICE FAULT PREDICTIONS SYSTEM USING MACHINE LEARNING

The Internet of Things (IOT) began as a niche market for hobbyists and has since into a multibillion-dollar industry. The Internet of Things brings together a variety of innovations, including real-time computing, deep learning, and artificial intelligence.

Home control, prior system fault identification, fitness equipment, and remote tracking systems are examples of customer needs. In modern implementations, programmed identification and determination of various types of computer disappointment is a fascinating method. Vibration sensors, sound sensors, warm sensors, infrared cameras, light cameras, and other multispectral sensors are among the sensors that are used to detect flaws. In today's world, modern electronics have become commonplace and widespread. This device necessitates the use of trustworthy and predictable algorithms. This post focuses on the prediction of faults in real-world gadgets that make our daily lives simpler. The device's archive contains existing errors, which are recovered in real time using cloud storage technologies. This will aid in the prediction of the devices' defects that need to be fixed. It also employs the Nave Bayes method for locating shortfalls in the devices. The article's suggested model entails tracking each and every home appliance through the internet and, as a result, detecting faults with minimal human interference.

2.3 INTERNET OF THINGS FOR INDUSTRIAL AUTOMATION -- CHALLENGES AND TECHNICAL SOLUTIONS

In several business realms, such as smart city, smart energy, healthcare, food and water monitoring, logistics and retail, and transportation, using the internet of things (IoT) to link things, services, and people for intelligent operations has been debated and deployed. However, there is limited knowledge available for IoT applications in the industrial automation domain, such as facilitating flexible communication between heterogeneous devices and systems, providing predictable and fault-tolerant real-time closed-loop control, and incorporating intelligent service functionality from edge devices to the cloud. We would explain the basic content in this article.

We will clarify the specific quality attributes constraints within industrial automation ,present real

automation, present real industrial IoT problems as a result of these limitations, and explore the benefits of implementing certain technological strategies to address these issues.

2.4 GSM & DTMF BASED HOME AND INDUSTRIAL AUTOMATION USING ARDUINO

This paper presents an effective technique for the user to monitor and control the house/office appliances and other equipment's via the mobile phone. The automation improves the lifestyle of control of the device. Embedded systems are used in this approach. In this research, we propose a novel automation system that combines Dual Tone Multi Frequency (DTMF) with a wireless module to provide integrated wireless control of multiple devices in a home or industry. This paper proposes a control method based on the DTMF tone created when a user presses buttons on a cell phone keypad or connects to a remote mobile device. This machine has the bonus of being able to be controlled from either distant or remote location.

2.5 INDUSTRIAL AUTOMATION USING SENSING BASED APPLICATIONS FOR INTERNET OF THINGS

The internet of things (IoT) is a network of physical objects with embedded hardware that interact with the outside world. The manufacturing internet of things is a subset of the internet of things that focuses on business-related technologies and objects. It enables you to link anything in your environment to the internet, including wearable devices, meters, and environmental sensors. These machines would be able to link to the internet and exchange various forms of data. For IoT, we suggest Industrial Automation focused on cloud computing and sensing applications.

CHAPTER-3

AIM AND SCOPE OF THE PRESENT INVESTIGATION

3.1 EXISTING SYSTEM:

- In existing system, they used only to control the devices using Bluetooth only.
- Bluetooth range is restricted in 10m only.

Disadvantage

- Range is restricted.

3.2 PROPOSED SYSTEM:

- In proposed system we used to control the devices using IOT.
- We can even monitor the system using IoT from anywhere in the world.
- In proposed system we can monitor the Industrial parameters like temperature, humidity and fire. These sensor data are uploaded through webserver with time and date using IOT.

Advantage

- By using IoT, we can use this system anywhere.

3.3 BLOCK DIAGRAM:

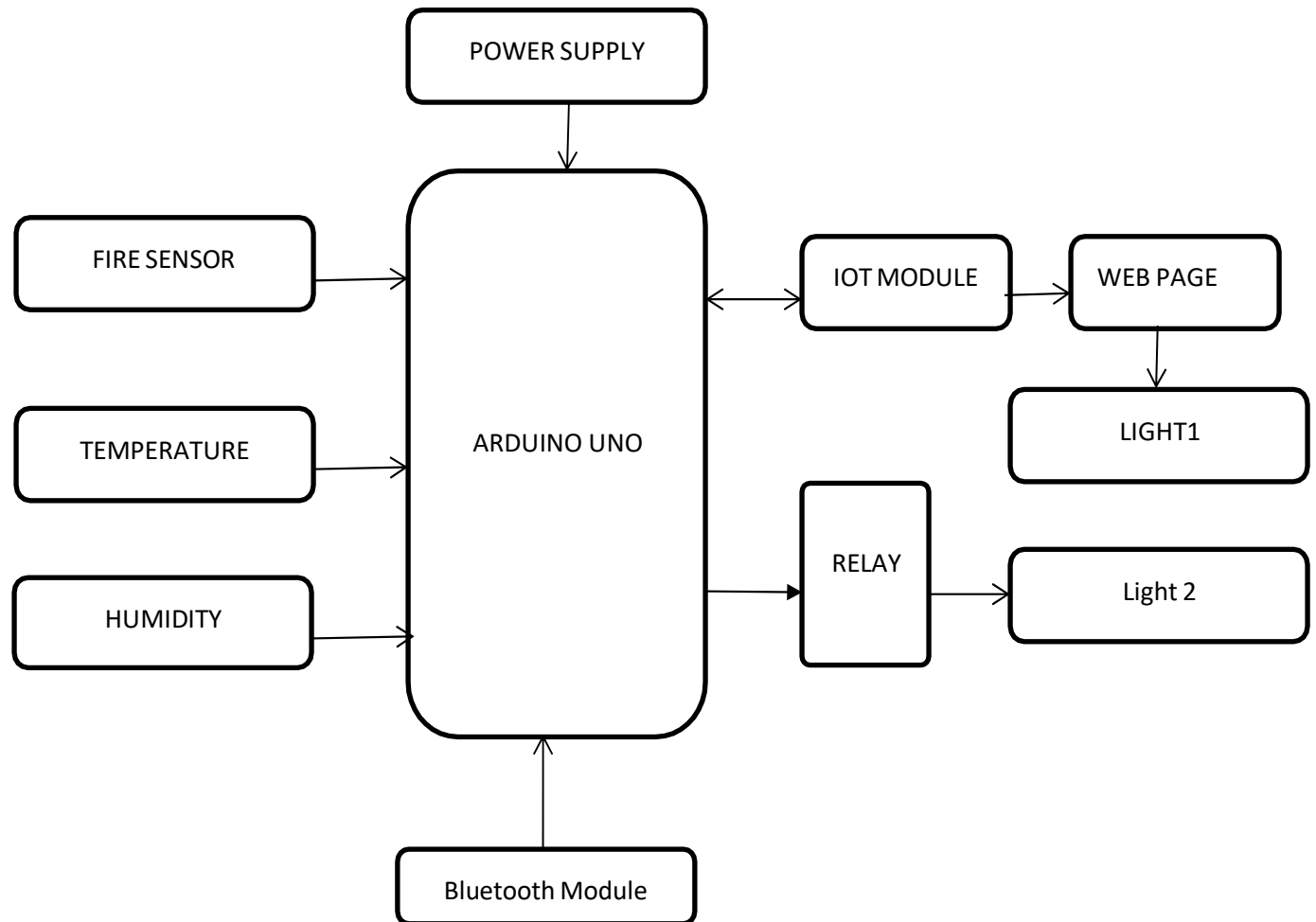


Fig 3.1 Block Diagram

HARDWARE REQUIREMENTS:

- Arduino UNO
- ESP8266 (IOT MODULE)
- Bluetooth Module
- Temperature sensor
- Humidity sensor
- Fire sensor
- Relay
- Light
- Motor
- Power supply

SOFTWARE REQUIREMENTS:

- Arduino IDE
- Embedded C
- PHP

4. MATERIALS AND METHODS USED

4.1 HARDWARE REQUIREMENTS:

4.1.1 ARDUINO UNO:

The Arduino Uno is a microcontroller board that uses the ATmega328 microcontroller (datasheet). There are 14 optical input/output pins (six of which can be used as PWM outputs), six analogue inputs, a 16 MHz ceramic resonator, a USB link, a power port, an ICSP header, and a reset button on the board. It comes with everything you'll need to get started with the microcontroller; simply plug it into a device with a USB cable or power it with an AC-to-DC converter or battery. The Uno is unique in that it does not use the FTDI USB-to-serial driver chip used on previous boards. Instead, it has a USB-to-serial adapter built into the Atmega16U2 (Atmega8U2 up to version R2. The 8U2 HWB line on revision 2 of the Uno board is pulled to ground by a resistor, making it simpler to bring into DFU mode. The board's third revision has the following new features:

- 1.0 pinout: inserted SDA and SCL pins near the AREF pin, as well as two additional pins near the RESET pin, the IOREF, which enable the shields to respond to the voltage supplied by the board. Shields will be compliant in the future with both the AVR-based boards that run on 5V and the 3.3V-based Arduino Due boards. The second is an unconnected pin that will be used in the future.
- Stronger RESET circuit.
- The 8U2 is replaced by the Atmega 16U2. The name "Uno" comes from the Italian word "uno," which means "one." It was chosen to commemorate the forthcoming release of Arduino 1.0. Going forward, the Uno and version 1.0 will be the reference versions of Arduino. The Uno is the most recent in a long line of

USB Arduino boards and the Arduino platform's reference model; see the index of Arduino boards for a comparison with previous models.

POWER:

When using an external power source, VIN is the reference voltage to the Arduino board (as opposed to 5 volts from the USB connection or other regulated power source). This pin may be used to supply voltage or to access voltage if it is supplied through the power socket.

□ 5 volts. This pin receives a controlled 5V from the board's regulator. The board can be powered by the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin on the board (7-12V). Bypassing the regulator and supplying voltage through the 5V or 3.3V pins, you risk damaging your board. We don't recommend it.

□ 3V 3. The on-board regulator generates a 3.3-volt supply. The maximum existing pull is 50 milliamperes.

□ GND. Ground pins.

ARDUINO UNO:

Memory

The ATmega328 has 32 KB of memory (with 0.5 KB used for the bootloader). There's also 2 KB of SRAM and 1 KB of EEPROM on board (which can be read and written with the EEPROM library). Output and Input Using the pin Mode (), digital Write (), and digital Read () modes, any of the Uno's 14 digital pins can be used as an input or output. They are powered by 5 volts. Each pin has a maximum amount of energy that it can supply or obtain

40 mA, with a 20-50 kilo Ohm internal pull-up resistor (disconnected by default).

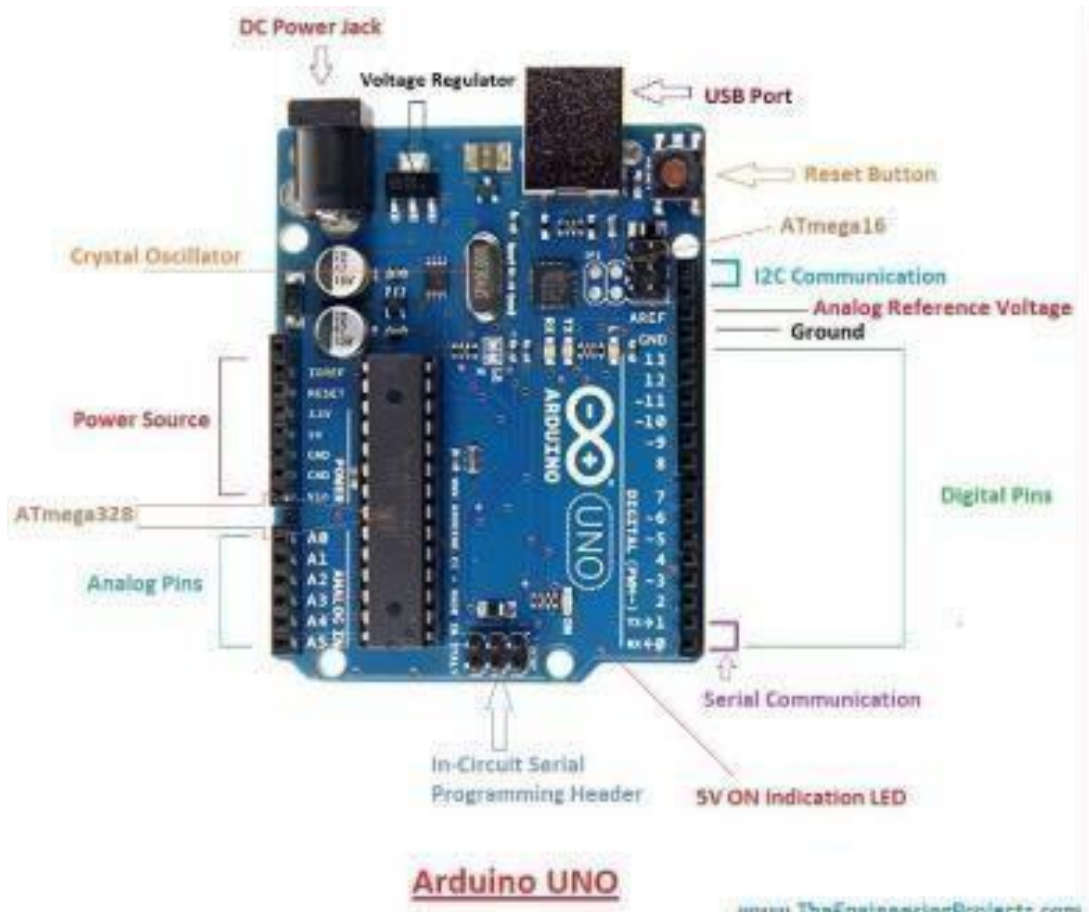


Fig 4.1 Arduino UNO

In addition, some pins have specialized functions:

- 0 (RX) and 1 (TX) serial numbers (TX). TTL serial data is received (RX) and transmitted (TX) using this device. These pins are wired to the ATmega8U2 USB-to-TTL Serial chip's corresponding pins.
- 2 and 3 External Interrupts On a low value, a rising or dropping lip, or a shift in value, these pins may be programmed to cause an interrupt. For more details, see the connect Interrupt () feature.

□ PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the `analogWrite()` function.

□ SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.

□ LED number: 13 A built-in LED is attached to digital pin 13 by a wire. The LED is turned on when the pin is HIGH, and it is turned off when the pin is Low. The Uno has six analogue inputs, numbered A0 through A5, each with a resolution of 10 bits (i.e., 1024 different values). They scale from ground to 5 volts by default, but the AREF pin and the analogue Reference () feature can be used to adjust the upper end of their range. Furthermore, certain pins have specific functions.

□ TWI: A4 (SDA) and A5 (SCL) pins. Using the Wire library, support TWI contact. On the board, there are a few more pins:

□ AREF. Reference voltage for the analog inputs. Used with `analogReference()`.

□ Restart. To reset the microcontroller, set this line to LOW. Often used to apply a reset button to shields that are in the way of the board's reset button. Also see the ATmega328 port mapping and the Arduino pin mapping. The Atmega8, 168, and 328 all have the same routing. Communication is important. A cpu, another Arduino, or other microcontrollers can all be communicated with using the Arduino Uno.

On optical pins 0 (RX) and 1 (TX), the ATmega328 supports UART TTL (5V) serial communication (TX). This serial connectivity is channelled over USB by an ATmega16U2 on the board, which appears to software on the device as a virtual com port. There is no need for an additional driver since the '16U2 firmware uses normal USB COM drivers.

On Windows, however, a.inf file is needed. A serial display is included in the Arduino programme, allowing basic textual data to be transmitted to and from the Arduino board. As data is transferred via the USB-to-serial chip and USB link to the device, the RX and TX LEDs on the board can glow (but not for serial communication on pins 0 and 1). Serial correspondence can be done on any of the Uno's digital pins using a Software Serial library. I2C(TWI) and SPI connectivity are both supported by the ATmega328. The Wire library is included with the Arduino programme to make using the I2C bus easier; see the documentation for more details. Using the SPI library for SPI correspondence.

PIN CONFIGURATION:

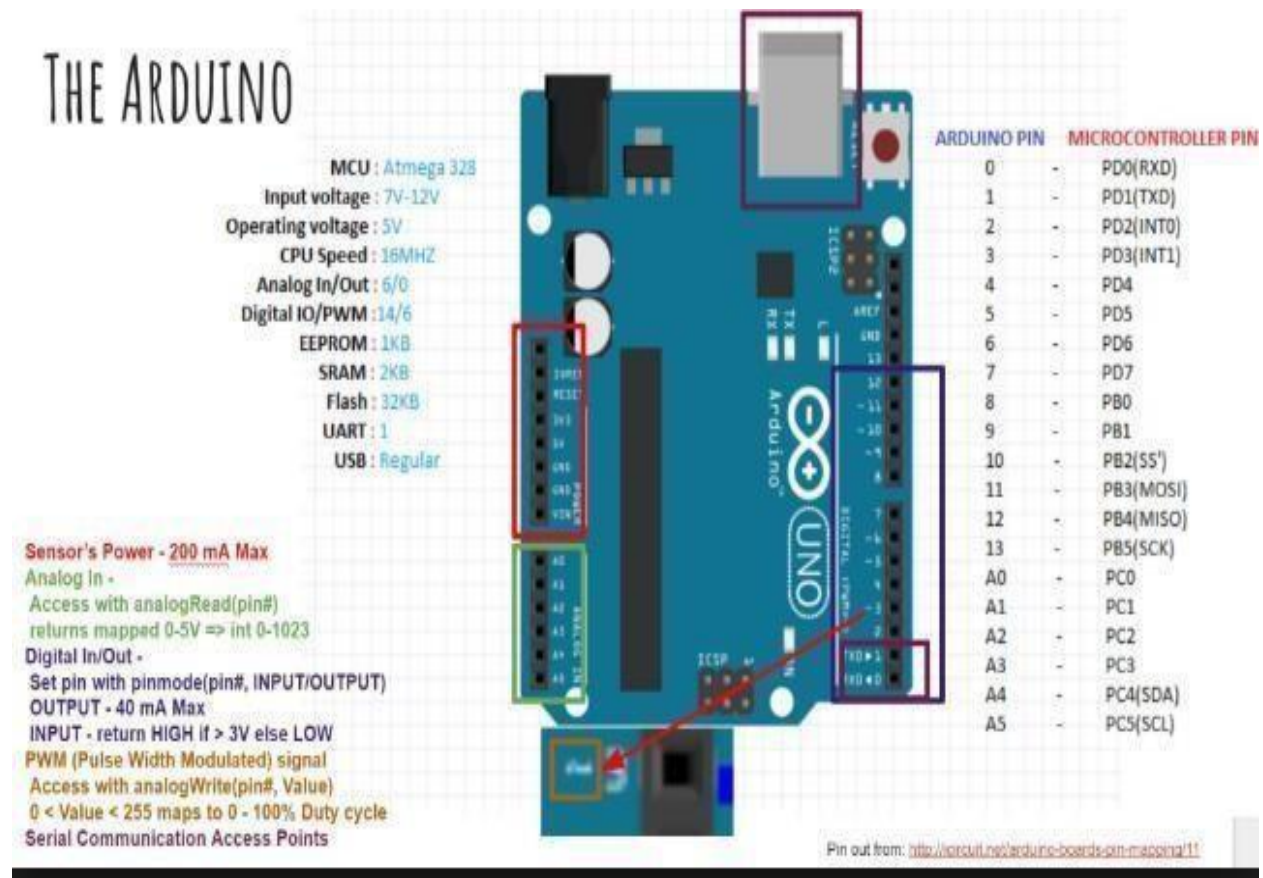


Fig 4.2 PIN Configuration

USB Overcurrent Protection

A resettable poly fuse on the Arduino Uno prevents the computer's USB ports from shorts and overcurrent. Although most computers have their own built-in protection, the fuse adds another layer of security. The fuse would immediately sever the link if more than 500 mA is added to the USB port before the short or overload is removed.

Physical Characteristics

The Uno PCB's full length and width are 2.7 and 2.1 inches, respectively, with the USB connector and power jack protruding beyond the former. The board has four screw holes that allow it to be connected to a surface or case. The width between optical pins 7 and 8 is 160 mil (0.16"), which is not an equal multiple of the other pins' 100-mil spacing.

4.1.2 ESP8266

The ESP8266 is a complete and self-contained Wi-Fi networking solution that can either host or offload all Wi-Fi networking functions to another application processor. When the ESP8266 hosts the programme and is the device's only application processor, it can boot up from an external flash drive. It has an optimised cache to increase processor stability and reduce memory needs in such applications.

Alternatively, by acting as a Wi-Fi adapter, wireless internet networking may be applied to any microcontroller-based design with ease using the UART or CPU AHB bridge interfaces. The on-board processor and storage capacities of the ESP8266 make it possible to combine it with sensors and other applications.

relevant devices through its GPIOs with minimal up-front production and minimal load during runtime. It needs minimal external circuitry due to its high degree of on-chip integration, which includes the antenna switch balun and power management converters, and the entire solution, including the front-end board, is configured to occupy minimal PCB space.

FEATURES

- SDIO 2.0, SPI, UART
- 32-pin QFN package
- Integrated RF switch, balun, 24dBm PA, DCXO, and PMU
- Integrated RISC processor, on-chip memory and external memory interfaces
- Integrated MAC/baseband processors
- Quality of Service management
- I2S interface for high fidelity audio applications
- On-chip low-dropout linear regulators for all internal supplies
- Proprietary spurious-free clock generation architecture
- Integrated WEP, TKIP, AES, and WAPI engines

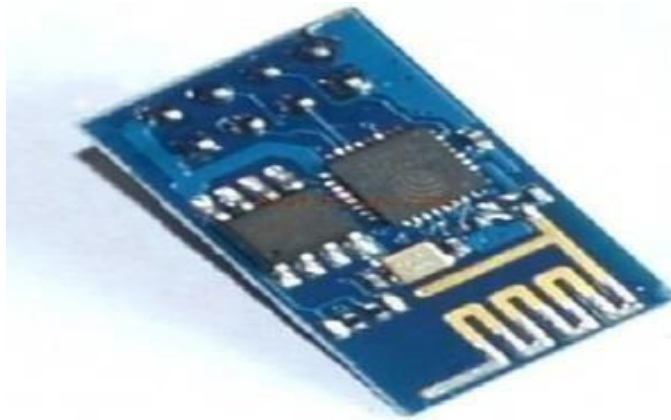


Fig 4.3 WIFI MODULE (ESP8266)

SPECIFICATION:

- 802.11 b/g/n
- Wi-Fi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLLs, regulators, DCXO and power management units
- +19.5dBm output power in 802.11b mode
- Power down leakage current of <10uA
- Integrated low power 32-bit CPU could be used as application processor
- SDIO 1.1/2.0, SPI, UART
- STBC, 1×1 MIMO, 2×1 MIMO
- A-MPDU & A-MSDU aggregation & 0.4ms guard interval
- Wake up and transmit packets in < 2ms
- Standby power consumption of < 1.0mW (DTIM3)

4.1.3 BLUETOOTH MODULE

The HC-05 module is a simple Bluetooth SPP (Serial Port Protocol) module that allows for the setup of a transparent wireless serial link.

Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation serial port Bluetooth package with total 2.4GHz radio transceiver and baseband. It has a CSR Bluecore 04- External single chip Bluetooth device with CMOS and AFH technologies (Adaptive Frequency Hopping Feature). It has a compact footprint of 12.7mmx27mm. I hope it will make the overall design/development process easier.

BLUETOOTH MODULE

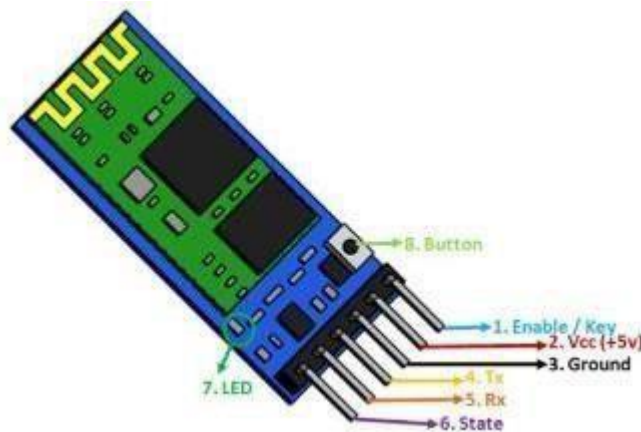


Fig 4.4 Bluetooth Module

Hardware Features

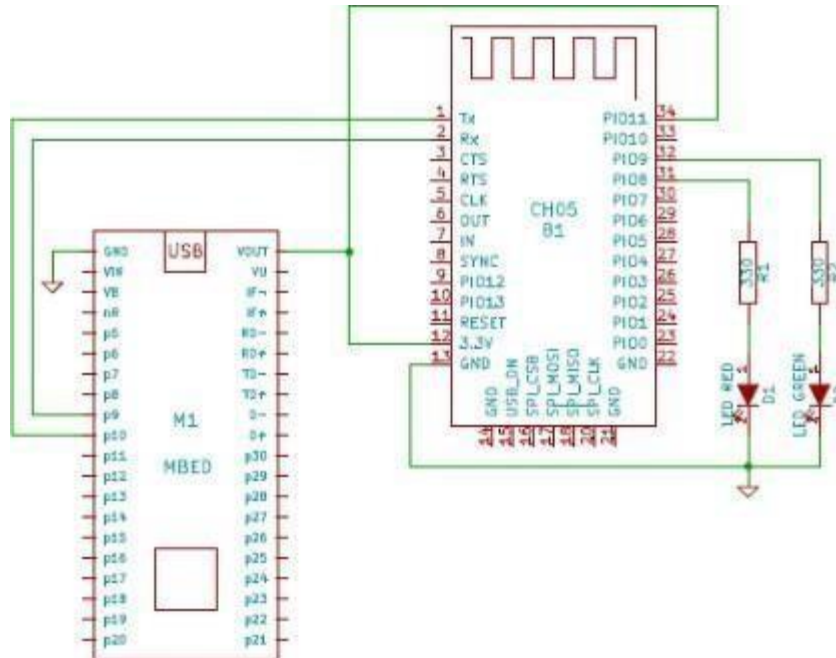
- Typical -80dBm sensitivity
- Up to +4dBm RF transmit power
- Low Power 1.8V Operation ,1.8 to 3.6V I/O
- PIO control
- UART interface with programmable baud rate
- With integrated antenna
- With edge connector

Software Features

- Data bits: 8, Stop bit: 1, Default Baud rate: 38400 Parity: There is no parity. Has data access.
- The following baud rates are supported:
9600,19200,38400,57600,115200,230400,460800.
- If PIO0 has a rising heartbeat, the system will be disconnected.
- Low-disconnected, high-connected status instruction port PIO1;

- Red and blue leds can be attached to PIO10 and PIO11 independently.
When owner and slave are in conflict

PIN CONFIGUARTION



When combined, the red and blue leds blink once every 2 seconds, while when disconnected, only the blue led blinks twice every 2 seconds.

- As a default, auto-connect to the last computer on battery.
- Enable the pairing system to attach automatically.
- Default PINCODE:"0000" for auto-pairing
- If you're disconnected because you've gone past the range of your link, it'll auto-reconnect in 30 minutes.

The HC-05 has two modes of operation: one is Data, which allows it to send and receive data from other Bluetooth devices, and the other is AT Command, which allows it to send and receive commands from other Bluetooth devices.

The default system settings can be changed in this mode. Using the key pin as described in the pin definition, we can run the unit in any of these two modes.

Since the HC-05 module uses the Serial Port Protocol, it is very simple to connect it to microcontrollers (SPP). Simply add the Rx pin of the module to the Tx of the MCU and the Tx pin of the module to the Rx of the MCU with +5V.

If the main pin is grounded during power up, it will reach Command mode; if it is not, it will default to Data mode. You should be able to discover the Bluetooth computer as "HC-05" as soon as the module is powered up, then communicate with it using the default password 1234 and begin communicating with it. By entering into the, you will change the name, password, and other default parameters.

Applications

1. Wireless communication between two microcontrollers
2. Communicate with Laptop, Desktops and mobile phones
3. Data Logging application
4. Consumer applications
5. Wireless Robots
6. Home Automation

4.1.4 FIRE SENSOR:

A flame detector is a sensor that detects and responds to the appearance of a flame or heat, making it possible to identify flames. Sound an alert, deactivating a fuel line (such as a propane or natural gas line), and activating a fire control system are all possible responses to a perceived blaze, depending on the installation.



Fig 4.5 FIRE SENSOR

As used in applications such as industrial furnaces, their function is to ensure that the furnace is operating properly; they do not take any action other than alert the operator or control device in these situations. Because of the methods it uses to detect the blaze, a flame detector may also respond quicker and more accurately than a smoke or heat detector.

OPTICAL FLAME DETECTORS:

Ultraviolet detector

UV detectors operate by measuring UV radiation that is released at the time of ignition. Though capable of detecting fires and explosions in 3–4 milliseconds, a 2–3 second time interval is often included to reduce false alerts caused by other UV sources such as lightning, arc welding, radiation, and sunlight. UV detectors typically run at wavelengths less than 300 nm to reduce the influence of the sun.

background pollution from the natural world Oily pollutants can quickly blind the solar blind UV wavelength band.

Near-infrared scope

Visual flame detectors, also known as near infrared (IR) array flame detectors (0.7 to 1.1 μm), use flame recognition devices to validate fire by measuring near IR radiation using a charge-coupled unit (CCD). A near infrared (IR) sensor can be used to detect flame phenomena without being hampered by water or water vapour. At this wavelength, pyroelectric sensors can be surprisingly inexpensive. Multiple channels or pixel array sensors tracking flames in the near infrared band are arguably the most reliable fire detecting technology present. The light emitted by a fire gives the appearance of a flame at a certain time. Via examination of the video generated from the near IR images, digital image processing can be used to identify flames.

Infrared

Flame detectors that use infrared (IR) or wideband infrared (1.1 μm and higher) scan the infrared spectral band for complex patterns emitted by hot gases. A sophisticated fire-fighting thermal imaging camera (TIC), a kind of thermographic camera, detects these. Other hot surfaces and background thermal radiation in the environment can cause false alarms. Water on the detector's mirror, as well as exposure to direct sunlight, can significantly limit the detector's accuracy. 4.3 to 4.4 μm is a unique frequency spectrum. This is a CO₂ resonant frequency. As a hydrocarbon (such as wood or fossil fuels like oil and natural gas) is burned, a lot of heat and CO₂ is emitted.

At its resonance frequency of 4.3 μm , hot CO₂ emits a lot of energy. This results in a peak in overall radiation exposure, which is easily detectable. Furthermore, the "cold" CO₂ in the air filters out sunshine and other infrared radiation. As a result, the sensor operates at this frequency.

"solar blind"; however, illumination reduces immunity. The detector is made less vulnerable to false alarms caused by heat radiation, such as that caused by hot equipment, by observing the flicker frequency of a fire (1 to 20 Hz).

The fact that nearly all radiation can be absorbed by water or water vapour is a significant disadvantage; this is especially true for infrared flame detection in the 4.3 to 4.3 m range. Water or ice absorbs almost entirely at a wavelength of around 3.5 m and greater. As a result, infrared sensors for outdoor use are extremely unresponsive to flames. The most serious issue is our lack of knowledge; although certain infrared detectors have a (automatic) detector window self-test, this self-test only detects the presence of water or ice on the detector window.

Since salt absorbs water, a salt film is also toxic. Water vapour, cloud, or light rain, on the other hand, blinds the sensor without the user's awareness. The reason is analogous to what a firefighter does when approaching a hot fire: he uses a water vapour screen to cover himself from the intense infrared heat radiation. Water vapour, cloud, or light rain would then "shield" the monitor, preventing it from seeing the flames. However, visible light can pass through the water vapour filter, as shown by the fact that a person can see the flames through the water vapour screen.

An IR detector's typical reaction time is 3–5 seconds.

UV/IR

These detectors detect blaze by matching the threshold signals at both UV and IR wavelengths. This reduces the number of false alarms.

Detection of flames in the infrared/infrared range

Flame detectors with dual infrared ranges (IR/IR) equate the threshold signal in two infrared ranges.

Typically, one sensor measures 4.4 micrometre carbon dioxide (CO₂) and the other measures a reference frequency. For hydrocarbon fuels, measuring CO₂ emissions is acceptable; for non-carbon-based fuels, such as hydrogen, measuring broadband water bands is appropriate.

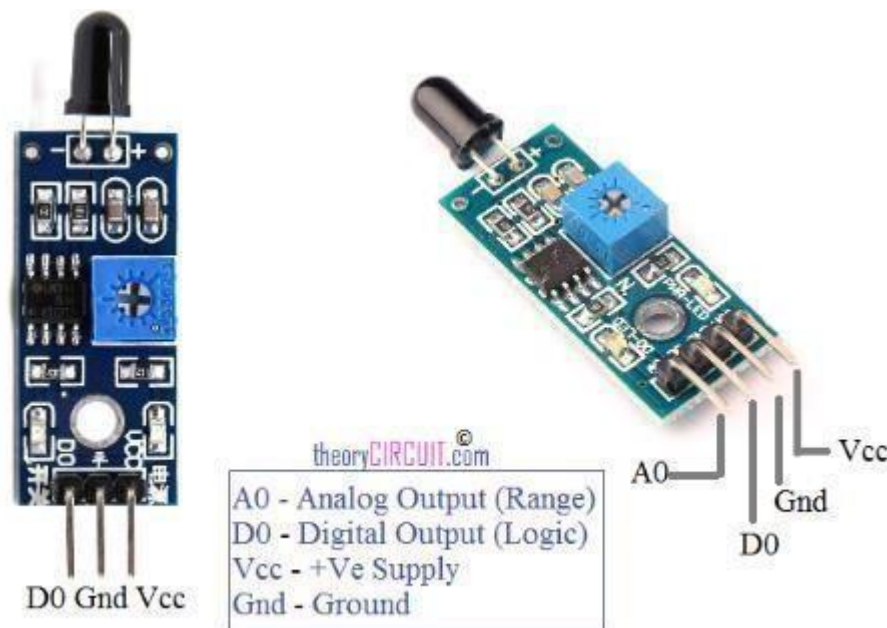


Fig 4.6 IR Sensor

UV/IR flame detectors are used in:

- Hydrogen stations.
- Gas-fueled cookers
- Industrial heating and drying systems

- Domestic heating systems
- Industrial gas turbines

4.1.5 HUMIDITY SENSOR:

Humidity sensing is essential in such fields as environmental control, process monitoring and biomedical analysis. A microfabricated humidity sensor is developed which uses a nitride/silicon microstructure suspended at a small distance above the surface of a glass substrate as the movable electrode of a capacitor and thin-film platinum resistors as temperature sensing elements. The suspending structure is coated with polyimide - a vapor-absorbent polymer film. Moisture- dependent bending of the micro-cantilever is caused by the variation of humidity. The measured capacitance between the micro suspending structure and the substrate is changed.

The humidity sensor is integrated with a platinum resistor as a micro temperature detector for compensation of the capacitance signal drift caused by temperature. A low hysteresis value is indicated at high relative humidity. Because of the large electrode area on the microcantilever tip and the low stiffness of the microcantilever, a high degree of sensitivity is also attained. The relative humidity and calibrated capacitance/resistance is documented and both of the simulated and experimental samples indicate a high stability and a high degree of linearity. The average time constant of the proposed microcantilever-based humidity sensors is

1.10 sec in the relative humidity range of 20 percent R.H

ST's digital humidity and temperature sensor is based on a planar capacitance technology that integrates the temperature and humidity sensors in the sensing element



Fig 4.7 Humidity Sensor

The MVH3201D is the highest accuracy miniature digital relative humidity and

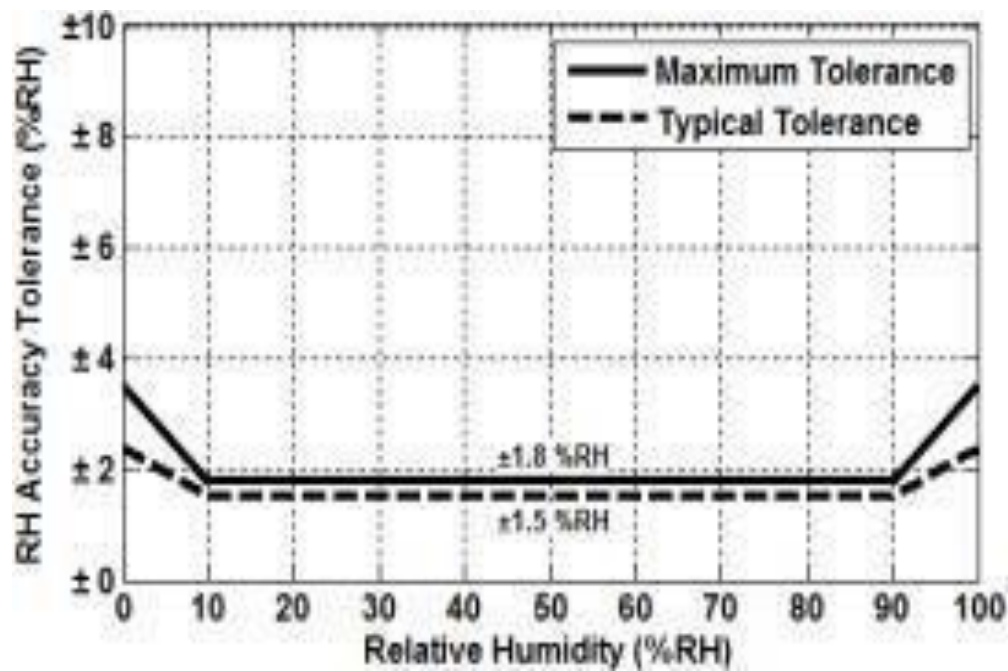


Fig 4.8 RELATIVE HUMIDITY

temperature sensor in the world. It is well-suited for the most stringent accuracy

Sensor performance must be best-in-class under a wide variety of environmental factors in applications where sensor performance must be best-in-class.

Humidity and temperature are two of the most basic environmental variables that affect human life and the atmosphere.

APPLICATIONS OF HUMIDITY SENSORS:

- Humidity sensors have a wide variety of uses. Humidity sensors are used to detect and deter diseases in people who are affected by humidity.
- Humidity sensors are also used in heating, ventilation, and air conditioning applications in homes (HVAC systems). This are also used in meteorology stations to report and forecast weather in workplaces, vehicles, humidors, libraries, manufacturing spaces, and greenhouses.

4.1.6 TEMPERATURE SENSOR:

'Every day, the climate gets colder.' This phrase has begun to appear more often in our daily lives. Still we hardly ponder what it entails. What is the hotter option? How hot is too hot? Is it colder than water, or maybe a little bit hotter than cold? Temperature is just a subjective assessment of our human senses. We ought to calculate the temperature values for an objective and repeatable calculation, and to do so, we'll need an appropriate measurement instrument.

SPECIFICATIONS:

Range	0°...100°C
Accuracy	< 0,1°C + NTC-spread over 0°...70°C
Resolution	2 m°C@30°C and 25 m°C@100°C
Linearity	see table
No. Sensors	1....30
Type	5 kOhm NTC-resistors Max. wireresistance 3,3 Ohm
Conditioner	Wheatstone-bridge with +15 Bits ADC
Calibration	at 0°C and 100°C _ 0,1°C
Drift	1 m°C/°C with periodic calibration and 5 m°C/°C without calibration
Scanfreq.	default max. 10 meas./s
Amb.temp	0°...60°
Control	Micro-Wire™ 5 (Di, Do, Clk en CS)
Levels	0 and 5 Volt
Power	+12 Volt 3,5 mAmp (+5,5 +20 Volt) -5 Volt 1 mAmp (-4,5 -8 Volt)
Dimensions	224 x 120 x 60 + 40 mm

4.1.7 RELAY:

A relay is a switch that is regulated by electricity. Often relays use an electromagnet to mechanically control a switch, but solid-state relays and other operating concepts are also used. Relays are used where a separate low-power signal is required to operate a circuit, or when multiple circuits may be operated by a single signal. The first relays were used as amplifiers in long-distance telegraph circuits, repeating the signal from one circuit and re-transmitting it to another.

circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

a circuit Relays were widely used to execute logical operations in telephone exchanges and early computers.

A contactor is a form of relay that can handle the high power needed to operate an electric motor or other loads directly. Solid-state relays use a semiconductor chip to handle switching instead of shifting parts to control power circuits. To defend electrical circuits from overload or errors, relays with calibrated operating characteristics and often multiple operating coils are used; in modern electric power systems, these functions are performed by digital instruments still referred to as "protective relays. "To drive their contacts in one direction, magnetic latching relays need one pulse of coil power and another, diverted pulse to move them out." Pulses from the same input that are repeated have no effect. Magnetic latching relays are helpful in applications where power interruptions can prevent the contacts from transitioning.

RELAY MODULE



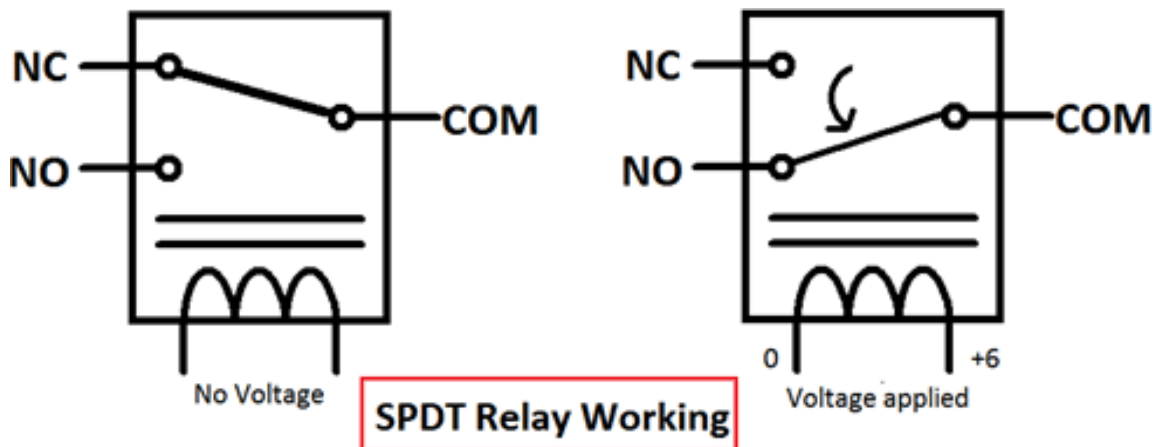
Fig 4.9 RELAY

Single or dual coil magnetic latching relays are available. When power is applied to a single coil device, the relay can only operate in one direction.

When the polarity is reversed, the device will reset. As polarised voltage is applied to the reset coil of a dual coil system, the contacts will transition. Single-coil AC-controlled magnetic latch relays use steering diodes to distinguish between run and reset orders.

BASIC DESIGN AND OPERATION

A basic electromagnetic relay is made up of a wire coil wound around a softiron core (a solenoid), an iron yoke that provides a low reluctance direction for magnetic flux, a movable iron armature, and one or more sets of contacts (there are two contacts in the relay pictured). The armature is physically connected to one or more pairs of travelling contacts and is hinged to the yoke. When the relay is de-energized, the armature is fixed in place by a spring, creating an air gap in the magnetic circuit. One of the two sets of contacts in the relay shown is closed, while the other is open in this condition. Other relays may have more or fewer sets of contacts depending on their function. . A wire connects the armature to the yoke on the relay in the photo. The yoke, which is soldered to the PCB, maintains circuit continuity between the travelling contacts on the armature and the circuit track on the printed circuit board (PCB).



When an electric current passes through the coil, it creates a magnetic field that stimulates the armature, and the movable contact(s) travel as a result, making or breaking a bond with a fixed contact (depending on the construction). If the contacts were closed while the relay was de-energized, the movement opens the contacts and breaks the link, and if the contacts were open, the movement opens the contacts and breaks the connection. As the current to the coil is shut off, a force only half as powerful as the gravitational force returns the armature to its comfortable state. A spring is typically used to provide this energy, but gravity is often widely used in automotive engine starters. . The majority of relays are designed to run rapidly. This decreases noise in low-voltage applications and arcing in high-voltage or current applications.

When a coil is energised with direct current, a diode is often mounted over the coil to dissipate the energy from the collapsing magnetic field at deactivation, which would otherwise cause a voltage spike that could damage semiconductor circuit components. Such diodes were not commonly used until transistors were used as relay drivers, but as early germanium transistors were quickly killed by this surge, they became widespread. In the case of certain car relays, there is a diode.

The vast majority of relays are made to run quickly. In low-voltage implementations, this reduces noise, while in high-voltage or current applications, it reduces arcing.

As a coil is energised with direct current, it is common to place a diode over it to dissipate the energy from the collapsing magnetic field at deactivation, which would otherwise produce a voltage spike that could destroy semiconductor circuit components. These diodes were not widely used until transistors were used as relay drivers, but since early germanium transistors were easily destroyed by the surge, they became common. A diode is used in the case of such car relays.

Types

Coaxial relay

When radio transmitters and receivers use the same antenna, a TR (transmit-receive) relay is often used to move the antenna from the receiver to the transmitter. This shields the receiver from the transmitter's high power. These types of relays are often used in transceivers that incorporate the transmitter and receiver into a single chip. The relay contacts are designed to have very high separation between the receiver and transmitter terminals by not reflecting any radio frequency power back toward the source. The relay's signature impedance is matched to the system's transmission line impedance, which is usually 50 ohms.

Contactors

A contactor is a high-current relay used to transfer electric motors and lighting loads. Popular contactors have continuous current ratings ranging from 10 amps to several hundred amps. Silver alloys are used to make high-current contacts. The contacts oxidise as a result of the inevitable arcing, but silver oxide is still a strong conductor. (15) To start motors, contactors with overload protection are commonly used. [number 16]

Force-guided contact relay

The relay contacts in a 'force-guided contacts relay' are mechanically connected so that when the relay coil is energised or de-energized, all of the linked contacts shift together. If one group of contacts in a relay are immobilised, none of the other contacts in the same relay can pass. The aim of force-guided contacts is to allow the relay's status to be checked by the safety circuit. "Positive-guided contacts," "captive contacts," "locked contacts," "mechanically connected contacts," and "safety relays" are all terms used to describe force-guided contacts.

This safety relays must adhere to design and manufacturing guidelines outlined in EN 50205: Relays with forcefully driven (mechanically linked) contacts, a major machinery standard. These guidelines for safety design are specified as Basic safety principles and Well-tried safety principles for machinery in type B standards such as EN 13849-2 and apply to all machines.

4.1.8 LAMP

An electric light is a device that uses electricity to emit visible light. It is the most common form of artificial lighting and is essential in modern society, providing both interior and exterior lighting for evening and nighttime activities. A lamp is a replaceable item that generates light from electricity in technical terms. The incandescent light bulb is an example of a lamp that is widely referred to as a light bulb. A lamp's frame, which is normally made of clay, metal, glass, or plastic, secures the lamp in a light fixture's socket. A screw-thread frame, two metal pins, two metal caps, or a bayonet cap may all be used to attach to the socket electrically.

Incandescent lamps, which produce light by heating a filament to a white-hot temperature with an electric current, gas-discharge lamps, such as fluorescent lamps, and LED lamps, which produce light by a flow of electrons across a band gap in a semiconductor, are the three main types of electric lights.

People used torches, gas lights, oil lamps, and fires until electric lighting became common in the early twentieth century. Humphry Davy, an English chemist, invented the first incandescent light in 1802, and the first practical electric arc light in 1806. Davy's arc lamp had been commercialised by the 1870s and was used to illuminate many public spaces.

Commercial incandescent light bulbs were readily available in the 1880s thanks to Swan and Thomas Edison, and by the early twentieth century, they had largely replaced arc lamps.

Since the first demonstrations of arc lamps and the incandescent light bulb in the nineteenth century, the energy efficiency of electric lighting has improved dramatically. Modern electric light sources are available in a wide range of styles and sizes to suit a wide range of applications. The majority of modern electric lighting is powered by centrally generated electricity, but handheld or standby electric generators or battery systems may also be used. As and where stationary lights malfunction, battery-powered illumination is also used in the form of flashlights or electric lanterns, as well as in cars.

- Incandescent light bulb, which consists of a hot filament enclosed in a glass envelope.
 - Halogen lamps are incandescent lamps with a halogen gas covered fused quartz envelope.
- An LED lamp is a solid-state lamp that emits light from light-emitting diodes (LEDs).
- Arc lamp
 - Carbon arc lamp
 - Xenon arc lamp, used in many cameraflashes, stroboscopes and digital cinema projectors
 - Mercury-xenon arc lamp
- Ultra-high-performance lamp, a mercury-vapor arc lamp with an ultra-high pressure found in many screen projectors.
 - A light source that produces light by transmitting an electric discharge through an ionised gas is known as a gas-discharge lamp.

- Fluorescent lamp
 - Compact fluorescent lamp, a fluorescent lamp designed to replace an incandescent lamp
- Neon lamp
- Mercury-vapor lamp
- Sodium-vapor lamp
- Sulfur lamp
- Metal-halide lamp
 - High-intensity discharge lamp

o An electrodeless lamp is a gas discharge lamp that receives its electricity from electromagnetic fields or radio waves.

o Plasma light

-

Name	Optical spectrum	Nominal efficacy (lm/W)	Lifetime (MTTF) (hours)	Color temperature (kelvin)	Color	Color rendering index
Incandescent light bulb	Continuous	4–17	2–20,000	2,400–3,400	Warm white (yellowish)	100
Fluorescent lamp	Mercury line + Phosphor	52–100 (white)	8,000–20,000	2,700–5,000*	White (various color temperatures), as well as saturated colors available	15–85

lamp	continuous		20,000			
Sulfur lamp	Continuous	80–110	15,000–20,000	6,000	Pale green	79
High pressure sodium	Broadband	55–140	10,000–40,000	1,800–2,200*	Pinkish orange	0–70
Low pressure sodium	Narrow line	100–200	18,000–20,000	1,800*	Yellow, no color rendering	0
LED lamp	Line plus phosphor	10–200[7] (white)	50,000–100,000	Various white from 2,700 to 6,000*	Various color temperatures , aswell as saturated colors	70–85 (white)
Electrodel esslamp	Mercury line + Phosphor	70–90 (white)	80,000–100,000	Various white from 2,700 to 6,000*	Various color temperatures , aswell as saturated colors	70–85 (white)



Different types of lights have vastly differing efficacies and color of light

The low-pressure sodium lamp is the most energy-efficient kind of electric light. For all intents and purposes, it provides a monochromatic orange-yellow glow that gives every lit image an equally monochromatic vision. As a result, it is commonly used in outdoor street lighting applications. Astronomers use low-pressure sodium lamps for street lighting because they last longer.

In contrast to large bandor continuous spectra, the light emission they produce is easily filtered.

4.1.9 MOTOR:

A motor is a mechanical instrument that generates mechanical output. The below is how a motor works: One option is to use an alternating current, which is an electric current that regularly reverses direction (AC). A safer option for lightweight, battery-powered motors like the ones we use around the house is to connect a commutator to the coil's ends. (Don't care about the pointless scientific name: "commutation" sounds a lot like "commute.") It actually means to switch back and forth, just like commuting means to go back and forth). The commutator is a metal ring separated into two halves that has the task of reversing the electric current in the coil any time the coil rotates around half a spin. Each half of the commutator is connected to one end of the coil. The battery's electric current is connected to the motor's electric terminals.

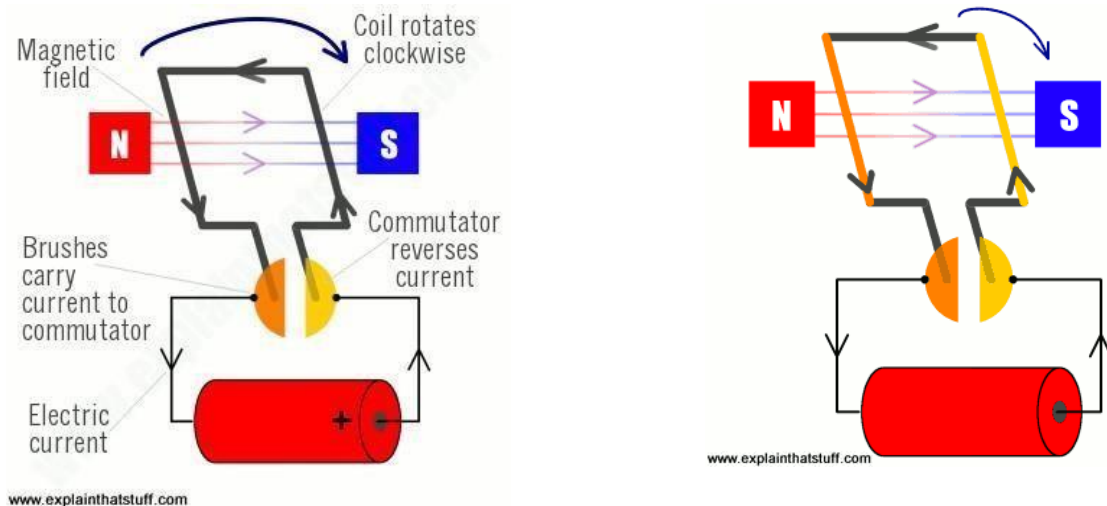


Fig 4.10 DC MOTOR

Brushes, made of graphite (soft carbon equivalent to pencil "lead") or thin lengths of springy wire, are used to feed electric power into the commutator. They "rub" against the commutator, as the name implies. As electricity flows through the circuit with the commutator in place, the coil will continue to spin in the same direction.

Components



Fig 4.11 ROTOR

The rotor, which turns the shaft to deliver mechanical power, is the moving component of an electric motor. Conductors are normally woven into the rotor to hold currents, which interfere with the stator's magnetic field to produce the forces that spin the shaft. Alternatively, certain rotors contain permanent magnets, with the conductors held by the stator.

Bearings

Bearings stabilise the rotor and allow it to rotate around its axis. The engine housing, in fact, supports the bearings. The engine shaft travels from the inside of the motor to the outside, where the load is applied, through the bearings. As a result

The load is said to be when its forces are exerted outside the outermost bearing.

Spectator

The stator, which is normally made up of windings or permanent magnets, is the stationary component of the motor's electromagnetic circuit. The stator heart is made up of laminations, which are thin metal sheets. Laminations are used to minimise energy losses that would occur for a solid core.

a void of air

The air gap is the distance between the rotor and the stator. The air gap has significant consequences and should be kept as small as possible. A big gap has a significant negative impact on results. It is the primary cause of motors' low power factor activity. The air gap raises the magnetising current. As a result, the air gap should be kept to a minimum. In addition to noise and losses, very small gaps can cause mechanical issues.

Windings

When energised with current, windings are wires that are laid in coils and wound around a laminated soft iron magnetic core to form magnetic poles. A shaded-pole motor has a winding around a portion of the pole that causes the magnetic field process for that pole to be delayed. The transformer isolates the power supply from the power line by stepping up or down the input line voltage. The rectifier portion transforms the alternating current signal into a pulsing direct current signal.

There are two types of magnet field pole configurations in electric machines: salient-pole and non-salient-pole configurations. The magnetic field of the pole in the salient-pole machine is generated by a winding wrapped around the pole below the pole face. The winding is distributed in pole face slots in the nonsalient-pole, distributed sector, or round-rotor machine. [number 60] A shaded-pole motor has a winding around a portion of the pole that causes the magnetic field process for that pole to be delayed.

Few motors have thicker metal conductors, such as bars or sheets of metal, which are normally copper but may also be aluminium. Electromagnetic induction is often used to operate these devices.

Commutator



Fig 4.12 COMMUTATOR

it's the pipe As the rotor rotates from pole to pole, the armature current is supplied by stationary brushes in contact with the spinning commutator, which induces necessary current reversal and adds power to the system in an optimised fashion. The motor would come to a halt if there was no current reversal. Externally commutated induction and permanent-magnet motors are displacing electromechanically commutated motors as a result of improved developments in the electronic-controller, sensor-less-control, induction-motor, and permanent-magnet-motor sectors. it's the pipe The armature current of the motor is supplied by stationary brushes in contact with the rotating commutator.

Motor supply and control

Motor supply

As previously mentioned, a DC motor is normally driven by a slip ring commutator. Commutation in AC motors may be either slip ring commutator or externally commutated, fixed-speed or variable-speed power, and synchronous or asynchronous. Universal motors can operate on either AC or DC power sources.

Motor control

Direct-on-line or soft-start starters are available for fixed-speed operated AC motors.

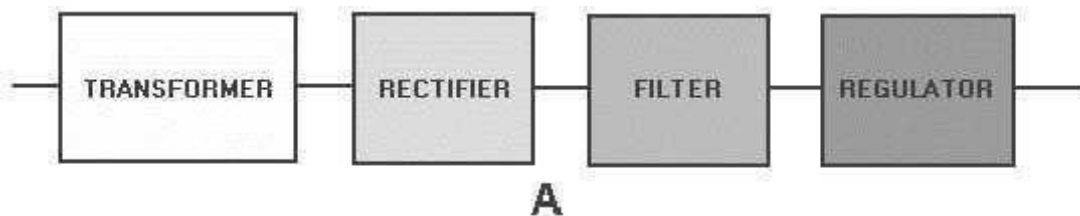
A variety of power inverter, variable-frequency drive, and electronic commutator technologies are available for variable-speed operated AC motors.

Typically, the term "electronic commutator" refers to self-commutated brushless DC motors and switched reluctance motors.

4.1.10 POWER SUPPLY:

DEFINITION:

A power supply (also known as a power supply unit or PSU) is a computer or system that provides electrical or other forms of energy to one or more output loads. The concept is most widely used to describe electrical energy sources, with mechanical energy sources being used less often and some being used only occasionally.



Block diagram of a basic power supply

The transformer isolates the power supply from the power line by stepping up or down the input line voltage. The rectifier portion transforms the alternating current signal into a pulsating direct current signal. However, as you progress through this part, you'll discover that pulsating dc isn't a good idea. To transform pulsating dc to a purer, more suitable type of dc voltage, a filter segment is used.

The regulator, the final part, does just as its name suggests. It keeps the power supply's output steady in the face of significant variations in load current or input line voltages. Let's trace an AC signal through the power supply now that you know what each segment does. You must also examine how this signal is changed inside each part of the power supply. You'll see how these modifications happen later in the chapter. An input signal of 115 volts AC is added to the transformer's main in view B of figure 4-1. The transformer is a one-to-three turn-ratio step-up transformer. The value of this transformer can be calculated by multiplying the input voltage by the ratio of main to secondary turns; thus, the output voltage is $115 \text{ volts AC} \times 3 = 345 \text{ volts ac}$ (peak-to-peak). The rectifier's output would be one-half, or roughly 173 volts of pulsating DC, since each diode in the rectifier segment conducts for 180 degrees of the 360-degree supply. The filter section, a network of resistors, capacitors, or inductors, controls the rise and fall time of the varying signal. The rise and fall time of the changing signal is regulated by the filter portion, which is made up of a network of resistors, capacitors, and inductors. As a result, the signal maintains a more consistent DC frequency. In the discussion of the real filter circuits, we can see the filter process more clearly. The filter's output is a signal of 110 volts dc with ac ripple on the dc. The lower voltage (average voltage) would be due to

explanatory The regulator retains a steady 110-volt dc standard in its output, which is used for electronic equipment (more commonly called the load).

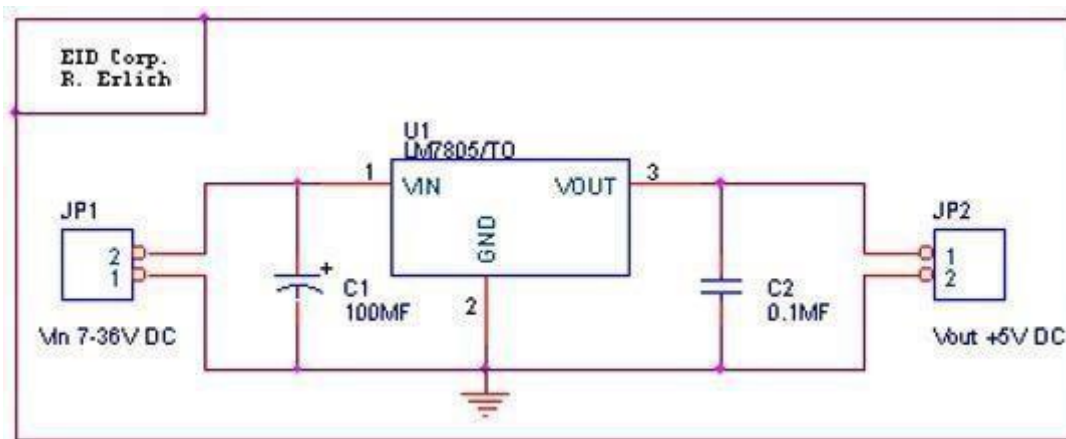
Simple 5v supply for digital circuits

- Process in a nutshell: Produces a well-regulated +5V output with a 100 output current capability.
- Overheating safety: When the regulator IC becomes too high, the built-in overheating protection shuts down the performance.
Circuit complexity: Very basic and straightforward to build.
- Circuit performance: Very stable +5V output voltage and consistent running.
- Part availability: Simple to obtain; requires only very similar basic components.
- Applications: Minimal laboratory power source, part of electronics equipment.
- Voltage of power supply: DC 8-18V unregulated power supply
- Current supplied by the power supply: required output current + 5 mA

Circuit description

This is a simple +5V power supply that comes in handy when working with digital electronics. This transformers are inexpensive, but their voltage control is typically low, making them unsuitable for digital circuit experimentation unless better regulation can be accomplished in some way.

This circuit will provide +5V output at around 150 mA current, but it can be improved to 1 A if the 7805 regulator chip is properly cooled. Overload and terminal security are built into the circuit.



Circuit diagram

Circuit diagram of the power supply:

The capacitors must have a high enough voltage level to comfortably accommodate the circuit's input voltage. The circuit is simple to incorporate into a Vero board. The 7805 regulator IC's pinout.

4.1.10.1 Voltage that is not controlled

4.1.10.2 Terrain

4.1.10.3 Output voltage is controlled

LIST OF COMPONENTS

7805 regulator IC (4.1.10.3.1).

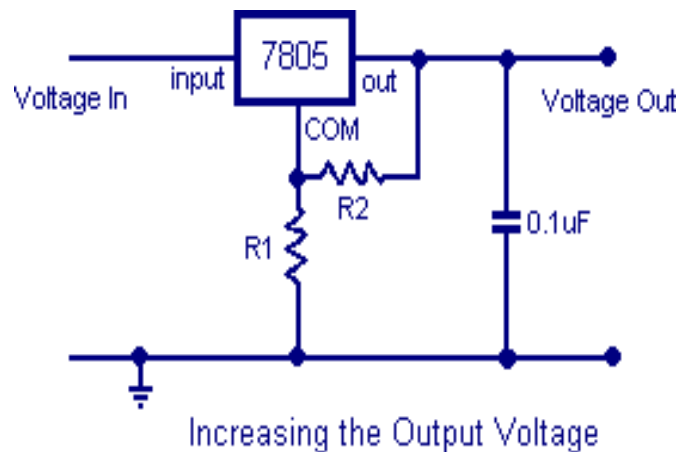
4.1.10.3.2 100 uF electrolytic capacitor with a voltage value of at least 25V

4.1.10.3.3 10 uF electrolytic capacitor with a voltage value of at least 6V

MORE OUTPUT CURRENT

If we need more than 150 mA of output current, we can increase it to 1A by making the following changes:

- Replace the transformer that delivers power to the circuit with one that can provide as much current as we need from the source.
- Mount the 7805 regulators on a heat sink (so big that it does not overheat because of the extra losses in the regulator)



MORE OUTPUT CURRENT

OTHER OUTPUT VOLTAGES

If we need voltages other than +5V, we can change the circuit by replacing the 7805 chips with another regulator from the 78xx chip family with a different output voltage. The output voltage is determined by the last numbers in the chip code. In order for the regulator to operate properly, the input voltage must be at least 3V higher than the regulator output voltage.

4.2 SOFTWARE REQUIREMENTS:

4.2.1 ARDUINO IDE:

Although the Arduino IDE is extremely simple, it offers a nearly complete environment for most Arduino-based projects. The regular options are “File” (new, load, save, etc.), “Edit” (fonts, copy, paste, etc.), “Sketch” (for compiling and programming), “Tools” (useful options for checking projects), and “Help” in the top menu bar. The IDE's middle section is a plain text editor where you can type in your programme file. The output window at the bottom of the IDE is used to see the state of the compilation, how much memory has been used, any bugs encountered in the software, and a variety of other helpful messages.

Fig 4.13 ARDUINO IDE



Sketches are projects created using the Arduino that are written in a trimmed-down version of C++ (a variety of C++ features are not included). There are a range of device-specific libraries available since programming a microcontroller differs from programming a machine (e.g., changing pin modes, output data on pins, reading analog values, and timers). Users who believe Arduino is coded in a "Arduino script" will be confused by this. The Arduino, on the other hand, is written in C++. It simply makes use of device-specific libraries.

The 6 Buttons

Though more sophisticated projects will make use of the IDE's built-in software, the majority of projects will depend on the six buttons underneath the menu bar.



The button bar

2.2.3. The check mark is used to ensure that your code is right. When you've finished writing your code, click here.

4.2.3.2 The arrow causes your code to be uploaded to the Arduino and run.

4.2.3.10

A new file would be generated by using the dotted pad.

4.2.3.35

To open an existing Arduino prototype, use the upward arrow.

4.2.3.10

The new file is saved by using the downward arrow.

4.2.3.18

A serial monitor is available on the far right switch, which can be used to send data from the Arduino to the PC for debugging purposes.



The GNU General Public License, version 2 is used to licence the IDE's source code. The Arduino IDE uses special code structuring rules to support the languages C and C++. The Wiring project includes a programme library that is included with the Arduino IDE that provides several standard input and output procedures.

User-written code only needs two simple functions to start the sketch and the main programme loop, which are compiled and connected into an executable cyclic executive programme with the GNU toolchain, which is also included with the IDE distribution. [5] The Arduino IDE uses the avrdude software to translate executable code into a text file in hexadecimal encoding, which is then loaded into the Arduino board's firmware through a loader programme.

Sketches are projects created using the Arduino that are written in a trimmed-down version of C++ (a variety of C++ features are not included). Since programming a microcontroller differs from programming a computer,

There are a variety of device-specific libraries available while programming a machine (e.g., changing pin modes, output data on pins, reading analogue values, and timers). Users who believe Arduino is coded in a "Arduino script" will be confused by this. The Arduino, on the other hand, is written in C++. It simply makes use of device-specific libraries.

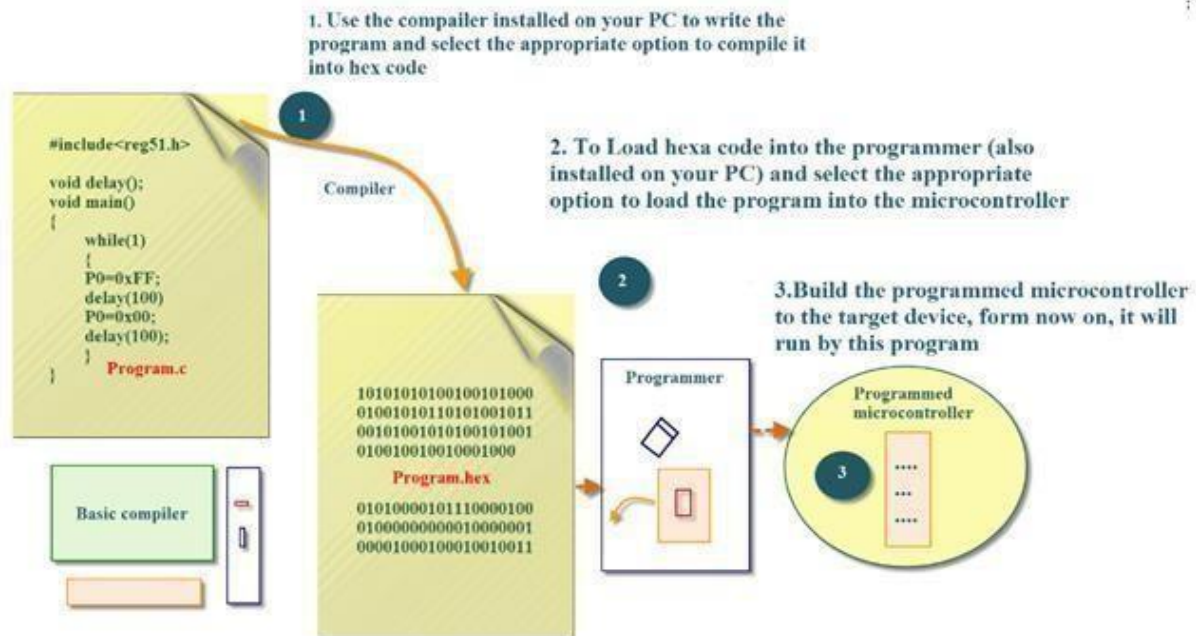
The Arduino IDE uses special code structuring rules to support the languages C and C++. The Wiring project includes a programme library that is included with the Arduino IDE that provides several standard input and output procedures. User-written code only needs two simple functions to start the sketch and run the main programme loop, which are compiled and connected with a programme stub `main()` into an executable cyclic executive programme using the GNU toolchain, which is also included with the IDE delivery.

The avrdude software is used by the Arduino IDE to convert executable code to a text file in hexadecimal encoding, which is then loaded into the Arduino board's firmware through a loader application.

4.2.2 EMBEDDED C:

Embedded C is the most widely used programming language in the electronics industry for creating electronic devices. Embedded software is connected with each processor used in an electronic device.

Embedded C programming is important for the processor to execute complex tasks. We use a variety of electronic gadgets in our daily lives, such as a cell phone, a washing machine, a portable camera, and so on. All of these devices are controlled by a microcontroller that is programmed in embedded C.



The Embedded C code in the block diagram above is used to wink the LED attached to the microcontroller's Port0.

C coding is favoured over other languages in embedded machine programming. Because of the following factors:

- Easy to understand
- High Reliability
- Portability
- Scalability

A programming language is a set of one or more functions that are used to perform a specific task. A function is a collection of statements that are used to perform a specific task.

Application software, which provides features on a device, is common to the majority of customers. Embedded tech, on the other hand, is less apparent but no less complex. Embedded software, unlike application software, has set hardware.

requirements and capabilities, and addition of third-party hardware or software is strictly controlled.

Embedded software must contain the necessary device drivers at the time of manufacture, and device drivers are written specifically for the hardware. The programme is extremely reliant on the CPU and the specific chips used. Most embedded software engineers have a basic understanding of reading schematics and component data sheets to assess register and communication system use. Bit modulation and conversion of decimal, hexadecimal, and binary are both helpful.

While XML files and other output may be forwarded to a device for display, web applications are seldom used. SQL files, as well as file systems with directories, are usually not present.

A cross compiler, which runs on a computer but produces executable code for the target platform, is needed for software development. An in-circuit simulator, JTAG, or SWD is needed for debugging. The source code for the kernel (OS) is often available to software developers.

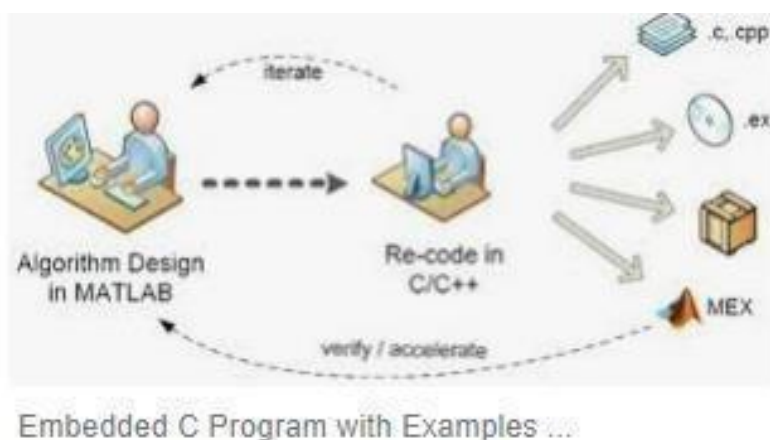
The disc memory and RAM sizes will differ greatly. Some systems have 16 KB of Flash and 4 KB of RAM and an 8 MHz CPU, while others will compete with modern computers. [eight] Because of the space constraints, more work is performed in C or embedded C++ rather than C++. Interpreted languages such as BASIC (while Parallax Propeller can use compiled BASIC) and Java (Java ME Embedded 8.3[9] is usable for ARM Cortex- M4, Cortex- M7 microcontrollers, and older ARM11 used in Raspberry Pi and Intel Galileo Gen. 2) are not widely used; however, an implementation of the interpreted Python 3 language – Micro Python – is available expressly for the Raspberry Pi and Intel Galileo Gen.

microcontroller use, e.g. 32-bit ARM-based (such as BBC micro:bit) and 16-bit PIC microcontrollers.

It is critical to communicate between processors and between one processor and other components. I2C, SPI, serial ports, and USB are all standard protocols in addition to direct memory addressing.

Companies such as Inter Niche Technologies and CMX Solutions provide closed source communications protocols for embedded systems. uIP, lwip, and other open-source protocols are examples.

- Using regular variables, this programme demonstrates how to use structure within structure in C. In this curriculum, the “student college detail” structure is declared within the “student detail” structure. Both structure variables are essential. Members of the “student college detail” structure are accessed using the 2 dot(.) operator, while members of the “student” structure are regular structure variables.



CHAPTER-5

RESULT

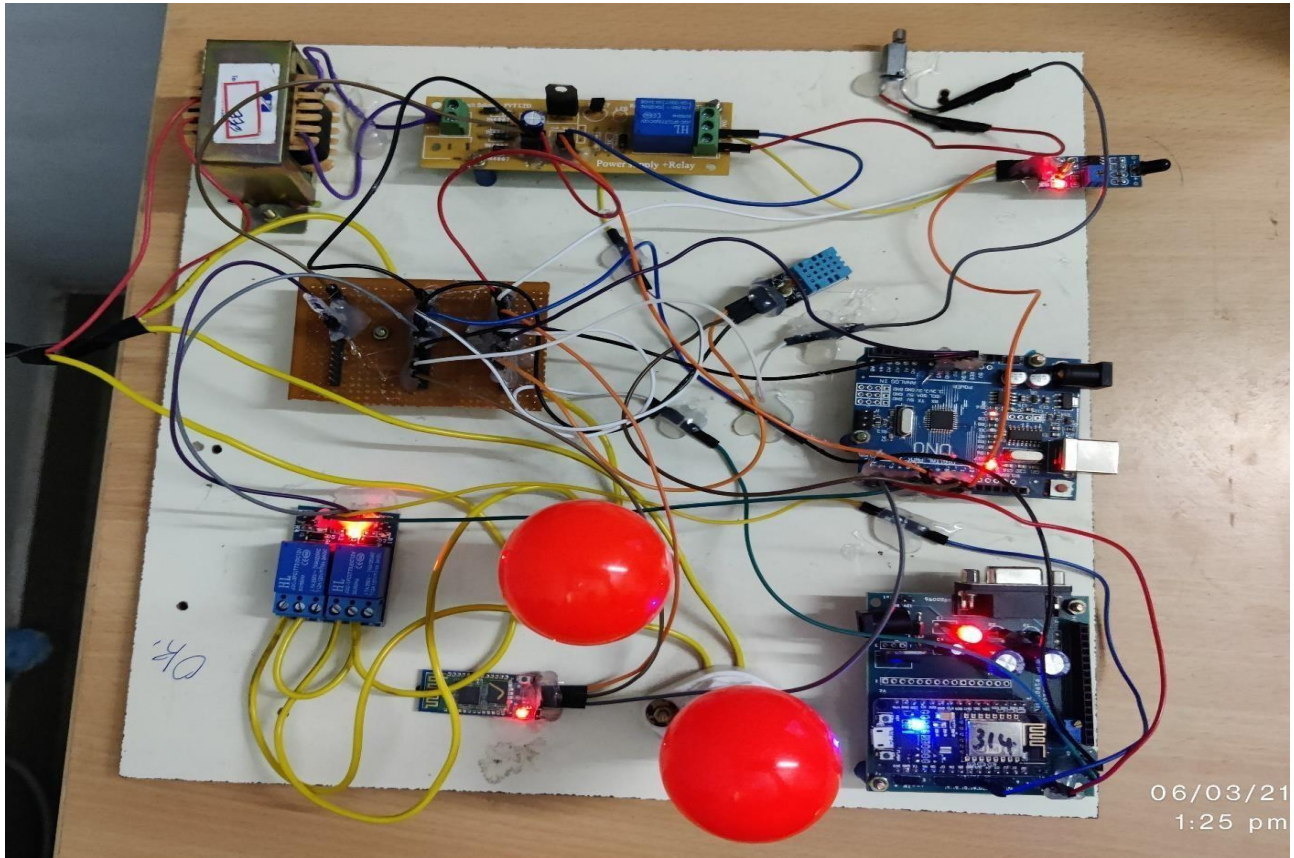


Fig. 5.1. Demonstration

CHAPTER-6

CONCLUSION

With the pressure to keep up with ever-changing market demands, the Internet of Things enables businesses to be more flexible and aggressive in their pursuit of new revenue sources and business models. It has the power to transform the way money is spent on constructing, repairing, and improving infrastructures for a variety of unrelated items. Internet-of-things is a modern means of realising market mobility and quicker speed of growth by providing new end-customer software offerings based on data derived from various linked devices. These IoT technologies have begun to appear in a variety of sectors, including smart cities, smart energy, healthcare, logistics and shopping, transportation, and so on. However, there is little knowledge on the use of IoT in the industrial automation domain for efficient and collective automation (538). Design and test implementation of a simple automation framework based on SMS technology and voice recognition was presented in this article. When automating an industrial load that is not apparent, the fault detection device in this configuration assists the customer in ensuring that their industrial items have turned ON or OFF precisely as they should. There will be two ON and OFF commands for each industrial load. The automation of two loads, such as a fan and a lamp, was checked using a personal computer and four voice commands. When a user generates his own profile and automates the load, the accuracy of speech recognition improves significantly. Other users who have been given permission to simplify the user's load will use the user profile to improve the performance of speech recognition on the same device.

Finally, we see the remaining problems inside sophisticated, long-lived industrial automation systems with proprietary solutions. Additional difficulties in incorporating these long-lived systems and advanced IoT solutions will emerge as a result of bringing industrial IoT into these systems, linking various long-lived systems, and developing new services focused on fast-paced technology – this has so far been relatively unaddressed by the Industrial IoT group, and remains a potential research path.

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