TSUNAMI ALERT AND DETECTION

A MINOR PROJECT - II REPORT

Submitted by

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(Autonomous)

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BONAFIDE CERTIFICATE

Certified that this **18ECP104L - Minor Project II** report "**TSUNAMI ALERT AND DETECTION"** is the bonafide work of " VIDHYA SHREE S (927621BEC239), SIVAPRIYA S (927621BEC200), VINOTHA P (927621BEC241), SHOBIKA S (927621BEC198) who carried out the project work under my supervision in the academic year **2021-2025 - EVEN**.

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This Minor project-III report has been submitted for the **18ECP104L – Minor Project-II** Review held at M. Kumarasamy College of Engineering, Karur on12-04-2023**.**

PROJECT COORDINATOR

INSTITUTION VISION AND MISSION

Vision

To emerge as a leader among the top institutions in the field of technical education.

Mission

M1: Produce smart technocrats with empirical knowledge who can surmount the global challenges.

M2: Create a diverse, fully -engaged, learner -centric campus environment to provide quality education to the students.

M3: Maintain mutually beneficial partnerships with our alumni, industry and professional associations

DEPARTMENT VISION, MISSION, PEO, PO AND PSO

Vision

To empower the Electronics and Communication Engineering students with emerging technologies, professionalism, innovative research and social responsibility.

Mission

M1: Attain the academic excellence through innovative teaching learning process, research areas & laboratories and Consultancy projects.

M2: Inculcate the students in problem solving and lifelong learning ability.

M3: Provide entrepreneurial skills and leadership qualities.

M4: Render the technical knowledge and skills of faculty members.

Program Educational Objectives

PEO1: Core Competence: Graduates will have a successful career in academia or industry associated with Electronics and Communication Engineering

PEO2: Professionalism: Graduates will provide feasible solutions for the challenging problems through comprehensive research and innovation in the allied areas of Electronics and Communication Engineering.

PEO3: Lifelong Learning: Graduates will contribute to the social needs through lifelong learning, practicing professional ethics and leadershipquality

Program Outcomes

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, anddemonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1: Applying knowledge in various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of Engineering application.

PSO2: Able to solve complex problems in Electronics and Communication Engineering with analytical and managerial skills either independently or in team using latest hardware and software tools to fulfil the industrial expectations.

Abstract	**Matching with POs, PSOs**
Tsunami detection, Disaster, Protocols, Algorithm, Sensors, Technology	**PO1, PO2, PO3, PO5, PO7,PO8, PO9, PO12, PSO1, PSO2**

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ABSTRACT

Tsunami Early Warning System (TEWS) is built for minimizing impact of tsunami disaster. The generic system consists of two components: the first is sensor network for tsunami detection and the second is interconnected communication infrastructure for evacuation notification. In this paper, additional sensor based on computer vision technology is proposed for observing ocean and wave condition. This technology, combined with other sensors technology, will increase the effectiveness of the TEWS.

IOT-based tsunami forecasting system is an IOT smart device that acts as a tsunami alert and monitoring system and has the ability to communicate via the Internet. Therefore, it is necessary to conduct studies and research in the field of tsunami management with the approach of minimizing financial and human losses. Tsunami detection is also one of the major problems, which is solved by using IoT. Tsunami alert and detection are important for avoiding the human death. So to solve these problems different techniques, algorithms, protocols are proposed by authors using IoT. In this paper, we have studied different papers on Tsunami detection and alert system for the survey. This paper is very helpful for new researchers and IoT learners.

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LIST OF ABBREVIATIONS

TEWS	Tsunami Early Warning System
HTML	Hypertext Markup Language
SCI	Serial Communication Interfaces
EEPROM	Electrically Erasable Programmable Read-only Memory
USB	Universal Serial Bus
PSU	Power Supply Unit

CHAPTER 1

INTRODUCTION

1.1 PROJECT DETAILS

Tsunami Early Warning System (TEWS) is built for minimizing impactof tsunami disaster. The generic system consists of two components: the first is sensor network for tsunami detection and the second is interconnected communication infrastructure for evacuation notification. In this paper, additional sensor based on computer vision technology is proposed for observing ocean and wave condition. This technology, combined with other sensors technology, will increase the effectiveness of the TEWS.

1.2 DESCRIPTION

The objective of ITEWS is to detect, locate, and deter- mine the magnitude of potentially tsunami genic earthquakes occurring in the Indian Ocean Basin and to provide timely advisories to the vulnerable community following a standard operating procedure (SOP) by means of various available communication methods. Such system subscribers will acquire a telephonic warning, as the threatening tsunami is unrolled. [3]

1.2.1 COMPONENTS OF INDIAN TSUNAMI WARNING SYSTEM

The Indian Tsunami Early Warning System includes a continuous system of seismic stations, Bottom Pressure Recorders (BPR), tide checks and a 24X7 operational torrent cautioning focus to identify tsunamic quakes, to screen tidal waves and to furnish ideal warnings with back-end backing of situation database, helplessness displaying and Choice Support.

1.2.2 OBSERVATION NETWORKS

Bottom Pressure Recorders (BPRs) are utilized to identify the engenderingof tidal wave waves in untamed sea and subsequent ocean level changes. A system of BPRs has been introduced near the tsunamic source districts to distinguish tidal waves, by the National Organization of Sea Innovation (NIOT). These BPRs can recognize changes of 1 cm at water profundities up to 6 km. A system of flowing checks (Figure 1) along the coast assists with observing the advancement of a tidal wave and to approve the model situations. Close continuous information from national and universal focuses is being gotten through VSAT correspondence and web individually.

CHAPTER 2

LITERATURE SURVEY

2.1 Cautionary Tales and Education Saves Lives from Tsunamis

Some 78,000 people were living on Simeulue Island, off the west coast of Aceh, Indonesia, at the time of the 2004 Indian Ocean tsunami. Most lived along the coast in villages the tsunami would strike. The tsunami began coming ashore as soon as eight minutes after the shaking stopped and too soon for official warnings. Although hundreds of thousands of lives were lost elsewhere, only seven people onSimeulue died. What saved thousands of lives was knowledge of when to run to higher ground. This knowledge had been passed down within families over the years by repeating tales of smong—a local term that entails earthquake shaking,thewithdrawal of the sea beyond the usual low tide, and rising water that runs inland. Smong can be traced to a tsunami in 1907 said to have taken thousands of Simeulue lives and reminders of that event reinforced the story, such as victims' graves, a religious leader's grave untouched by the tsunami, and coral boulders in rice paddies. After any felt earthquake, a family member would mention the smongof 1907 and often concluded with this kind of lesson: "If the ground rumbles and if the sea withdraws soon after, run to the hills before the sea rushes ashore." By contrast on mainland Aceh, where education had suffered from years of military conflict, only a tiny fraction of the population used the giant 2004 earthquake as a tsunami warning. After the initial earthquake, many people gathered outdoors, fearing further damage from aftershocks. Most missed their opportunity to evacuate—a time window of 20 minutes on western mainland shores and 45minutes in downtown Banda Aceh.1

2.2 Increasing the Effectiveness of Public Education of Tsunamis

Although tasked to review the availability and adequacy of tsunami education and out-reach for children, adults, and tourists, the committee discovered it could not fully comment on

a pilot tsunami awareness program in 2004. The goal was to develop a comprehensive tsunami outreach program that reached various segments of the community through multiple channels and outreach types. Baseline measurements followed by post-outreach assessments were integral to gauging the influence of outreach efforts on public knowledge of and capacity to respond to future tsunamis. The outreach efforts were managed by a tsunami outreach coordinator, made possible with NTHMP funding, and were primarily driven by the involvement of more than 50 volunteers, including local students, retired residents, and officials.

The tsunami awareness program was based on five outreach strategies designed to reach target audiences and provide multiple channels for learning: a neighborhood educator project had volunteers going door to door to discuss tsunami issues with homeowners; a business workshop focused on improving the business community's emergency plan and preparedness planning; a school outreach program educated elementary-school children through auditorium-style presentation and activities and middle-school youth through small-group discussions; a public workshop was geared for involving the community and tourists in discussing tsunami preparedness; and a tsunami-evacuation drill was runat the end of the outreach program as a chance for individuals to practice what theyhad learned.

Surveys were conducted before and after the various outreach strategies to determine their influence on public understanding of tsunamis and their preparedness to future events. Post-outreach surveys indicate that 68 percent of Seaside households received information and more than 2,200 people participated in outreach events. The surveys documented measurable differences in tsunami knowledge and preparedness of Seaside community members because of the various outreach efforts. The project demonstrated that each of the five strategies served a different role to fully prepare the community and create a culture of awareness. Project organizers concluded that program success was largely due to the “people-to-people, face-to-face discussions” at each event. An important next step is to see if and how these lessons could be transferred to larger communities (e.g., Los Angeles, Honolulu) where social networks are more complicated and the magnitude of people in tsunami hazards is much greater.

2.3 A review of tsunami detection technology

This paper focuses on the different technologies that can be used to detect tsunamis, such as seismometers, pressure sensors, and acoustic systems. The authors compare the advantages and limitations of each technology and discuss their suitability for different types of coastal environments.

This paper describes a new approach to tsunami detection and forecasting, which involves using real-time data from ocean sensors and numerical models to predict the extent of flooding in coastal areas. The authors discuss the potential benefits of this approach and its limitations.

Tsunamis are natural disasters that can cause significant loss of life and property damage. Therefore, early detection and warning systems are essential to minimize their impact.

This paper provides an overview of the different components of a tsunami warning system, including seismic monitoring, ocean sensors, communication networks, and public outreach. The authors also discuss the challenges of implementing such systems in different regions of the world.

2.4 A review of tsunami evacuation modeling

This paper focuses on the modeling of tsunami evacuation scenarios, which is an essential component of tsunami warning systems. The authors review different approaches to modeling, including agent-based models and network flow models, and discuss their strengths and limitations.

This paper describes a new approach to tsunami detection and forecasting, which involves using real-time data from ocean sensors and numerical models to predict the extent of flooding in coastal areas. The authors discuss the potential benefits of this approach and its limitations.

Overall, these papers highlight the importance of early detection and warning systems for tsunamis and the challenges of implementing such systems in different regions of the world. They also emphasize the need for public education and outreach to ensure that people understand the risks and know how to respond in the event of a tsunami.

CHAPTER 3

EXISTING SYSTEM

A tsunami alert and detection system is an essential tool for early warning and mitigation of the impacts of tsunamis. Such a system typically involves the use of various sensors, communication networks, and software tools to detect and analyze data related to tsunami events.

3.1 Seismic sensors

Seismic sensors are the primary tools used to detect earthquakes, which are often the cause of tsunamis. These sensors detect ground movements and can provide early warning of potential tsunamis.

3.2 Buoy networks

Buoy networks are a key component of many tsunami alert and detection systems. These buoys are equipped with sensors that can detect changes in sea level and pressure, which can indicate the presence of a tsunami.

A variety of software tools are used to process and analyze the data collected by sensors and buoys. This software can identify potential tsunamis and provide early warning alerts to those in the affected areas.

Finally, effective evacuation plans are critical to ensuring that those in the affected areas are able to quickly and safely evacuate to higher ground or other safe areas.

Overall, a well-designed tsunami alert and detection system can save countless lives and help to mitigate the impacts of tsunamis on vulnerable coastal communities.

CHAPTER 4

PROPOSED SYSTEM

In this project, we propose a tsunami alert and detection system that uses a combination of sensors and communication technologies to detect and notify people of p1otential tsunami events.

Seismic sensors will be installed in the ocean floor to detect earthquakes that could potentially cause tsunamis. These sensors will measure the intensity and duration of the earthquake and send the data to the central processing unit (CPU).

Buoy sensors will be installed in the ocean to detect changes in water level and pressure caused by a tsunami. These sensors will send the data to the CPU.

he system will use satellite communication to send the alerts and warnings to the concerned authorities, media channels, and general public.

When an earthquake occurs, the seismic sensors will detect the intensity and duration of the quake. If the earthquake exceeds a certain threshold, the system willactivate the tsunami detection process. The buoy sensors will detect the changes in water level and pressure caused by the tsunami and send the data to the CPU. The GPS sensors will track the movement of the tsunami and predict its path.

The CPU will analyze the data from the seismic, buoy, and GPS sensors to determine if a tsunami is likely and calculate its potential impact. If the system detects a potential tsunami, it will send out an alert to the concerned authorities, media channels, and general public through satellite communication.

CHAPTER 5

WORKING PRINCIPLE

BLOCK DIAGRAM

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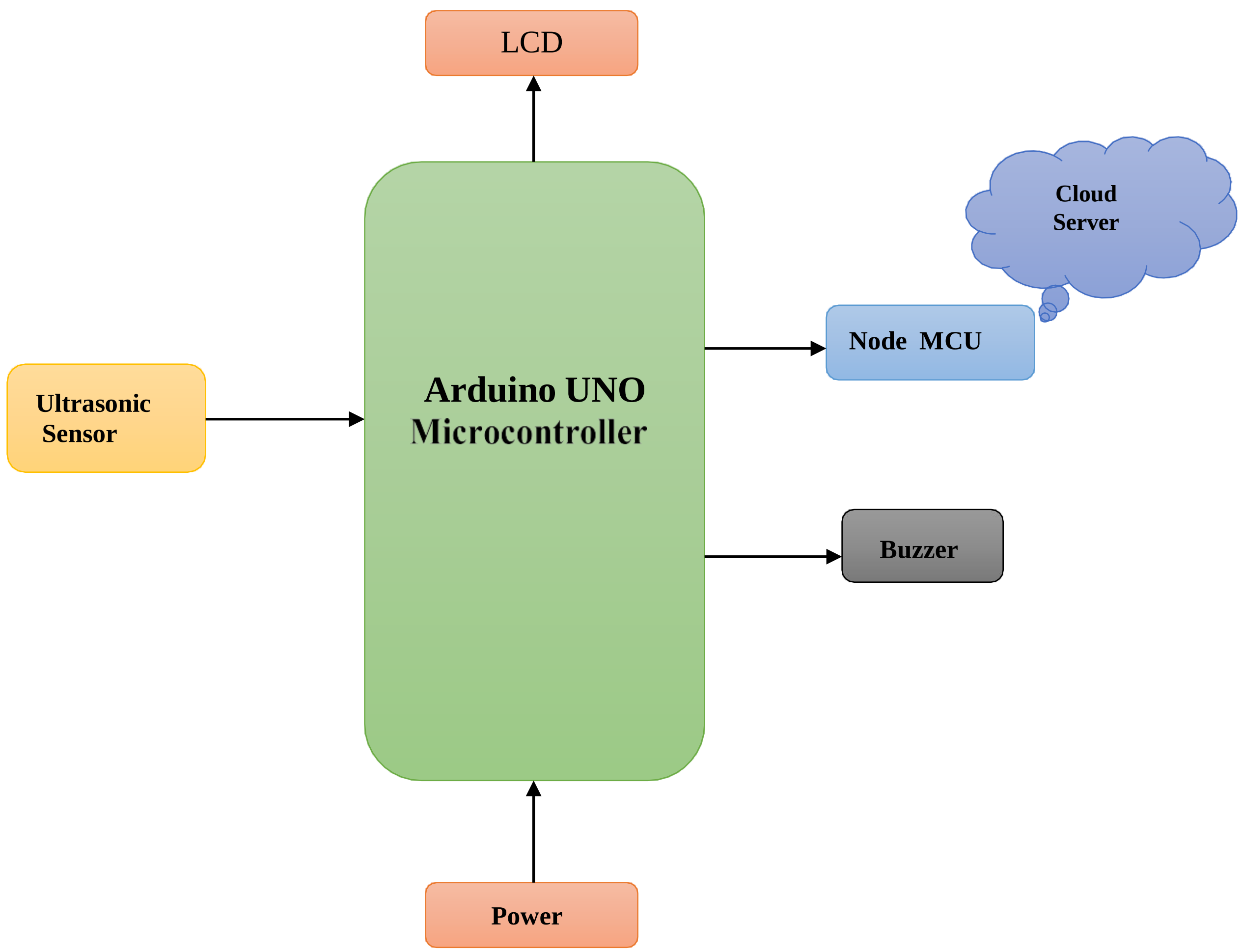


Fig 5.1 Tsunami alert and detection system

The working principle of a buzzer depends on the theory that, once the voltage is given across a piezoelectric material, then a pressure difference is produced. A piezo type includes piezo crystals among two conductors. Once a potential disparity is given across these crystals, then they thrust one conductor & drag the additional conductor through their internal property. So, this continuous action will produce a sharp sound signal.

Buzzer Circuit Diagram

The circuit diagram of the water level indicator using the buzzer is shown below. This circuit is used to sense or detect the water level within the tank or washing machine or pool, etc. This circuit is very simple to design using few components such as a transistor, buzzer, 300K variable resistor, and powersupply or 9V battery.

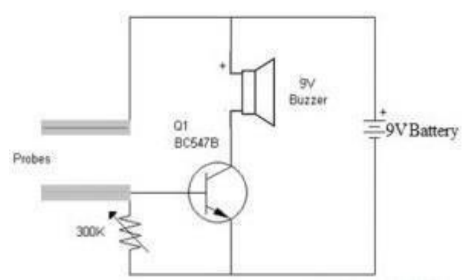


Fig 5.2 Buzzer Circuit Diagram

Once the two probes of the circuit are placed in the tank, it detects the level of water. Once the water level exceeds the fixed level, then it generates a beep sound through a buzzer connected to the circuit. This circuit uses a BC547B NPN transistor however we can also use any general-purpose transistor instead ofusing 2N3904/2N2222. This water level sensor circuit working is very simple and the transistor used within the circuit works as a switch. Once the two probes notice the water level within the tank, then the transistor turns ON & the voltage begins flowing throughout the transistor to trigger the buzzer.

Advantages

- Simply Compatible, Frequency Response is Good, Size is small
- Energy Consumption is less, The Range of Voltage usage is Large
- Sound Pressure is high Disadvantages
- Controlling is a little hard
- Generates Annoying Sound
- Training is necessary to know how to repair the condition without just turning off.

Applications

- Communication Devices, Electronics used in Automobiles, Alarm Circuits
- Portable Devices, Security Systems, Timers, Household Appliances
- Electronic Metronomes, Sporting Events, Annunciator Panels, Game Shows

LCD DISPLAY

Liquid crystal cell displays (LCDs) are used in similar applications where LEDs are used. These applications are display of display of numeric and alphanumeric characters in dot matrix and segmental displays.

LCDs are of two types:

- Dynamic scattering type
- Field effect type

A liquid crystal display (LCD) is an electronically-modulated optical device shaped into a thin, flat panel made up of any number of color or monochrome pixels filled with liquid crystals and arrayed in front of a light source (backlight) orreflector. It is often utilized in battery-powered electronic devices because it uses very small amounts of electric power. LCD has material, which continues the properties of both liquids and crystals.

Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered from similar to a crystal.

LCD consists of two glass panels, with the liquid crystal materials sandwiched in between them. The inner surface of the glass plates is coated with transparent electrodes which define in between the electrodes and the crystal, which makes the liquid crystal molecules to maintain a defined orientation angle. When a potential is applied across the cell, charge carriers flowing through the liquid will disrupt the molecular alignment and produce turbulence.

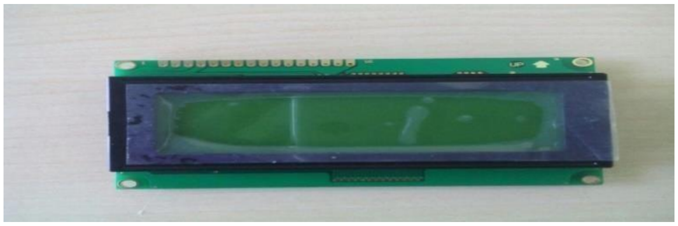


Fig 5.3 LCD

LCD Pin Descriptions:

The function of each pins of LCD is described below **VCC, VSS and VEE** while v and v provide +5v and ground, respectively, v is used for controlling LCD contrast.

RS, register select

There are two very important registers inside the LCD. The RS pin is used for their selection as follows. If RS=0, the instruction code register is selected, allowing the user to send a command such as clear display, cursor at home, etc.if RS=1 the data register is selected, allowing the user to send data to be displayed on the LCD.

R/W, read/write

R/W input allows the user to write information to the LCD or read information from it. R/W=1 when reading; R/W=0 when writing.

E, enable

The enable pin is used by the LCD to latch information presented on 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 in the data present at the data pins.

D0 - D7

The 8-bit data pins, D0 – D7, are used to send information to the LCD or read contents of the LCD’S internal registers. There are also instruction codes that can be sent to the LCD to clear the display or force the cursor to the home position or blink the cursor. RS=0 is used to check the busy flag bit to see if the LCD is ready to receive information. The busy flag is D7 and can be read when R/W=1 and RS=0, as follows: if R/W=1, RS=0.when D7=1, the LCD is busy taking care of internal operation and will not accept any new information, when D7=0, the LCD is ready to receive new information.

Advantages

- Consume much lesser energy (i.e. low power) when compared to LEDs. Utilizes the light available outside and no generation of light.
- Since very thin layer of liquid crystal is used, more suitable to act as display elements (in digital watches, pocket calculators, ect.) Since reflectivity is highly sensitive to temperature, used as temperature measuring sensor. Very cheap.

Applications:

1. Watches
2. Fax & Copy machines & Calculators.

A POWER SUPPLY

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others. Power supplies for electronic devices can be broadly divided into linear and switching power supplies. The linear supply is a relatively simple design that becomes increasingly bulky and heavy for high current devices; voltage regulation in a linear supply can result in low efficiency. A switched- mode supply of the same rating as a linear supply will be smaller, is usually more efficient,but will be more complex.

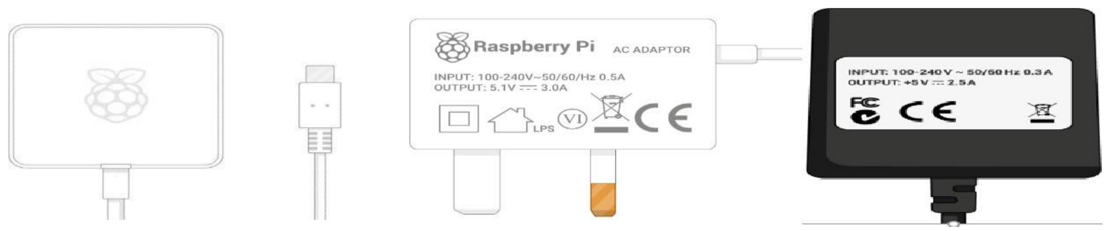


Fig 5.4 Power Supply

You need a power supply that provides:

- At least 3.0 amps for raspberry pi 4
- At least 2.5 amps for raspberry pi 3

Linear Power supply

An AC powered linear power supply usually uses a transformer to convert the voltage from the wall outlet (mains) to a different, usually a lower voltage. If it is used to produce DC, a rectifier is used. A capacitor is used to smooth the pulsating current from the rectifier. Some small periodic deviations from smooth direct current will remain, whichis known as ripple. These pulsations occur at a frequency related to the AC power frequency (for example, a multiple of 50 or 60 Hz).

The voltage produced by an unregulated power supply will vary depending on the load and on variations in the AC supply voltage. For critical electronics applications a linear regulator will be used to stabilize and adjust the voltage. This regulator will also greatly reduce the ripple and noise in the output direct current. Linear regulators often provide current limiting, protecting the power supply and attached circuit from over current.

Adjustable linear power supplies are common laboratory and service shop test equipment, allowing the output voltage to be set over a wide range.

For example, a bench power supply used by circuit designers may be adjustable up to 30 volts and up to 5 amperes output. Some can be driven by an external signal, for example, for applications requiring a pulsed output.

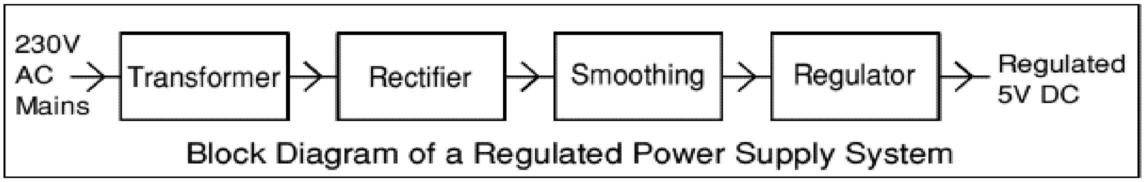


Fig 5.5 Block Diagram of a RPS

CHAPTER 6

HARDWARE AND SOFTWARE REQUIREMENTS

HARDWARE REQUIREMENTS

- Arduino UNO Motherboard
- Ultrasonic Sensor
- Node MCU
- Buzzer
- LCD Display
- Power Supply

ARDUINO

I was surprised to see a twelve-year-old boy giving life to his electronic gadgets. He was trying his hands on building his own creative toys which involved hard electronics and software skills. My zeal was on its peak to know the magical power inside the young chap. How did he understand the concepts of electronics so early? How did he develop the software? Anxiously I went down and asked him about the magic he was doing. The answer was “ARDUINO”.

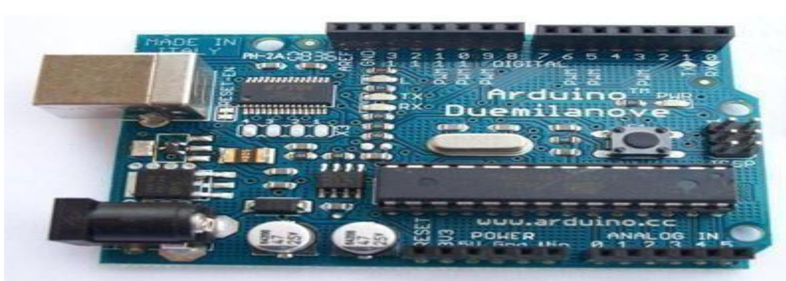


Fig 6.1 Arduino

Arduino is an open source electronics platform accompanied with a hardware and software to design, develop and test complex electronics prototypes and products. The hardware consists of a microcontroller with other electronic components which can be programmed using the software to do almost any task. The simplicity of the Arduino language makes it very easy for almost everyone who has an interest in electronics to write programs without the understanding of complex algorithms or codes. Arduino is intended for an artist, tinker, designer or anyone, interested in playing with electronics without the knowhow of complex electronics and programming skills. Arduino is an excellent designed open source platform. It has specially designed boards which can be programmed using the Ardunio Programming Language (APL). The presence of Arduino is not only spreading between hobbyists, but it has also expanded its roots in industries and used by experts for making prototypes of commercial products. Arduino takes off the efforts required in complex coding and designing hardware. The open source nature of Arduino has been the main reason for its rapid horizontal growth. Since itis an Open Source project, all the files related to hardware and software is availablefor personal or commercial use. The development cost of the hardware is very small as against the costly similar proprietary products by the industrial giants. Theopen source nature doesn’t require any licenses to develop, use, redistribute or even sell the product. But the Arduino name is trade mark protected (Arduino™) i.e., you are free to sell the Arduino board under any other name however in order to sell it under the name “Arduino” you need to take permission from the founders and follow their quality terms. The Software files which includes all the source code library are also open sourced. A user can modify them to make the project more versatile and improve its capabilities. This provides a strong online community support.

Concept of Arduino

The root of Arduino goes deep down to the development of Processing Language by MIT researchers. Processing language is an open source language designed to introduce the software development environment for the artistic people without the need of deep knowledge of programming of algorithms. Processing is based on java.

In year 2003 Hernando Barragan, a programmer developed an open source electronics development platform with software IDE, where anyone with a small knowledge in electronics and programming could use his project to give wings to their creativity. His focus was to reduce the burden of complexity in designing electronics hardware and software. The project was named as Wiring. The software IDE of the Wiring used processing language to write the codes.

As the program written in C\C++ is named as Project, in the same way the code written in Wiring (even in Processing and Arduino) is termed as Sketch. The name sketch gives a familiar look for an artist.

Wiring has predefined libraries to make the programming language easy. Arduino uses these libraries. The predefined libraries are written in C and C++. One can even write his software in C\C++ and use them on Wiring boards. The difference between writing a program in C/C++ and Wiring is that the WiringApplication Programmable Interface (API) has simplified programming style and the user doesn't require detailed knowledge of the concepts like classes, objects, pointers, etc. While sketching hardware you need to call the predefined functions and rest will be handled by the Wiring software.

The basic difference between the Processing and the Wiring is that the Processing is use to write the program which can be used on other computers while Wiring program is used on microcontrollers.

Hardware

This board is designed around the ATmega328 AVR microcontroller. It is an 8 bit microcontroller with 32KB of flash, 2KB of SRAM, 1KB of EEPROM, timers, ADC, I2C, SPI, and UART peripherals. Arduino Uno is based on ATmega328P Atmel AVR family microcontroller (MCU). This MCU has 32KB of flash, 2KB of SRAM and 1 KB of EEPROM. It has 14 digital IO pins (PORTD – 8pins, PORTC – 6 pins, PORTB – 5pins), 6 Analogue input pins, which can be sampled using on-chip ADC. It also has 6 PWM outputs multiplexed on to the digital IO pins. A 16 MHz crystal is installed on the board.

Arduino Uno Pinout

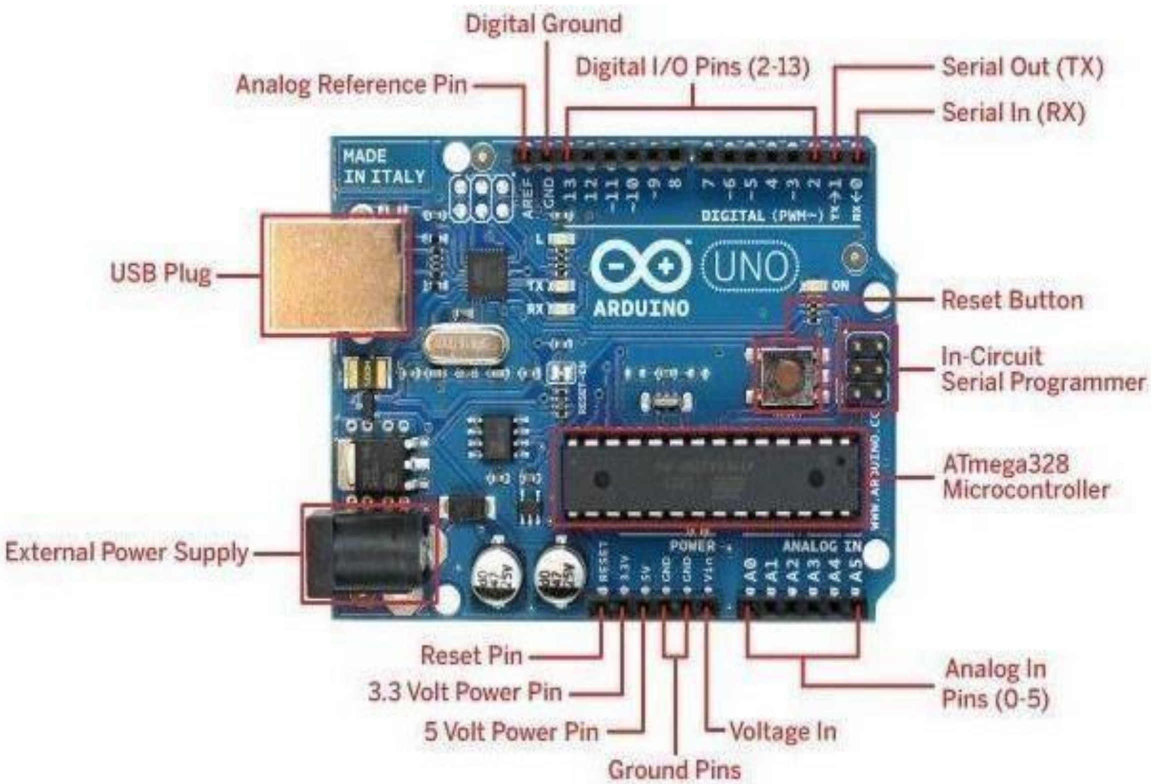


Fig 6.2 Arduino UNO pinout

External Power Supply - allows the Arduino to run when its not connected plugged into a USB port for power. It accepts between 7V- 12V of voltage.

USB Plug - This powers the Arduino without needing to use an external power supply and is what you use to upload sketches (program) to the microcontroller, and to communicate with your Arduino sketch (via Serial, println(), etc..

AtMega328 Microcontroller - The brains of the Arduino which you program through the USB plug. It contains three types of memory. It has 32KB of nonvolatile Flash memory. This is used to store applications and is stored on your board even after it is removed from it's power source. 2KB of volatile SRAM memory which is used to store variables used by applications while it's running. 1KB of EEPROM nonvolatile memory. This is used to store data that remains available even after the board is powered down and powered up again.

Pin Functions:

Power Pins (3.3 V, 5 V, GND) - Use these pins to connect to circuitry at 3.3 V, 5V, or GND. Make sure that whatever you power doesn't draw more than a few milliamps.

Serial Out (TX) and Serial In (RX) - Pins (0-1) are RX and TX respectively and used for sending and receiving serial data. This port can be used to send and receive data from a GPS module, blue tooth modules, WIFI modules, etc.

Digital I/O Pins (2-13) - Accept 0 to 5 V input or output. Utilizing tristate logic Arduino makes it easy to change between inputs and outputs in software. You can use this pin as an output where it spits out 5V for a digital 1, or 0 V for a digital 0. You can also configure it to expect a voltage on the pin and that voltage could be interpreted as a 1 or a 0. These pins are used with digital Read(), digital Write (),analog Write() works only on pins with PWM symbol.

External Interrupts - Pins 2 and 3 can be configured to trigger an interrupt on low value, a rising or falling edge, or a change in value.

PWM Pins - any pins with ~ in front of them can be used to generate pulse modulated square waves. Pins 3, 5, 6, 9, 10, and 11 provide 8-bit PWM output with the analog Write() function.

Pin 13 - drives the built in LED, that is used by Arduino to receive power and useful for debugging. When pin is HIGH value, the LED is on, when pin is LOW value, it's off.

Analog In Pins - Pins A0 through A5 provide 10 bits of resolution. Accepts 0 to 5 V inputs and is used to measure continuous voltages anywhere from 0 V to 5 V. It is possible to change the upper end of their range using the AREF pin and the analog Reference () function.

Analog Reference Pin (AREF) - input pin used optionally if you want external voltage reference for ADC rather than internal Vref. You can configure using an internal register.

Reset Pin - bring this line low to reset the microcontroller. Typically used to add a reset button to shields that block the one on the board.

Memory - The ATmega328 has 32 KB (with 0.5 KB used for the bootloader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

Communication

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega8U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '8U2 firmware uses the standard USB COM drivers, and no external driver is needed.

However, on Windows, a .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

ULTRASONIC (UV) SENSORS OR ULTRASOUND SENSORS

Bats are wonderful creatures. Blind from the eyes and yet a vision so precise that could distinguish between a moth and a broken leaf even when flying at full speed. No doubt the vision is sharper than ours and is much beyond human capabilities of seeing, but is certainly not beyond our understanding. **Ultrasonic ranging** is the technique used by bats and many other creatures of the animal kingdom for navigational purposes. In a bid to imitate the ways of nature to obtain an edge over everything, we humans have not only understood it but have successfully imitated some of these manifestations and harnessed their potential to the greatest extent.

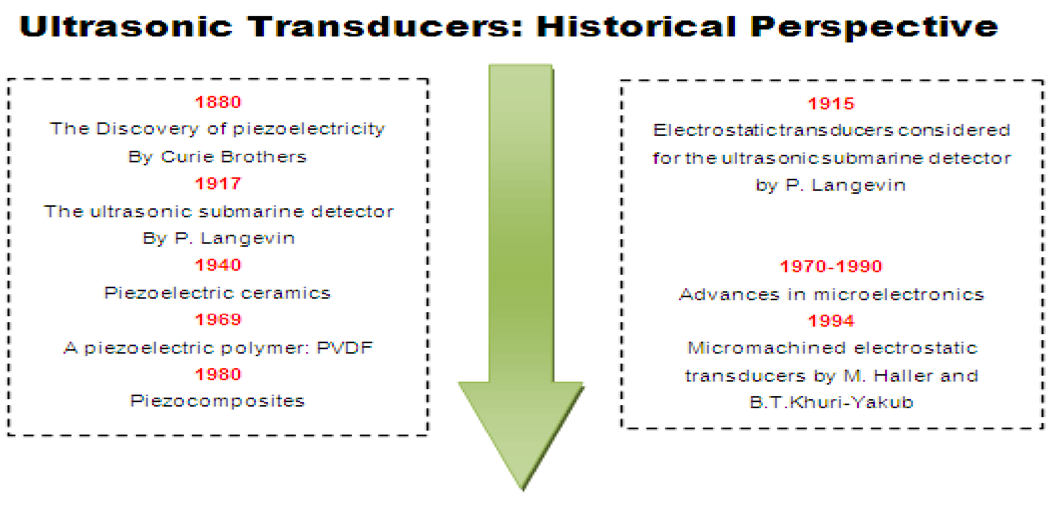


Fig 6.3 Ultrasonic Transducers:Historical Perspective

How Ultrasonic Sensors work?

Ultrasonic sensors are devices that use electrical–mechanical energy transformation, the mechanical energy being in the form of ultrasonic waves, to measure distance from the sensor to the target object. Ultrasonic waves are longitudinal mechanical waves which travel as a succession of compressions and rarefactions along the direction of wave propagation through the medium. Any sound wave above the human auditory range of 20,000 Hz is called ultrasound. Depending on the type of application, the range of frequencies has been broadly categorized as shown in the figurebelow:

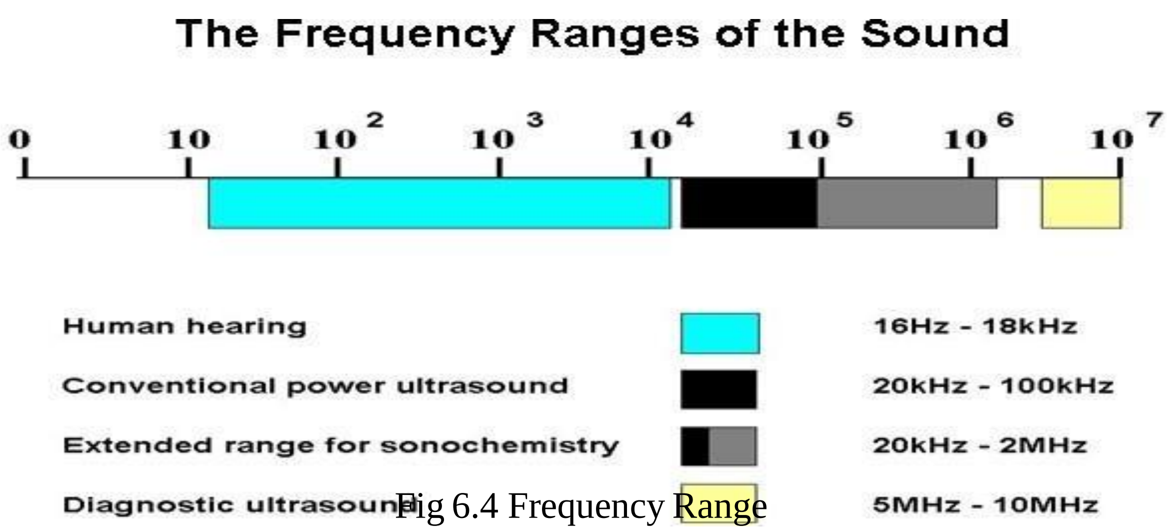
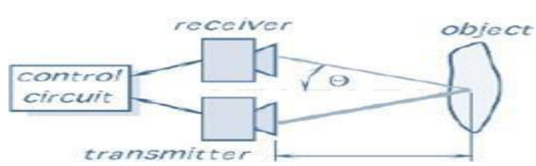


Fig 6.4 Frequency Range

When ultrasonic waves are incident on an object, diffused reflection of the energy takes place over a wide solid angle which might be as high as 180 degrees. Thus some fraction of the incident energy is reflected back to the transducer in the form of echoes and is detected. The distance to the object (L) can then be calculated through the speed of ultrasonic waves (v) in the medium by the relation

$$L = \frac{v\,t\cos\theta}{2}$$



Where ‘t’ is the time taken by the wave to reach back to the sensor and ‘’ is the angle between the horizontal and the path taken as shown in the figure. If the object is in motion, instruments based on Doppler shift are used. Get all the details about internal structure and working of an ultrasound sensor at Insight-How Ultrasonic Sensors Work.

Applications

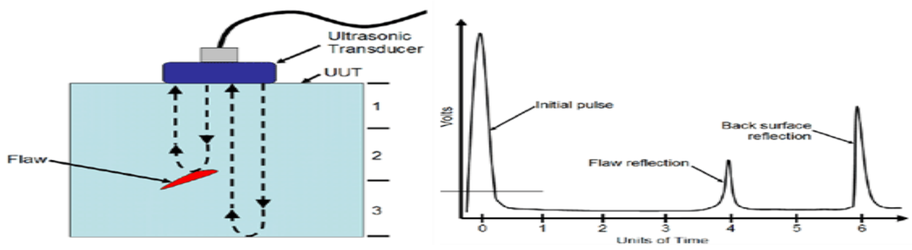
The applications of ultrasonic sensors can be classified on the basis of the property that they exploit. These can be summarized as:

Domain	**Parameter**	**Applications**
Time	Tile-of-Flight, Velocity	Density, Thickness, Flaw Detection, Anisotropy, Robotics, Remote Sensing etc.
Attenuation	Fluctuations in reflected Transmitted Signals	Defect characterization, microstructures, interface analysis
Frequency	Ultrasonic Spectroscopy	Microstructure, grain size, porosity, phase analysis.
Image	Time-of-Flight, velocity, attenuation mapping in Raster C-Scan or SARs	Surface and internal Defect imaging, density, velocity, 2D and 3D imaging.

Table 6.1 Applications of Ultrasonic Sensors

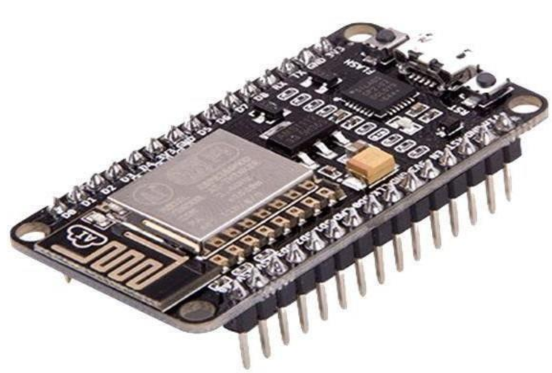
Research has been going on to overcome the problems of ultrasonic sensors, particularly in medical imaging where it is known as ultrasound. The artifacts of ultrasonic sensors like Acoustic shadowing and Acoustic Enhancement are being exploited to characterize tissues which allow the differentiation between solid and cystic tissues.

The industry too has reaped the benefits from ultrasonic sensors in applications like plastic welding, jewelry cleaning, remote sensing and telemetry, assisted parking systems etc. Robotics has been known to use ultrasonic rangefinders as a favorite tool for distance ranging and mapping. Even the fashion industry is using ultrasonic sensors in hair styling like hair extension implants.



Node MCUESP8266

The Node MCU is an open-source firmware and development kit that helps you to Prototype your IOT product within a few Lua script lines. The Node MCU (Node Micro Controller Unit) is an open source software and hardwaredevelopment environment that is built around a very inexpensive System-on-a- Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espress if Systems, contains all crucial elements of the modern computer: CPU, RAM, networking (Wi-Fi), and even a modern operating system and SDK.



The term NodeMCU usually refers to the firmware, while the board is called Devkit. NodeMCU Devkit 1.0 consists of an ESP-12E on a board, which facilitates its use. It also has a voltage regulator, a USB interface.

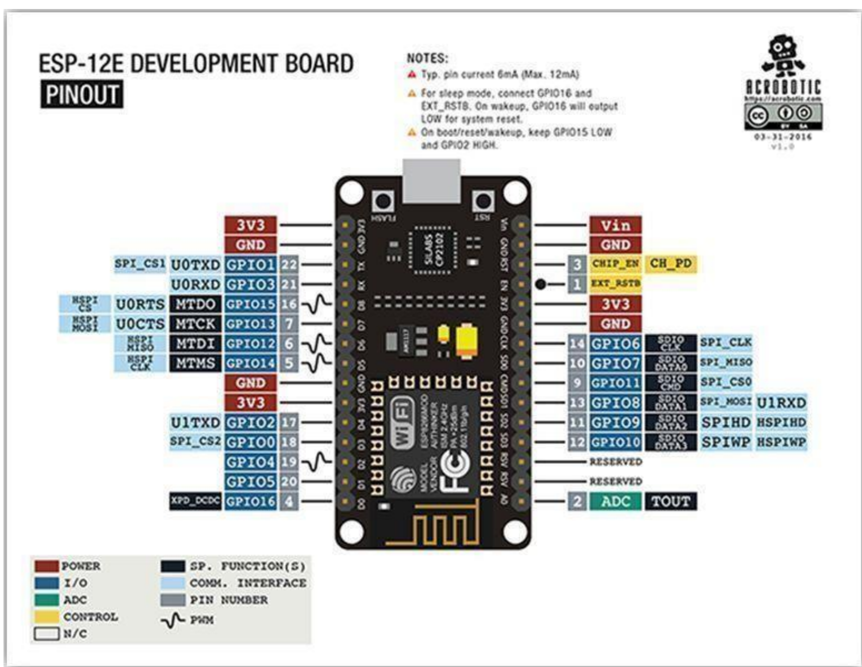
ESP-12E

The ESP-12E is a board created by AI-THINKER, which consists of an ESP8266EX inside the metal cover.

ESP8266EX

Made by Expressif, this microchip has integrated Wi-Fi and low-power consumption. Processor RISC Tensilica L 106 32bit with a maximum clock of 160 MHz

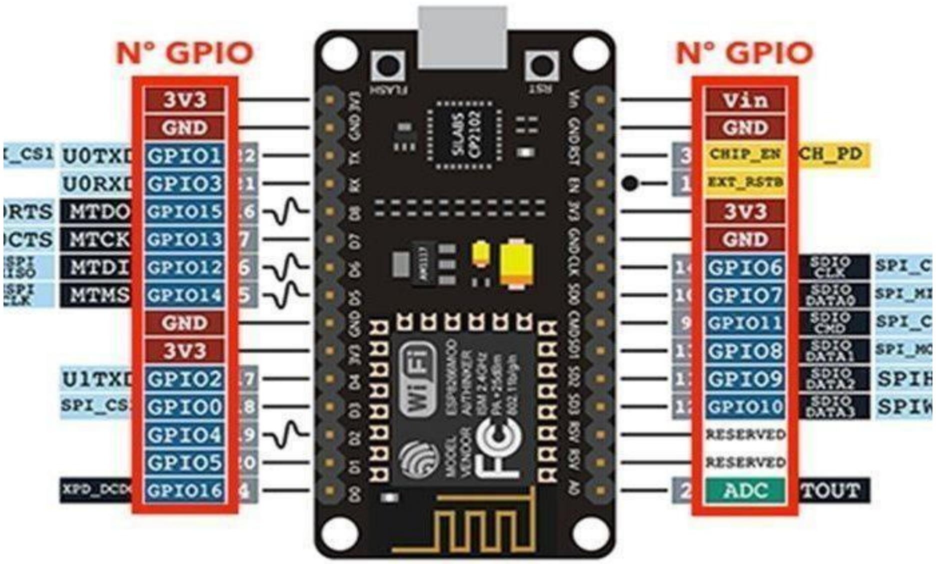
Node MCU 1.0 ESP-12E Pinout



ESP-12E Pinout

I want to emphasize that NodeMCU and ESP-12E are not the same things. In the case of the ESP-12E, the recording uses the serial, the UART. In NodeMCU, this is performed by the USB.

Step 6: And After All This, What's the Number to Put When Programming?



Use the number that is in front of the GPIO or the constants A0, D0, D1, D2, D3, D4, D5, D6, D7, and D8.

Boot

We put the oscilloscope at the tip of each pin. This allows us to find, for example, that when we turn on the NodeMCU, its pins are not all the same. Some are up and others down, by default. See the comments on the behavior of each post after the boot in the image below.

Constants That Are Already Predefined

Constante	Valor
D0	16
D1	5
D2	4
D3	0
D4	2
D5	14
D6	12
D7	13
D8	15
A0	17

- **digitalWrite** did NOT work with GPIOs 6, 7, 8, 11, and ADC (A0)
- **digitalRead** did NOT work with GPIOs 1, 3, 6, 7, 8, 11, and the ADC (A0)
- **analogWrite** did NOT work with GPIOs 6, 7, 8, 11, and ADC (A0) (GPIOs 4, 12, 14, 15 have hardware PWM, and the others are by software)
- **analogRead** worked only with the ADC (A0)
- **6**, **7**, **8**, **11** do NOT work for the above four commands

BUZZER

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user inputsuch as a mouse click or keystroke. When current is applied to the buzzer it causes the ceramic disk to contract or expand. Changing the This then causes the surrounding disc to vibrate. That's the sound that you hear. By changing the frequency of the buzzer, the speed of the vibration’s changes, which changes the pitch of the resulting sound.

Fig 6.5 Buzzer

There are many ways to communicate between the user and a product. One of the best ways is audio communication using a buzzer IC. So, during the design process, understanding some technologies with configurations is very helpful. So, this article discusses an overview of an audio signaling device like a beeper or a buzzer. An audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type.

The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren. The pin configuration of the buzzer is shown below. It includes two pins namely positive and negative. The positive terminal of this is represented with the '+' symbol or a longer terminal. This terminal is powered through 6Volts whereas the negative terminal is represented with the '- 'symbol or short terminal and it is connected to the GND terminal.

SOFTWARE REQUIREMENTS

ARDUINO SOFTWARE (IDE)

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

Writing Sketches

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and openthe serial monitor.

NB: Versions of the Arduino Software (IDE) prior to 1.0 saved sketches with the extension .pde. It is possible to open these files with version 1.0, you will be prompted to save the sketch with the .ino extension on save.

Verify

Checks your code for errors compiling it.

Upload

Compiles your code and uploads it to the configured board. See uploading below for details.

Note: If you are using an external programmer with your board, you can hold down the "shift" key on your computer when using this icon. The text will change to "Upload using Programmer"

New

Creates a new sketch.

Open

Presents a menu of all the sketches in your sketchbook. Clicking one will open it within the current window overwriting its content.

Note: due to a bug in Java, this menu doesn't scroll; if you need to open a sketch late in the list, use the File | Sketch book menu instead.

Save

Saves your sketch.

Serial Monitor

Opens the serial monitor.

Additional commands are found within the five menus: File, Edit, Sketch, Tools, Help. The menus are context sensitive, which means only those items relevant to the work currently being carried out are available.

File

- **New**

  Creates a new instance of the editor, with the bare minimum structure of a sketch already in place.

- **Open**

  Allows to load a sketch file browsing through the computer drives and folders.

- **Open Recent**

  Provides a short list of the most recent sketches, ready to be opened.

- **Sketchbook**

  Shows the current sketches within the sketchbook folder structure; clicking on any name opens the corresponding sketch in a new editor instance.

- **Examples**

  Any example provided by the Arduino Software (IDE) or library shows up in this menu item. All the examples are structured in a tree that allows easy access by topic or library.
- **Close**

  Closes the instance of the Arduino Software from which it is clicked.
- **Save**

  Saves the sketch with the current name. If the file hasn't been named before, a name will be provided in a "Save as.." window.
- **Save as...**

  Allows to save the current sketch with a different name.
- **Page Setup**

  It shows the Page Setup window for printing.
- **Print**

  Sends the current sketch to the printer according to the settings defined in Page Setup.
- **Preferences**

  Opens the Preferences window where some settings of the IDE may be customized, as the language of the IDE interface.
- **Quit**

  Closes all IDE windows. The same sketches open when Quit was chosen will be automatically reopened the next time you start the IDE.

Edit

- **Undo/Redo**

  Goes back of one or more steps you did while editing; when you go back, you may go forward with Redo.

- **Cut**

  Removes the selected text from the editor and places it into the clipboard.

- **Copy**

  Duplicates the selected text in the editor and places it into the clipboard.

- **Copy for Forum**

  Copies the code of your sketch to the clipboard in a form suitable for posting to the forum, complete with syntax coloring.

- **Copy as HTML**

  Copies the code of your sketch to the clipboard as HTML, suitable for embedding in web pages.

- **Paste**

  Puts the contents of the clipboard at the cursor position, in the editor.

- **Select All**

  Selects and highlights the whole content of the editor.

- **Comment/Uncomment**

  Puts or removes the // comment marker at the beginning of each selected line.

- **Increase/Decrease Indent**

  Adds or subtracts a space at the beginning of each selected line, moving the text one space on the right or eliminating a space at the beginning.

- **Find**

  Opens the Find and Replace window where you can specify text to search inside the current sketch according to several options.

- **Find Next**

  Highlights the next occurrence - if any - of the string specified as the search item in the Find window, relative to the cursor position.

- **Find Previous**

  Highlights the previous occurrence - if any - of the string specified as the search item in the Find window relative to the cursor position.

Sketch

- **Verify/Compile**
  Checks your sketch for errors compiling it; it will report memory usage for code and variables in the console area.
- **Upload**
  Compiles and loads the binary file onto the configured board through the configured Port.
- **Upload Using Programmer**
  This will overwrite the bootloader on the board; you will need to use Tools > Burn Bootloader to restore it and be able to Upload to USB serial port again. However, it allows you to use the full capacity of the Flash memory for your sketch. Please note that this command will NOT burn the fuses. To do so a *Tools* -> *Burn Bootloader* command must be executed.
- **Export Compiled Binary**
  Saves a .hex file that may be kept as archive or sent to the board using other tools.
- **Show Sketch Folder**
  Opens the current sketch folder.
- **Include Library**
  Adds a library to your sketch by inserting #include statements at the start of your code. For more details, see libraries below. Additionally, from this menu item you can access the Library Manager and import new libraries from .zip files.
- **Add File...**
  Adds a source file to the sketch (it will be copied from its current location). The new file appears in a new tab in the sketch window. Files can be removed from the sketch using the tab menu accessible clicking on the small triangle icon below the serial monitor one on the right side o the toolbar.

Tools

- **Auto Format**

  This formats your code nicely: i.e. indents it so that opening and closing curly braces line up, and that the statements inside curly braces are indented more.

- **Archive Sketch**

  Archives a copy of the current sketch in .zip format. The archive is placed in the same directory as the sketch.

- **Fix Encoding & Reload**

  Fixes possible discrepancies between the editor char map encoding and other operating systems char maps.

- **Serial Monitor**

  Opens the serial monitor window and initiates the exchange of data with any connected board on the currently selected Port. This usually resets the board, if the board supports Reset over serial port opening.

- **Board**

  Select the board that you're using. See below for descriptions of the various boards.

- **Port**

  This menu contains all the serial devices (real or virtual) on your machine. It should automatically refresh every time you open the top-level tools menu.

- **Programmer**

  For selecting a harware programmer when programming a board or chip and not using the onboard USB-serial connection. Normally you won't need this, but if you're burning a bootloader to a new microcontroller, you will use this.

- **Burn Bootloader**

  The items in this menu allow you to burn a bootloader onto the microcontroller on an Arduino board. This is not required for normal use of an Arduino or Genuino board but is useful if you purchase a new At mega microcontroller (which normally come without a bootloader).

- Ensure that you've selected the correct board from the Boards menu before burning the bootloader on the target board. This command also set the right fuses.

Help

Here you find easy access to a number of documents that come with the Arduino Software (IDE). You have access to Getting Started, Reference, this guide to the IDE and other documents locally, without an internet connection. The documents are a local copy of the online ones and may link back to our online website.

- **Find in Reference**
  This is the only interactive function of the Help menu: it directly selects the relevant page in the local copy of the Reference for the function or command under the cursor.

Sketchbook

The Arduino Software (IDE) uses the concept of a sketchbook: a standard place to store your programs (or sketches). The sketches in your sketchbook can be opened from the File > Sketchbook menu or from the Open button on the toolbar. The first time you run the Arduino software, it will automatically create a directory for your sketchbook. You can view or change the location of the sketchbook location from with the Preferences dialog.

Beginning with version 1.0, files are saved with a .ino file extension. Previous versions use the .pde extension. You may still open .pde named files in version 1.0 and later, the software will automatically rename the extension to .ino.

Tabs, Multiple Files, and Compilation

Allows you to manage sketches with more than one file (each of which appears in its own tab). These can be normal Arduino code files (no visible extension), C files (.c extension), C++ files (.cpp), or header files (.h).

Uploading

Before uploading your sketch, you need to select the correct items from the Tools > Board and Tools > Port menus. The boards are described below.

On the Mac, the serial port is probably something like /dev/tty.usbmodem241 (for an Uno or Mega2560 or Leonardo) or /dev/tty.usbserial-1B1 (for a Duemilanove or earlier USB board), or/dev/tty.USA19QW1b1P1.1 (for a serial board connected with a Key span USB-to-Serial adapter). On Windows, it's probably COM1 or COM2 (for a serial board) or COM4, COM5, COM7, or higher (for a USB board) - to find out, you look for USB serial device in the ports section of the Windows Device Manager. On Linux, it should be /dev/ttyACMx ,/dev/ttyUSBx or similar. Once you've selected the correct serial port and board, press the upload button in the toolbar or select the Upload item from the File menu. Current Arduino boards will reset automatically and begin the upload. With older boards (pre-Diecimila) that lack auto-reset, you'll need to press the reset button on the board just before starting the upload. On most boards, you'll see the RX and TX LEDs blink as the sketch is uploaded. The Arduino Software (IDE) will display a message when the upload is complete, or show an error.

When you upload a sketch, you're using the Arduino bootloader, a small program that has been loaded on to the microcontroller on your board. It allows you to upload code without using any additional hardware. The bootloader is activefor a few seconds when the board resets; then it starts whichever sketch was most recently uploaded to the microcontroller. The bootloader will blink the on-board (pin 13) LED when it starts (i.e. when the board resets).

Libraries

Libraries provide extra functionality for use in sketches, e.g. working with hardware or manipulating data. To use a library in a sketch, select it from the Sketch > Import Library menu. This will insert one or more #include statements at the top of the sketch and compile the library with your sketch. Because libraries are uploaded to the board with your sketch, they increase the amount of space it takes up. If a sketch no longer needs a library, simply delete its #includestatements from the top of your code.

There is a list of libraries in the reference. Some libraries are included with the Arduino software. Others can be downloaded from a variety of sources or through the Library Manager. Starting with version 1.0.5 of the IDE, you do can import a library from a zip file and use it in an open sketch. See these instructions for installing a third-party library.

Third-Party Hardware

Support for third-party hardware can be added to the hardware directory of your sketchbook directory. Platforms installed there may include board definitions (which appear in the board menu), core libraries, bootloaders, and programmer definitions. To install, create the hardware directory, then unzip the third-party platform into its own sub-directory. (Don't use "arduino" as the sub-directory name or you'll override the built-in Arduino platform.) To uninstall, simply delete its directory.

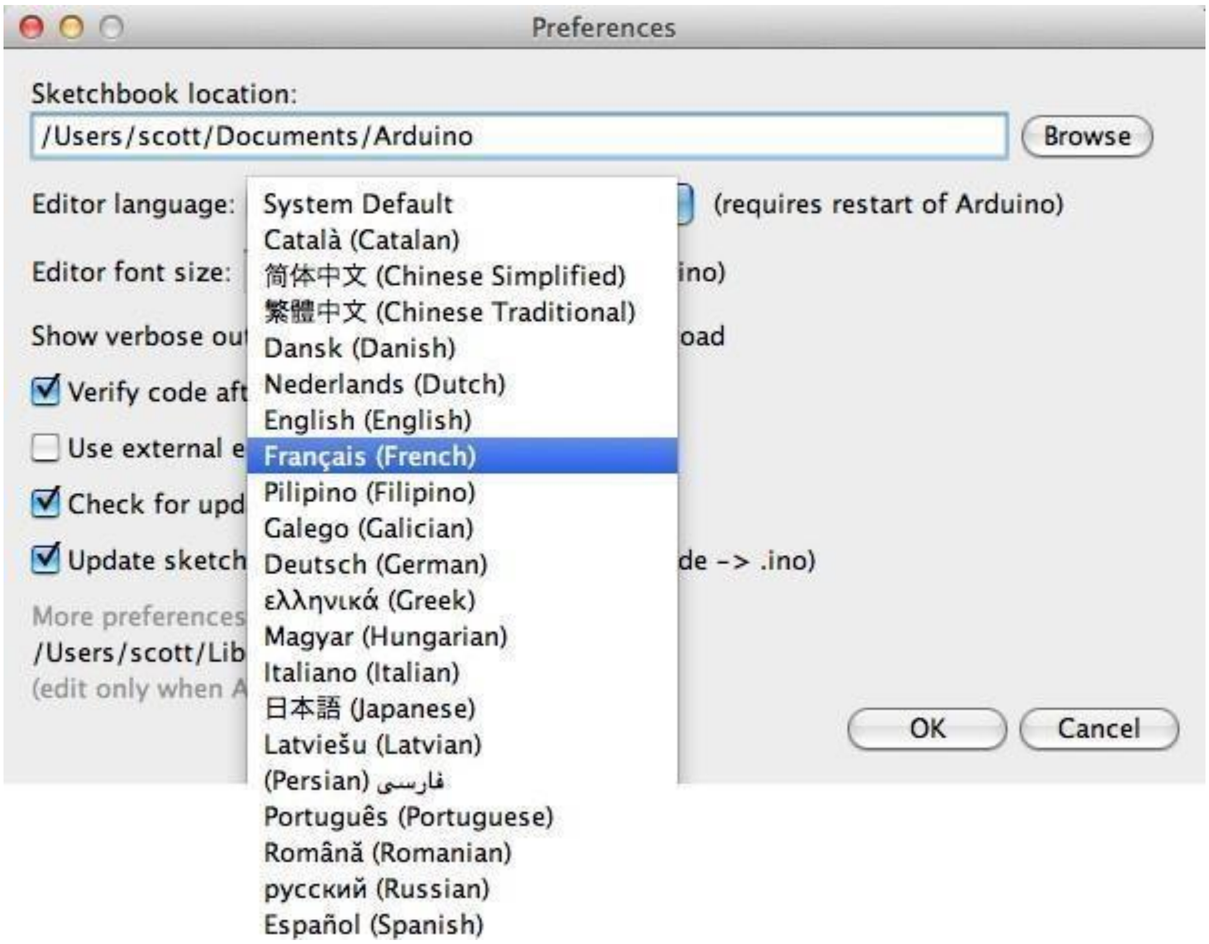
Serial Monitor

Displays serial data being sent from the Arduino or Genuino board (USB or serial board). To send data to the board, enter text and click on the "send" button or press enter. Choose the baud rate from the drop-down that matches the rate passed to Serial begin in your sketch. Note that on Windows, Mac or Linux, the Arduino or Genuino board will reset (rerun your sketch execution to the beginning) when you connect with the serial monitor.

Preferences

Some preferences can be set in the preferences dialog (found under the Arduino menu on the Mac, or File on Windows and Linux). The rest can be found in the preferences file, whose location is shown in the preference dialog.

Language Support



Since version 1.0.1 , the Arduino Software (IDE) has been translated into 30+ different languages. By default, the IDE loads in the language selected by your operating system. (Note: on Windows and possibly Linux, this is determined bythe locale setting which controls currency and date formats, not by the language the operating system is displayed in.)

If you would like to change the language manually, start the Arduino Software (IDE) and open the Preferences window. Next to the Editor Language there is a dropdown menu of currently supported languages.

Select your preferred language from the menu, and restart the software to use the selected language. If your operating system language is not supported, the Arduino Software (IDE) will default to English.

You can return the software to its default setting of selecting its language based on your operating system by selecting system default from the Editor Language drop-down. This setting will take effect when you restart the Arduino Software (IDE). Similarly, after changing your operating system's settings, you must restart the Arduino Software (IDE) to update it to the new default language.

Boards

The board selection has two effects: it sets the parameters (e.g. CPU speed and baud rate) used when compiling and uploading sketches; and sets and the file and fuse settings used by the burn bootloader command. Some of the board definitions differ only in the latter, so even if you've been uploading successfully with a particular selection you'll want to check it before burning the bootloader. You can find a comparison table between the various boards here.

Arduino Software (IDE) includes the built in support for the boards in the following list, all based on the AVR Core. The Boards Manager included in the standard installation allows to add support for the growing number of new boards based on different cores like Arduino Due, Arduino Zero, Edison, Galileo and so on.

4.2 EMBEDDED C

An embedded system is a computer system designed to perform one or a few dedicated functions often with real-time computing constraints. It is embeddedas part of a complete device often including hardware and mechanical parts. By contrast, a general-purpose computer, such as a personal computer (PC), is designed to be flexible and to meet a wide range of end-user needs. Embedded systems control many devices in common use today.

Embedded systems are controlled by one or more main processing cores that are typically either microcontrollers or digital signal processors (DSP).The key characteristic, however, is being dedicated to handle a particular task, which may require very powerful processors Since the embedded system is dedicated tospecific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale.

Peripherals

Embedded Systems talk with the outside world via peripherals, such as:

- Serial Communication Interfaces (SCI): RS-232, RS-422, RS-485 etc.
- Synchronous Serial Communication Interface: I2C, SPI, SSC and ESSI (Enhanced Synchronous Serial Interface)
- Universal Serial Bus (USB)
- Analog to Digital/Digital to Analog (ADC/DAC)

Advantages

- Reliability
- Simple control loop
- Interrupt controlled system

CHAPTER 7

RESULT AND DISCUSSION

Tsunamis are among the most devastating natural disasters, with the potential to cause widespread destruction and loss of life. Early detection and warning systems are crucial for minimizing the impact of these events.

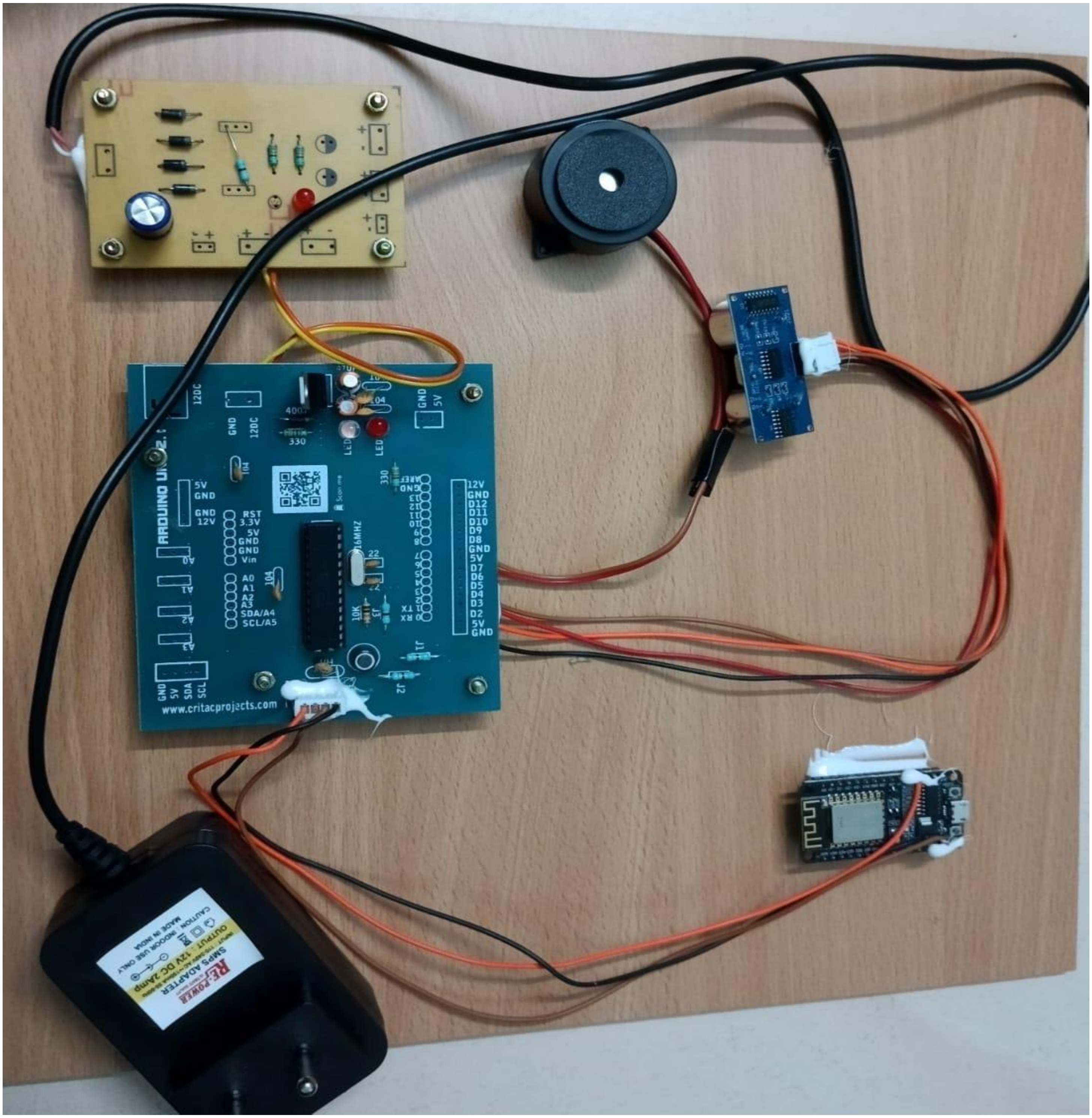
There are several methods used for detecting and alerting about tsunamis. One common approach is to use seismic sensors to detect earthquakes that can generate tsunamis. If a large earthquake is detected, it can trigger an automatic alert to coastal communities that may be at risk.

Another method is to use oceanographic sensors to measure changes in sea level that may indicate the presence of a tsunami. These sensors can be located on buoys or other platforms in the ocean, and can transmit real-time data to monitoring centers on land.

Once an alert is issued, it is important to have effective communication and evacuation plans in place to ensure that people in affected areas can move to higher ground or other safe locations. This requires coordination between government agencies, emergency services, and local communities.

Overall, while no system is foolproof, early detection and effective communication can help to minimize the impact of tsunamis and save lives. Ongoing research and development in this area are critical for improving the effectiveness of these systems and mitigating the risks posed by these catastrophic events.

Tsunami Detection Kit



CHAPTER 8

CONCLUSION AND FUTURE WORK

The global networks that monitor seismic activity and coastal and open- ocean sea level variations remain essential to the tsunami warning process. The current global seismic network is adequate and sufficiently reliable for the purposes of detecting likely tsunami-triggering earthquakes.

A DART system combines a surface buoy and a sensor on the ocean floor. This sensor detects changes in water pressure and seismic activity and transmits the data back to the surface. If these changes indicate a tsunami may form, the buoy signals an alert via satellite to the Tsunami Warning Centers in Alaska and Hawaii. People living in the coastal areas must be educated and trained to face tsunamis. However, efforts have been taken to reduce the loss of life by tsunami with investment in early warning systems.

APENDICES

One element in the committee’s statement of task was to comment on the statusand adequacy of tsunami education efforts, based on existing national compilationsor assessments. Such compilations and assessments currently do not exist fortsunami education efforts in the United States, nor do National Tsunami Hazard Mitigation Program (NTHMP) criteria for evaluating the effectiveness of the information content, style, process, and dissemination of tsunami education efforts.It is beyond the scope of this committee to develop such an inventory or evaluative criteria, therefore a thorough assessment is not possible. Instead, in an effort to simply demonstrate the breadth of current tsunami education efforts, the committee compiled the following list based on received information and online searches. This list is not designed to be exhaustive, as NTHMP plans to develop such an inventory and web-based repository in the coming years (as noted in its 2009-2013 strategic plan). This list serves to illustrate the range of education efforts and is organized by passive education (e.g., books, brochures), active education (e.g., workshops, curriculum), education training, and online resources.

REFERENCES

[1]Jan Krikke and Near Real-time, "Tsunami Computer Simulation within Reach", IEEE Computer Graphics and Applications, pp. 16-21, September/October 2005.

[2]L. Kong, "Intergovernmental Co-ordination Group for the Pacific Tsunami Warning and Mitigation System", PTWS Tsunami Warning Center Operations Seminar, 2–3 April 2007.

[3]C. Meinig, S. Stalin, A. Nakamura and H. Milburn, "Real-Time Deep-Ocean Tsunami Measuring Monitoring and Reporting System: The NOAA DART II Description and Disclosure".

[4] Geetika Malhotra and Deepali Virmani, "Intelligent Information Retrieval in a Tsunami Detection System Using Wireless Sensor Networks", 2016 InternationalConference on Computing Communication and Automation (ICCCA, 2016.

[5] Deepali Virmani and Nikita Jain, "Intelligent Information Retrieval for Tsunami Detection using Wireless Sensor Nodes", IntI. Conference on Advancesin Computing Communications and Informatics (ICACCI), 2016.

[6] Qingyun Yan and Weimin Huang, "Tsunami Detection and Parameter Estimation From GNSS-R Delay-Doppler Map", IEEE journal of selected topics in applied earth observations and remotesensing,2016

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