AMET
ACADEMY OF MARITIME EDUCATION AND TRAINING
DEEMED TO BE UNIVERSITY
(Under Section 3 of UGC Act 1956)

SHIP MONITORING SYSTEM USING LIFI TECHNOLOGY

AN INTERNSHIP REPORT

SUBMITTED BY

BE ME -16

PROJECT GUIDE: PROF. VENKATAGANESH

PROJECT MEMBERS

1. **GOWTHAM KUMAR. R (2276B)**
2. **GOWTHAM. R (2277B)**
3. **HARIHARAN. N (2279B)**
4. **HANOCK MANOHAR. K (2278B)**

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INTERNSHIP EVALUATION REPORT 2019-20

Name of the Department: MARINE ENGINEERING

(In view of advisory from the AICTE, internships for the year 2019-20 are offered by the Department itself to facilitate the students to take up required work from their home itself during the lock down period due to COVID-19 outbreak)

Name of the Student	GOWTHAM KUMAR. R
Register No and Roll No	AMA16067
Programme of study	BE - MARINE
Year and Batch/Group	FINAL YEAR
Semester	II / IV / VI / VIII
Title of Internship	SHIP MONITORING SYSTEM USING LIFI TECHNOLOGY
Duration of Internship	40 Hours
Mentor of the Student	PROF. VENKATAGANESH

Evaluation by the Department

Sl No.	Criterion	Max. Marks	Marks Allotted
1	Regularity in maintenance of the diary.	10	8
2	Adequacy & quality of information recorded	10	8
3	Drawings, sketches and data recorded	10	9
4	Thought process and recording techniques used	5	4
5	Organization of the information	5	4
6	Originality of the Internship Report	20	18
7	Adequacy and purposeful write-up of the Internship Report	10	9
8	Organization, format, drawings, sketches, style, language etc. of the Internship Report	10	9
9	Practical applications, relationships with basic theory and concepts	10	8
10	Presentation Skills	10	8
Total		100	85

Signature of the Mentor	Signature of the Internal Examiner	Signature of HoD / Programme Head

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Name of the Student	GOWTHAM.R
Register No and Roll No	AME16068
Programme of study	BE-MARINE
Year and Batch/Group	FINAL YEAR
Semester	II / IV / VI / VIII
Title of Internship	SHIP MONITORING SYSTEM USING LIFI TECHNOLOGY
Duration of Internship	.....60.....Hours
Mentor of the Student	PROF. VENKATAGANESH

Evaluation by the Department

Sl No.	Criterion	Max. Marks	Marks Allotted
1	Regularity in maintenance of the diary.	10	8
2	Adequacy & quality of information recorded	10	8
3	Drawings, sketches and data recorded	10	9
4	Thought process and recording techniques used	5	4
5	Organization of the information	5	4
6	Originality of the Internship Report	20	18
7	Adequacy and purposeful write-up of the Internship Report	10	9
8	Organization, format, drawings, sketches, style, language etc. of the Internship Report	10	9
9	Practical applications, relationships with basic theory and concepts	10	8
10	Presentation Skills	10	8
Total		100	84

Signature of the Mentor	Signature of the Internal Examiner	Signature of HoD / Programme Head

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Name of the Student	HANOCH MANOHAR
Register No and Roll No	AME16069
Programme of study	BE- MARINE
Year and Batch/Group	FINAL YEAR
Semester	II / IV / VI / VIII
Title of Internship	SHIP MONITORING SYSTEM USING LIFI TECHNOLOGY
Duration of Internship	.....60.....Hours
Mentor of the Student	PROF. VENKATA HANESH

Evaluation by the Department

Sl No.	Criterion	Max. Marks	Marks Allotted
1	Regularity in maintenance of the diary.	10	7
2	Adequacy & quality of information recorded	10	7
3	Drawings, sketches and data recorded	10	8
4	Thought process and recording techniques used	5	4
5	Organization of the information	5	4
6	Originality of the Internship Report	20	18
7	Adequacy and purposeful write-up of the Internship Report	10	9
8	Organization, format, drawings, sketches, style, language etc. of the Internship Report	10	9
9	Practical applications, relationships with basic theory and concepts	10	9
10	Presentation Skills	10	8
Total		100	83

Signature of the Mentor	Signature of the Internal Examiner	Signature of HoD / Programme Head

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INTERNSHIP EVALUATION REPORT 2019-20

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Name of the Student	HARIHARAN. N
Register No and Roll No	AMEI0070
Programme of study	BE - MARINE
Year and Batch/Group	FINAL YEAR
Semester	II / IV / VI / VIII
Title of Internship	SHIP MONITORING SYSTEM USING LIFI TECHNOLOGY
Duration of Internship	.....60.....Hours
Mentor of the Student	PROF. VENKATAGANESH

Evaluation by the Department

Sl No.	Criterion	Max. Marks	Marks Allotted
1	Regularity in maintenance of the diary.	10	8
2	Adequacy & quality of information recorded	10	9
3	Drawings, sketches and data recorded	10	8
4	Thought process and recording techniques used	5	4
5	Organization of the information	5	4
6	Originality of the Internship Report	20	17
7	Adequacy and purposeful write-up of the Internship Report	10	7
8	Organization, format, drawings, sketches, style, language etc. of the Internship Report	10	8
9	Practical applications, relationships with basic theory and concepts	10	9
10	Presentation Skills	10	8
Total		100	82

Signature of the Mentor	Signature of the Internal Examiner	Signature of HoD / Programme Head

AMET

ACADEMY OF MARITIME EDUCATION AND TRAINING
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(Under Section 3 of UGC Act 1956)

DEPARTMENT OF MARINE ENGINEERING

Certificate

This is to certify that.....GOWTHAM KUMAR. R.....

with Register No. ...AME16067.....of .....FINAL.....~~Semester~~ / Year

has undergone with an **Internship at Home** titled .....SHIP MONITORING SYSTEM

.....USING LIFI TECHNOLOGY.....

and has successfully completed.

Faculty In-Charge

Principal DGS - Courses

AMET

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DEPARTMENT OF MARINE ENGINEERING

Certificate

This is to certify that.....GOWTHAM: R.....

with Register No. ....AME 16068.....of .....FINAL.....~~Semester~~ / Year

has undergone with an **Internship at Home** titled ...SHIP MONITORING SYSTEM

.....USING LIFI TECHNOLOGY.....

and has successfully completed.

Faculty In-Charge

Principal DGS - Courses

AMET

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DEPARTMENT OF MARINE ENGINEERING

Certificate

This is to certify that.....HANOCH MANOHAR.....

with Register No. ...AME 16069.....of .....FINAL.....Semester / Year

has undergone with an **Internship at Home** titled ....SHIP MONITORING SYSTEM

USING LIFI TECHNOLOGY.....

and has successfully completed.

Faculty In-Charge

Principal DGS - Courses

AMET

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(Under Section 3 of UGC Act 1956)

DEPARTMENT OF MARINE ENGINEERING

Certificate

This is to certify that.....HARI HARAN: N.....

with Register No. ...AME 16070.....of .....FINAL.....~~Semester~~ / Year

has undergone with an **Internship at Home** titled ....SHIP MONITORING SYSTEM

.....USING LIFI TECHNOLOGY.....

and has successfully completed.

Faculty In-Charge

Principal DGS - Courses

AMET UNIVERSITY
ACADEMY OF MARITIME EDUCATION AND TRAINING UNIVERSITY
(Declared as Deemed to be University u/s 3 of UGC Act 1956)

SHIP MONITORING USING LIFI TECHNOLOGY

A PROJECT REPORT

SUBMITED BY

BE ME -16

2019-2020

AMET UNIVERSITY
ACADEMY OF MARITIME EDUCATION AND TRAINING UNIVERSITY
(Declared as Deemed to be University u/s 3 of UGC Act 1956)

CERTIFICATE

This is to certify that the project entitled **"SHIP MONITORING SYSTEM USING LIFI TECHNOLOGY"** is to bonafide work carried out by the students of AMET UNIVERSITY, KANATHUR (CHENNAI) during the year 2018 for the partial fulfilment of the requirements for the award of the Degree of Bachelor of a Marine Engineering.

INTERNALGUIDE **EXTERNAL EXAMINER**

HEAD OF THE DEPARTMENT

PLACE :AMET UNIVERSITY

PROJECT GUIDE : PROF VENKATAGANESH

PROJECT MEMBERS

LEADER:-

HANOCK MANOHAR .K (2278B)

PARTICIPANTS:-

1. GOWTHAM KUMAR.R (2276B)
2. GOWTHAM.R (2277B)
3. HARIHARAN .N (2279B)

ACKNOWLEDGEMENT

- We would like to thank our **PRINCIPAL Prof Boopathy Baskaran** for giving us this opportunity to setup a working model to our Dry dock simulation room and to bring out best from us.

- We would like to express our thanks of gratitude to our project in charge **Prof VENKATAGANESH** for giving us opportunity to test our technical and practical skills as well as the knowledge.

- We would like to thank the in charge of fire fighting lab **Mr. V. RAMACHANDRAN** took an interest in our project and motivation us right from the beginning of our work till the completion of our project.

- We would also like to thank in the dry dock simulation room.

- We extend our thanks to ……..for their support.

We also acknowledge with deep sense of reverence, our gratitude towards our parents who has always supported us morally and economically. Any omission in this brief acknowledge doesn't mean lack of gratitude

SHIP MONITORING SYSTEM USING LIFI TECHNOLOGY

ABSTRACT

Li-Fi is a high speed and fully networked wireless optical communication and is a form of visible light communication. The proposed model helps in the transmission of data that is collected from the sensors which are implanted on work areas within the ship, to their respective officer's cabin through light signal. The sensors include a gas sensor that detects the presence of toxic gases, a fire sensor to indicate in case of fire outbreaks, a water leakage sensor to indicate whether there is water leakage in the ship. The collected data from the sensors are processed and transmitted through Li-Fi transmitter to the receiver in the audio output form.

INTRODUCTION

In the existing maritime communication, Radio Frequency communication plays the key role. The data from ship's sensors are transmitted using this conventional method of communication since 1999. It requires an additional infrastructure like on board system to carry out the transfer of data collected from any workspace in the ships. This requires specific frequency band to carry out the information about the parameters within the ship to the officer's cabin through wireless means. This requires manual operations to intimate about the sensor values which may sometimes lead to data loss. This can be overcome with the growing technology on Li-Fi system.

3.1 EXISTING SYSTEM

Radio frequency is the principle means of communication in ship. In the existing system, the parameters that are monitored using the sensors in the ship are transmitted through radio frequency communication. It includes radio telephone, automatic radio telegraph equipment, and mega phone. Radio spectrum is congested but the demand for wireless data doubles each year. This system lacks reliability of data uses spectrum which results in insufficient bandwidth. It has possibility of losing data. It data transmission rate is less.

3.1.1 DISADVANTAGE

- Insufficient bandwidth.
- It data transmission rate is less.
- It has possibility of losing data.

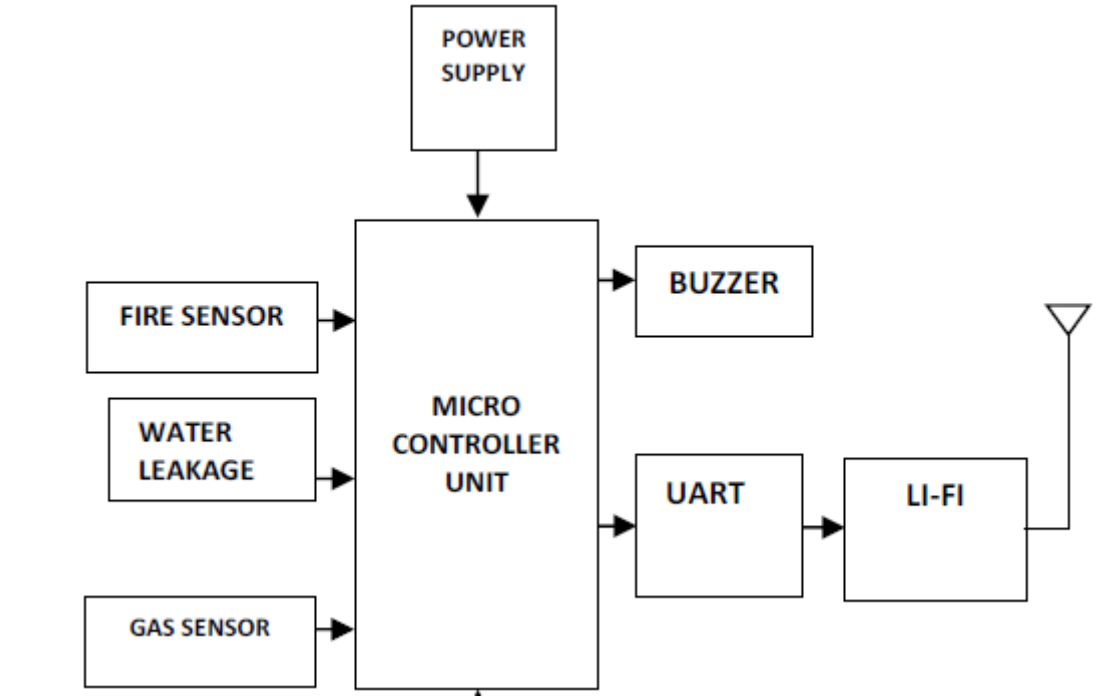
4.1 PROPOSED SYSTEM

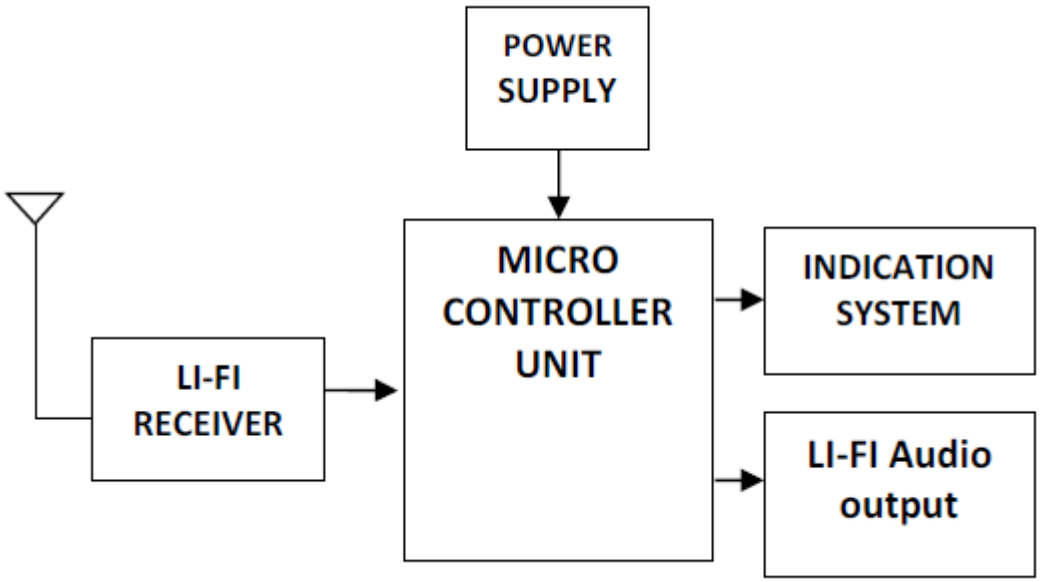
LIFI technology uses the light medium to transmit the data. This module requires both transmitter and receiver for communication. Li-Fi has the advantage of transmitting data at a faster rate than Wi-Fi. The data is approximately1Gbps in this model. The transmitter module uses an LED to stream the high data rate that is processed by the photo detector in the receiver module. The receiver converts the received light signal into audio output that is accessed using a speaker. The Li-Fi transmitter is placed in the work areas in the ship and receiver is devised in captain's cabin to receive reliable data instantaneously. All the sensors input are given to the micro controller. Any changes in the safe values from sensors are detected and buzzer is buzzed. These values collected from sensor are transmitted using LIFI transmitter module. The receiver section consists of the LIFI receiver, power supply, micro controller, LCD and audio output. The received data is displayed in LCD unit and also the emergency situation is told in audio module.

4.1.1 ADVANTAGE

- Fast communication.
- Long range possible.
- Better communication.

BLOCK DIAGRAM





5. LIFI TECHNOLOGY

LIFI technology uses the light medium to transmit the data. This module requires both transmitter and receiver for communication. Li-Fi has the advantage of transmitting data at a faster rate than Wi-Fi.The data is approximately1Gbps in this model. The transmitter module uses an LED to stream the high data rate that is processed by the photodetector in the receiver module. The receiver converts the received light signal into audio output that is accessed using a speaker. The Li-Fi transmitter is placed in the work areas in the ship and receiver is devised in captain's cabin to receive reliable data instantaneously.

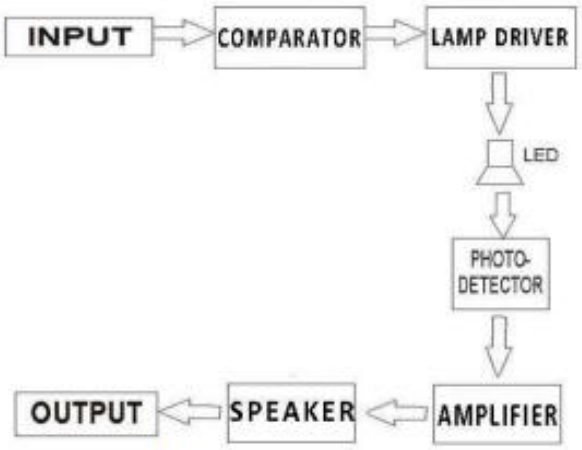


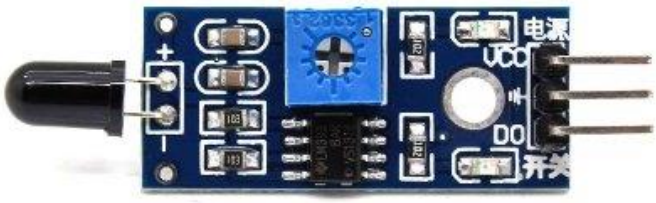
Fig 1.Block diagram of Lifi module

5.3 .GAS SENSOR

There are chances that toxic gases are released inside the ship which may create critical conditions within any cabin. Gas sensor detects the presence of toxic gas or any unwanted gas being released. This detection is carried out in terms of voltage, when there is a change in the normal voltage level that value is transmitted to the captain's cabin through Li-Fi technology and emergency situation is alarmed.

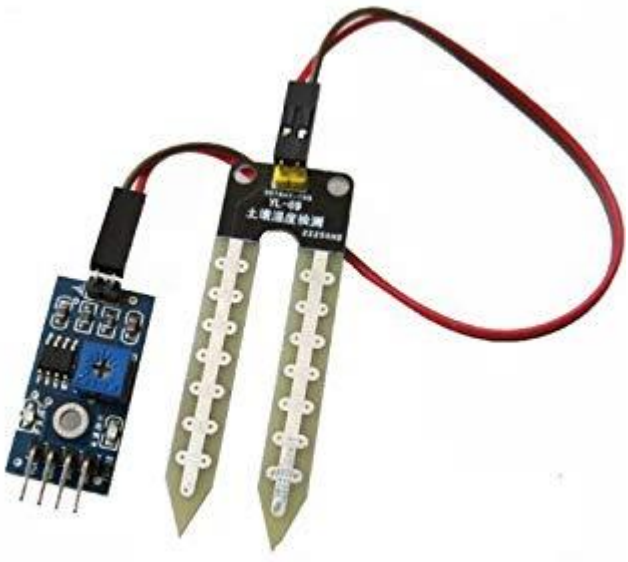
5.4 FIRE SENSOR

There are many chances for a fire outbreak in ships especially in the areas with heavy machines, boiler rooms and other areas where fuel, oil and exhaust gases are present. Therefore it is mandatory to monitor these areas regularly for any change in parameters. In case of a fire exposure, then it is detected by this sensor and that data is immediately transmitted to the receiver through the visible light.



5.5 WATER LEAKAGE SENSOR

One of the important parameters that needed to be checked in a marine system is whether there is leakage of water within the ship. The rough weather conditions, icebergs and collisions may create jeopardy situation, so a water leakage sensor is used to detect the presence of water within a cabin and transmit the information immediately to take rescue actions.



5.6 PIC MICROCONTROLLER

The PIC microcontroller used here is 16F877A. This performs the key role of processing the received data from the sensors and transmitting them to the Li-Fi module. The advantage of microcontroller such as low power consumption and flexibility to connect other devices makes it as the best choice among other processors. The features of this microcontroller include the following.

- RISC architecture
- Operating frequency 0-20 MHz
- Power supply voltage 2.0-5.5V
- 8K ROM memory in FLASH technology
- 256 bytes EEPROM memory
- 368 bytes RAM memory
- A/D converter:
  - 14-channels
  - 10-bit resolution
- 3 independent timers/counters
- Watch-dog timer

PIC (usually pronounced as "pick") is a family of microcontrollers made by Microchip Technology, derived from the PIC1650 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to Peripheral Interface Controller and is currently expanded as Programmable Intelligent Computer. The first parts of the family were available in 1976; by 2013 the company had shipped more than twelve billion individual parts, used in a wide variety of embedded systems.

Early models of PIC had read-only memory (ROM) or field-programmable EPROM for program storage, some with provision for erasing

memory. All current models use flash memory for program storage, and newer models allow the PIC to reprogram itself. Program memory and data memory are separated. Data memory is 8-bit, 16-bit, and, in latest models, 32-bit wide. Program instructions vary in bit-count by family of PIC, and may be 12, 14, 16, or 24 bits long. The instruction set also varies by model, with more powerful chips adding instructions for digital signal processing functions.

The hardware capabilities of PIC devices range from 6-pin SMD, 8-pin DIP chips up to 144-pin SMD chips, with discrete I/O pins, ADC and DAC modules, and communications ports such as UART, I2C, CAN, and even USB. Low-power and high-speed variations exist for many types.

The manufacturer supplies computer software for development known as MPLAB X, assemblers and C/C++ compilers, and programmer/debugger hardware under the MPLAB and PICKit series. Third party and some open-source tools are also available. Some parts have in-circuit programming capability; low-cost development programmers are available as well as high-production programmers.

PIC devices are popular with both industrial developers and hobbyists due to their low cost, wide availability, large user base, extensive collection of application notes, and availability of low cost or free development tools, serial programming, and re-programmable flash-memory capability.

5.6.1 FEATURES

5.6.1.1 High-Performance RISC CPU

- Only 35 single-word instructions to learn

- All single-cycle instructions except for program branches, which are two-cycle
- Operating speed: DC – 20 MHz clock input DC – 200 ns instruction cycle
- Up to 8K x 14 words of Flash Program Memory, Up to 368 x 8 bytes of Data Memory (RAM), Up to 256 x 8 bytes of EEPROM Data Memory
- Pin out compatible to other 28-pin or 40/44-pin
- PIC16CXXX and PIC16FXXX microcontrollers

5.6.1.2 Peripheral Features

- Timer0: 8-bit timer/counter with 8-bit prescaler
- Timer1: 16-bit timer/counter with prescaler, can be incremented during Sleep via external crystal/clock
- Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler
    - Two Capture, Compare, PWM modules
    - Capture is 16-bit, max. resolution is 12.5 ns
    - Compare is 16-bit, max. resolution is 200 ns
- PWM max. resolution is 10-bit
- Synchronous Serial Port (SSP) with SPI™ (Master mode) and I2C™ (Master/Slave)

- Universal Synchronous Asynchronous Receiver Transmitter (USART/SCI) with 9-bit address detection
- Parallel Slave Port (PSP) – 8 bits wide with external RD, WR and CS controls (40/44-pin only)
- Brown-out detection circuitry for Brown-out Reset (BOR)

5.6.1.3 Analog Features

- 10-bit, up to 8-channel Analog-to-Digital Converter (A/D)
- Brown-out Reset (BOR)
- Analog Comparator module with:
    - Two analog comparators
    - Programmable on-chip voltage reference (VREF) module
    - Programmable input multiplexing from device inputs and internal voltage reference
    - Comparator outputs are externally accessible

5.6.1.4 Special Microcontroller Features

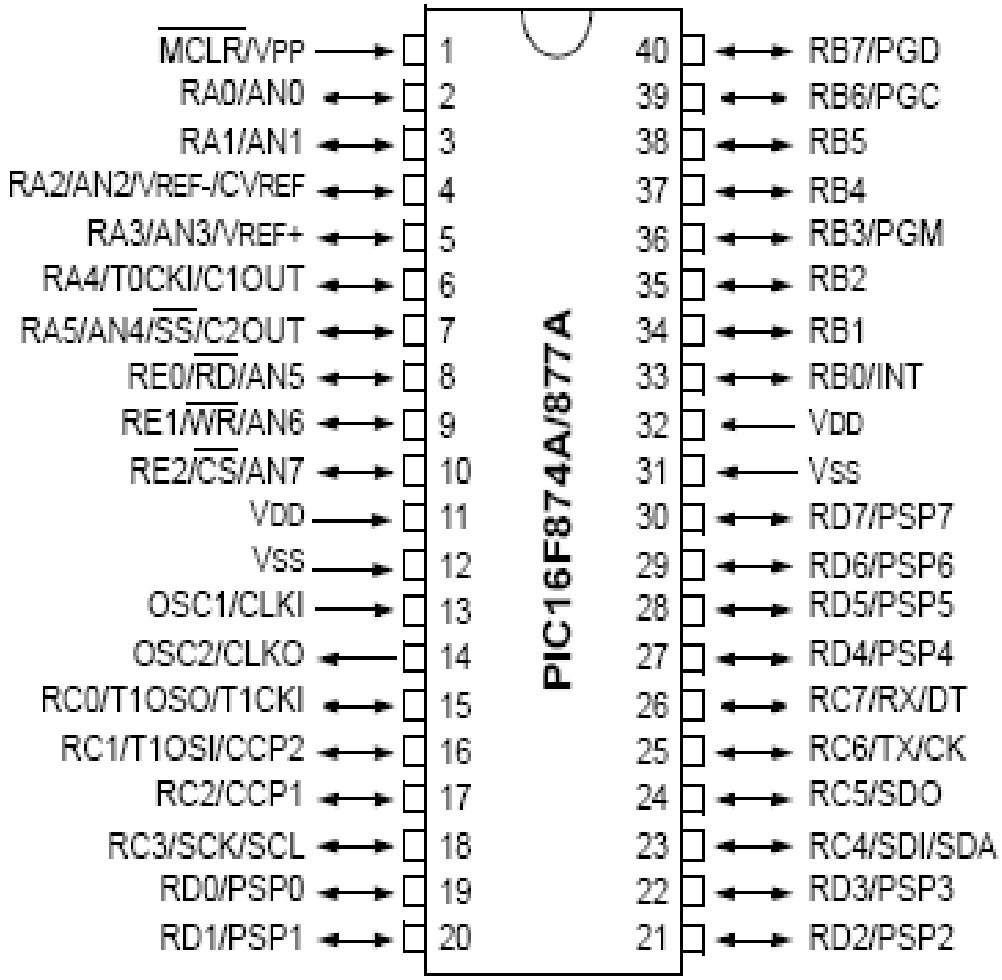
- 100,000 erase/write cycle Enhanced Flash program memory typical
- 1,000,000 erase/write cycle Data EEPROM memory typical

- Data EEPROM Retention > 40 years
- Self-reprogrammable under software control
- In-Circuit Serial Programming™ (ICSP™) via two pins
- Single-supply 5V In-Circuit Serial Programming
- Watchdog Timer (WDT) with its own on-chip RC oscillator for reliable operation
- Programmable code protection
- Power saving Sleep mode
- Selectable oscillator options
- In-Circuit Debug (ICD) via two pins

5.6.1.5 CMOS Technology

- Low-power, high-speed Flash/EEPROM technology
- Fully static design
- Wide operating voltage range (2.0V to 5.5V)
- Commercial and Industrial temperature ranges
- Low-power consumption

5.6.1.6 Pin Diagram



5.6.1.7 DEVICE OVERVIEW:

This document contains device specific information about the following devices:

• PIC16F873A

• PIC16F874A

• PIC16F876A

• PIC16F877A

PIC16F873A/876A devices are available only in 28-pin packages, while PIC16F874A/877A devices are available in 40-pin and 44-pin packages. All devices in the PIC16F87XA family share common architecture with the following differences:

- The PIC16F873A and PIC16F874A have one-half of the total on-chip memory of the PIC16F876A and PIC16F877A
- The 28-pin devices have three I/O ports, while the 40/44-pin devices have five
- The 28-pin devices have fourteen interrupts, while the 40/44-pin devices have fifteen
- The 28-pin devices have five A/D input channels, while the 40/44-pin devices have eight
- The Parallel Slave Port is implemented only on the 40/44-pin devices

The available features are summarized in Table 1-1. Block diagrams of the PIC16F873A/876A and PIC16F874A/877A devices are provided in Figure 1-1 and Figure 1-2, respectively. The pin outs for these device families are listed in Table 1-2 and Table 1-3. Additional information may be found in the

PICmicro® Mid-Range Reference Manual (DS33023), which may be obtained from your local Microchip Sales Representative or downloaded from the Microchip web site. The Reference Manual should be considered a complementary document to this data sheet and is highly recommended reading for a better understanding of the device architecture and operation of the peripheral modules.

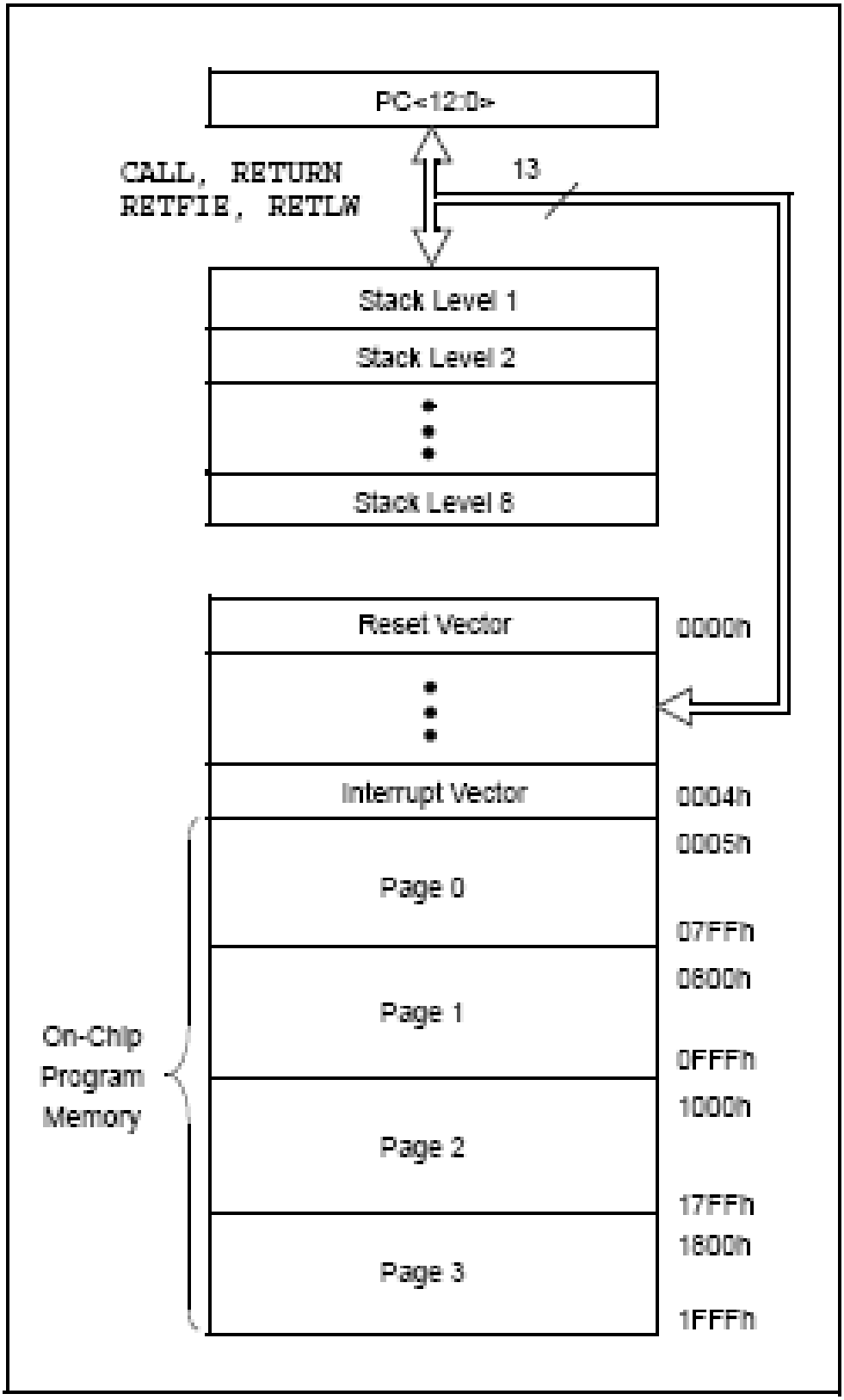
5.6.1.8 Memory Organization

There are three memory blocks in each of the PIC16F87XA devices. The program memory and data memory have separate buses so that concurrent access can occur and is detailed in this section. The EEPROM data memory block is detailed in **Section 3.0 "Data EEPROM and Flash Program Memory"**. Additional information on device memory may be found in the PICmicro® Mid-Range MCU Family Reference Manual (DS33023).

5.6.1.9 Program Memory Organization

The PIC16F87XA devices have a 13-bit program counter capable of addressing an 8K word x 14 bit program memory space. The PIC16F876A/877A devices have 8K words x 14 bits of Flash program memory, while PIC16F873A/874A devices have 4K words x 14 bits. Accessing a location above the physically implemented address will cause a wraparound. The Reset vector is at 0000h and the interrupt vector is at 0004h.

PROGRAM MEMORY MAP AND STACK



5.6.1.10 Data Memory Organization

The data memory is partitioned into multiple banks which contain the General Purpose Registers and the Special Function Registers. Bits RP1 (Status<6>) and RP0 (Status<5>) are the bank select bits. Each bank extends up to 7Fh (128 bytes). The lower locations of each bank are reserved for the Special Function Registers. Above the Special Function Registers are General Purpose Registers, implemented as static RAM. All implemented banks contain Special Function Registers. Some frequently used Special Function Registers from one bank may be mirrored in another bank for code reduction and quicker access.

5.6.1.11 I/O PORTS

Some pins for these I/O ports are multiplexed with an alternate function for the peripheral features on the device. In general, when a peripheral is enabled, that pin may not be used as a general purpose I/O pin. Additional information on I/O ports may be found in the PICmicro™ Mid-Range Reference Manual (DS33023).

5.6.1.12 PORTA and the TRISA Register:

PORTA is a 6-bit wide, bidirectional port. The corresponding data direction register is TRISA. Setting a TRISA bit (= 1) will make the corresponding PORTA pin an input (i.e., put the corresponding output driver in a High-Impedance mode). Clearing a TRISA bit (= 0) will make the corresponding PORTA pin an output (i.e., put the contents of the output latch on the selected pin). Reading the PORTA register reads the status of the pins, whereas writing to it will write to the port latch. All write operations are read-modify-write operations. Therefore, a write to a port implies that the port pins are read; the value is modified and then written to the port data latch. Pin RA4 is multiplexed with the Timer0 module clock input to become the RA4/T0CKI

pin. The RA4/T0CKI pin is a Schmitt Trigger input and an open-drain output. All other PORTA pins have TTL input levels and full CMOS output drivers. Other PORTA pins are multiplexed with analog inputs and the analog VREF input for both the A/D converters and the comparators. The operation of each pin is selected by clearing/setting the appropriate control bits in the ADCON1 and/or CMCON registers. The TRISA register controls the direction of the port pins even when they are being used as analog inputs. The user must ensure the bits in the TRISA register are maintained set when using them as analog inputs.

5.6.1.13 PORTB and the TRISB Register

PORTB is an 8-bit wide, bidirectional port. The corresponding data direction register is TRISB. Setting a TRISB bit (= 1) will make the corresponding PORTB pin an input (i.e., put the corresponding output driver in a High-Impedance mode). Clearing a TRISB bit (= 0) will make the corresponding PORTB pin an output (i.e., put the contents of the output latch on the selected pin). Three pins of PORTB are multiplexed with the In-Circuit Debugger and Low-Voltage Programming function: RB3/PGM, RB6/PGC and RB7/PGD. The alternate functions of these pins are described in **"Special Features of the CPU"**. Each of the PORTB pins has a weak internal pull-up. A single control bit can turn on all the pull-ups. This is performed by clearing bit RBPU (OPTION_REG<7>). The weak pull-up is automatically turned off when the port pin is configured as an output. The pull-ups are disabled on a Power-on Reset.

This interrupt can wake the device from Sleep. The user, in the Interrupt Service Routine, can clear the interrupt in the following manner:

a) Any read or write of PORTB. This will end the mismatch condition.

b) Clear flag bit RBIF.

A mismatch condition will continue to set flag bit RBIF. Reading PORTB will end the mismatch condition and allow flag bit RBIF to be cleared. The interrupt-on-change feature is recommended for wake-up on key depression operation and operations where PORTB is only used for the interrupt-on-change feature. Polling of PORTB is not recommended while using the interrupt-on-change feature. This interrupt-on-mismatch feature, together with software configurable pull-ups on these four pins, allow easy interface to a keypad and make it possible for wake-up on key depression.

5.6.1.14 PORTC and the TRISC Register

PORTC is an 8-bit wide, bidirectional port. The corresponding data direction register is TRISC. Setting a TRISC bit (= 1) will make the corresponding PORTC pin an input (i.e., put the corresponding output driver in a High-Impedance mode). Clearing a TRISC bit (= 0) will make the corresponding PORTC pin an output (i.e., put the contents of the output latch on the selected pin). PORTC is multiplexed with several peripheral functions (Table 4-5). PORTC pins have Schmitt Trigger input buffers. When the I2C module is enabled, the PORTC<4:3> pins can be configured with normal I2C levels, or with SMBus levels, by using the CKE bit (SSPSTAT<6>).

When enabling peripheral functions, care should be taken in defining TRIS bits for each PORTC pin. Some peripherals override the TRIS bit to make a pin an output, while other peripherals override the TRIS bit to make a pin an input. Since the TRIS bit override is in effect while the peripheral is enabled, read-modify write instructions (BSF, BCF, and XORWF) with TRISC as the destination, should be avoided. The user should refer to the corresponding peripheral section for the correct TRIS bit settings.

5.6.1.15 PORTD and TRISD Registers:

PORTD is an 8-bit port with Schmitt Trigger input buffers. Each pin is individually configurable as an input or output. PORTD can be configured as an 8-bit wide microprocessor port (Parallel Slave Port) by setting control bit, PSPMODE (TRISE<4>). In this mode, the input buffers are TTL.

5.6.1.16 PORTD Functions:

Name	Bit#	Buffer Type	Function
RD0/PSP0	bit 0	ST/TTL(1)	Input/output port pin or Parallel Slave Port bit 0.
RD1/PSP1	bit 1	ST/TTL(1)	Input/output port pin or Parallel Slave Port bit 1.
RD2/PSP2	bit2	ST/TTL(1)	Input/output port pin or Parallel Slave Port bit 2.
RD3/PSP3	bit 3	ST/TTL(1)	Input/output port pin or Parallel Slave Port bit 3.
RD4/PSP4	bit 4	ST/TTL(1)	Input/output port pin or Parallel Slave Port bit 4.
RD5/PSP5	bit 5	ST/TTL(1)	Input/output port pin or Parallel Slave Port bit 5.
RD6/PSP6	bit 6	ST/TTL(1)	Input/output port pin or Parallel Slave Port bit 6.
RD7/PSP7	bit 7	ST/TTL(1)	Input/output port pin or Parallel Slave Port bit 7.

5.6.1.17 PORTE and TRISE Register:

PORTE has three pins (RE0/RD/AN5, RE1/WR/AN6 and RE2/CS/AN7) which are individually configurable as inputs or outputs. These pins have Schmitt Trigger input buffers. The PORTE pins become the I/O control inputs for the microprocessor port when bit PSPMODE (TRISE<4>) is set. In this mode, the user must make certain that the TRISE<2:0> bits are set and that the pins are configured as digital inputs. Also, ensure that ADCON1 is configured for digital I/O. In this mode, the input buffers are TTL.

Register 4-1 shows the TRISE register which also controls the Parallel Slave Port operation. PORTE pins are multiplexed with analog inputs. When selected for analog input, these pins will read as ‘0’s. TRISE controls the direction of the RE pins, even when they are being used as analog inputs. The user must make sure to keep the pins configured as inputs when using them as analog inputs

5.7 TRANSFORMER

5.7.1 GENERAL DESCRIPTION

It is a general purpose chassis mounting mains transformer. Transformer has 240V primary windings and centre tapped secondary winding. The transformer has flying colored insulated connecting leads (Approx 100 mm long). The Transformer act as step down transformer reducing AC - 240V to AC - 12V. Power supplies for all kinds of project & circuit boards.

Step down 230 V AC to 12V with a maximum of 500mAmp current. In AC circuits, AC voltage, current and waveform can be transformed with the help of Transformers. Transformer plays an important role in electronic equipment. AC and DC voltage in Power supply equipment are almost achieved by transformer's transformation and commutation

5.7.2 PRODUCT DESCRIPTION

A transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. Electromagnetic induction produces an electromotive force within a conductor which is exposed to time varying magnetic fields. Transformers are used to increase or decrease the alternating voltages in electric power applications.

It is a step down transformer in which the secondary winding is more than primary winding. Due to these windings it can able to step down the voltage. A Transformer changes electricity from high to low voltage or low to high voltage using two properties of electricity.

FEATURES

- Output current:500mA
- Supply voltage: 220-230VAC
- Output voltage: 12VAC
- Soft Iron Core
- 500mAmp Current Drain

6. WORKING PRINCIPLE

The transmitter section consists of the power supply, pic micro controller, and the sensors like fire sensor, water leakage detector, gas sensor and PIR. Lifi transmitter module is attached to this.

All the sensors input are given to the micro controller. Any changes in the safe values from sensors are detected and buzzer is buzzed. These values collected from sensor are transmitted using lifi transmitter module.

The receiver section consists of thelifi receiver, power supply, micro controller, lcd and audio output. The received data is displayed in lcd unit and also the emergency situation is told in audio module.

7.1 SOFTWARE DESCRIPTION

7.1.1 MP LAB

MPLAB is a proprietary freeware integrated development environment for the development of embedded applications on PIC and dsPIC microcontrollers, and is developed by Microchip Technology. MPLAB and

MPLAB X support project management, code editing, debugging and programming of Microchip 8-bit PIC and AVR (including ATMEGA) microcontrollers, 16-bit PIC24 and dsPIC microcontrollers, as well as 32-bit SAM (ARM) and PIC32 (MIPS) microcontrollers.

MPLAB is designed to work with MPLAB-certified devices such as the MPLAB ICD 3 and MPLAB REAL ICE, for programming and debugging PIC microcontrollers using a personal computer. PICKit programmers are also supported by MPLAB.

MPLAB X supports automatic code generation with the MPLAB Code Configurator and the MPLAB Harmony Configurator plugins.

Early models of PIC had read-only memory (ROM) or field-programmable EPROM for program storage, some with provision for erasing memory. All current models use flash memory for program storage, and newer models allow the PIC to reprogram itself. Program memory and data memory are separated. Data memory is 8-bit, 16-bit, and, in latest models, 32-bit wide. Program instructions vary in bit-count by family of PIC, and may be 12, 14, 16, or 24 bits long. The instruction set also varies by model, with more powerful chips adding instructions for digital signal processing functions.

The hardware capabilities of PIC devices range from 6-pin SMD, 8-pin DIP chips up to 144-pin SMD chips, with discrete I/O pins, ADC and DAC modules, and communications ports such as UART, I2C, CAN, and even USB. Low-power and high-speed variations exist for many types.

The manufacturer supplies computer software for development known as MPLAB X, assemblers and C/C++ compilers, and programmer/debugger hardware under the MPLAB and PICKit series. Third party and some open-source tools are also available. Some parts have in-circuit programming

capability; low-cost development programmers are available as well as high-production programmers.

PIC devices are popular with both industrial developers and hobbyists due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, serial programming, and re-programmable Flash-memory capability.

7.1.2 Embedded C

Embedded C is a set of language extensions for the C programming language by the C Standards Committee to address commonality issues that exist between C extensions for different embedded systems.

Historically, embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations. In 2008, the C Standards Committee extended the C language to address these issues by providing a common standard for all implementations to adhere to. It includes a number of features not available in normal C, such as fixed-point arithmetic, named address spaces and basic I/O hardware addressing. Embedded C uses most of the syntax and semantics of standard C, e.g., main() function, variable definition, data type declaration, conditional statements (if, switch case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, etc

7.1.3 MATLAB SIM

MATLAB SIM is a simulation package specifically designed for power electronics. With MATLAB SIM's interactive simulation capability; you can change parameter values and view voltages/currents in the middle of a

simulation. It is like having a virtual test bench running on your computer. You can design and simulate digital power supplies using MATLAB SIM's Digital Control Module. The digital control can be implemented in either block diagram or custom C code.

MATLAB SIM is extremely fast since non-linear elements are only used where we choose that they are important. Furthermore, the fact that MATLAB SIM separates power and control has a major effect on reducing simulation time. Another very useful feature is the ability to integrate DLL blocks into the circuit with the code that we wrote. This is of great help to emulate a software routine that would be used in a microcontroller used in our power supplies. We also use those DLL to emulate all our control logic to again reduce simulation time.

In summary, with MATLAB SIM, we can improve our power supply performance, increase reliability because we can do virtual testing beyond what we could do in the real life, and drastically reduce the time to market from design to the final product.

7.1.3.1 Simulink

Simulink is a software package for modeling, simulating, and analyzing dynamical systems. It supports linear and nonlinear systems, modeled in continuous time, sampled time, or a hybrid of the two. Systems can also be multi rate, i.e., have different parts that are sampled or updated at different rates. For modeling, Simulink provides a graphical user interface (GUI) for building models as block diagrams, using click-and-drag mouse operations.

With this interface, you can draw the models just as you would with pencil and paper (or as most textbooks depict them). This is a far cry from previous simulation packages that require you to formulate differential equations and difference equations in a language or program. Simulink includes

a comprehensive block library of sinks, sources, linear and nonlinear components, and connectors. You can also customize and create your own blocks.

After you define a model, you can simulate it, using a choice of integration methods, either from the Simulink menus or by entering commands in MATLAB's command window. The menus are particularly convenient for interactive work, while the command-line approach is very useful for running a batch of simulations (for example, if you are doing Monte Carlo simulations or want to sweep a parameter across a range of values). Using scopes and other display blocks, you can see the simulation results while the simulation is running.

Model analysis tools include linearization and trimming tools, which can be accessed from the MATLAB command line, plus the many tools in MATLAB and its application toolboxes. And because MATLAB and Simulink are integrated, you can simulate, analyze, and revise your models in either environment at any point.

Features of Simulink

- Graphical editor for building and managing hierarchical block diagrams.
- Libraries of predefined blocks for modeling continuous-time and discrete-time systems.
- Simulation engine with fixed-step and variable-step ODE solvers.
- Scopes and data displays for viewing simulation results.
- Project and data management tools for managing model files and data.
- Model analysis tools for refining model architecture and increasing simulation speed.

- MATLAB Function block for importing MATLAB algorithms into models.
- Legacy Code Tool for importing C and C++ code into models.

SOURCE CODE

FOR TRANSMITTER

```
#include<pic.h>

#include<htc.h>

#define _XTAL_FREQ 20000000

__CONFIG(FOSC_HS &WDTE_OFF &  PWRTE_ON & CP_OFF & BOREN_ON & LVP_OFF & CPD_OFF);


void UART_INIT();

void uart_sendstring(unsigned char *str);

void uart_sendchar(unsigned char a);

unsigned char msg[90],ch,a,k=0,lat[40],lon[40],web[90],inp[5]="#13";

unsigned int i,j,count=0,flag=0,n1,n2,n3,l,d1,d2,d3,d4;

char UART_getchar();

void Delay1();

void delay();

void Delay2();
```

```
////LCD
#define lcd PORTB       // data of lcd at port B
#define rs RD6
#define en RD7

#define flame RC0
#define buz   RD0
#define relay RD1

void lcd_data(unsigned char a);
void lcd_com(unsigned char a);
void lcd_str(unsigned char *a);
void lcd_init();

//RELAY


void Delay(unsigned int s)
{
```

```
for(i=0;i<s;i++)
for(j=0;j<10555;j++);
}
void Delay1()
{

for(i=0;i<20;i++)
for(j=0;j<1075;j++);
}
void Delay2()
{

for(i=0;i<50000;i++);
}
void main()
{
TRISB=0X00;
PORTB=0X00;
TRISC=0x81;
```

```
PORTC=0X00;

TRISD=0X00;

PORTD=0X00;


UART_INIT();

lcd_init();

ADC_Init();


lcd_str("     WELCOME");

Delay(50);

lcd_com(0x01);

lcd_str(" BOAT MONITORING");

lcd_com(0xC0);

lcd_str(" AND CONTROLLING");

Delay(50);

lcd_com(0x01);

lcd_com(0x80);


while(1)

{
```

```
lcd_com(0x80);
lcd_str("G =");
n1=ADC_Read(1);
val(n1);
lcd_com(0x88);
lcd_str("S =");
n2=ADC_Read(0);
val(n2);
if(flame==0)
{
relay=1;
buz=1;
uart_sendstring("F");
}
else
{
relay=0;
buz=0;
}
if(n1>500)
```

```
{
uart_sendstring("G");
}
if(n2<700)
{
uart_sendstring("S");
}
}
}
```

```
void UART_INIT()
{
TXSTA=0X24;
RCSTA=0X90;
TXREG=0X00;
RCREG=0X00;
SPBRG=0X81;
//SPBRG=25;
```

```
//PEIE=1;
}

void uart_sendstring(unsigned char *str)
{
while(*str)
{
uart_sendchar(*str++);
for(i=0;i<2000;i++);
}
}

void uart_sendchar(unsigned char a)
{
while(!TXIF);
TXREG=a;
}

char UART_getchar()
{
```

```
while(RCIF == 0);
    return RCREG;
}

void lcd_init()
{
lcd_com(0x38);
lcd_com(0x0c);
lcd_com(0x06);
lcd_com(0x80);
lcd_com(0x01);
}

void lcd_com(unsigned char com)
{
lcd=com;
rs=0;
en=1;
delay();
en=0;
```

```
delay();
}
void lcd_data(unsigned char dat)
{
lcd=dat;
rs=1;
en=1;
delay();
en=0;
delay();
}
void lcd_str(unsigned char *a)
{
while(*a)
{
lcd_data(*a++);
}
}
void delay()
{
```

```
unsigned char i;
for(i=0;i<255;i++);
}

void ADC_Init()
{
  ADCON0 = 0x41;    //ADC Module Turned ON and Clock is selected
  ADCON1 = 0xC0;    //All pins as Analog Input
                    //With reference voltages VDD and VSS
}
unsigned int ADC_Read(unsigned char channel)
{
  if(channel > 7)          //If Invalid channel selected
  return 0;
  ADCON0 &= 0xC5;       //Clearing the Channel Selection Bits
  ADCON0 |= channel<<3;    //Setting the required Bits
  __delay_ms(10);       //Acquisition time to charge hold capacitor
}
void interrupt ISR(void)
{
```

```
GIE = 0;
if(TMR1IF)
{
count++;
}
TMR1IF=0;
}
void val(unsigned int re)
{
delay(200);
d1=(re/1000);
d2=((re-d1*1000)/100);
d3=((re-(d1*1000+d2*100))/10);
d4=(re-(d1*1000+d2*100+d3*10));
//lcd_display(d1+0x30);
//lcd_display(d2+0x30);
lcd_data(d1+0x30);
lcd_data(d2+0x30);
lcd_data(d3+0x30);
lcd_data(d4+0x30);
```

```
delay(50);
}

void val1(unsigned int re)
{
delay(200);
d1=(re/1000);
d2=((re-d1*1000)/100);
d3=((re-(d1*1000+d2*100))/10);
d4=(re-(d1*1000+d2*100+d3*10));

uart_sendchar(d1+0x30);
uart_sendchar(d2+0x30);
uart_sendchar(d3+0x30);
uart_sendchar(d4+0x30);
delay(50);
}
```

FOR RECEIVER

```
#include<pic.h>
```

```
#include<htc.h>

#define _XTAL_FREQ 20000000

__CONFIG(FOSC_HS &WDTE_OFF &  PWRTE_ON & CP_OFF & BOREN_ON & LVP_OFF & CPD_OFF);



void delay();

void lcd_data(unsigned char);

void lcd_com(unsigned char);

void lcd_str(unsigned char *dat);

void lcd_init();

void val(unsigned int re);

unsigned int ADC_Read(unsigned char channel);

void UART_INIT();

void uart_sendstring(unsigned char *str);

void uart_sendchar(unsigned char a);

unsigned char msg[90],ch,a,k=0,count;

char UART_getchar();


#define lcd PORTB

#define rs RD6
```

```
#define en RD7


unsigned int d1,d2,d3,d4;



void main()
{
TRISC=0x80;
TRISB=0X00;   // LCD set o/p mode
TRISD=0x02;  // PIN RD2 set as i/p mode
T1CON=0X10; // TIMER1 is initilize
PORTD=0x00;
PORTC=0x00;
lcd_init();
UART_INIT();
lcd_str("WELCOME");
__delay_ms(3000);
lcd_com(0x01);
lcd_com(0x80);
k=0;
```

```
RCIE=1;
GIE=1;
play=1;
A0=1;
A1=1;
while(1)
{
if(k>0)
{
k=0;
RCIE=0;
GIE=0;
lcd_com(0xC8);
lcd_str(msg);
if(msg[0]=='F')
{
RC0=1;
lcd_com(0x80);
lcd_str("FIRE ALERT");
A0=0;
```

```
A1=1;
play=0;
__delay_ms(100);
RC0=0;
__delay_ms(2000);
lcd_com(0x80);
lcd_str("          ");
play=1;
__delay_ms(100);
}
if(msg[0]=='G')
{
RC0=1;
lcd_com(0x80);
lcd_str("GAS LEAKAGE");
A0=1;
A1=0;
play=0;
__delay_ms(100);
RC0=0;
```

```
__delay_ms(2000);
lcd_com(0x80);
lcd_str("          ");
play=1;
__delay_ms(100);
RC0=0;
}
if(msg[0]=='S')
{
RC0=1;
lcd_com(0x80);
lcd_str("WATER LEAKAGE");
A0=0;
A1=0;
play=0;
__delay_ms(100);
RC0=0;
__delay_ms(2000);
lcd_com(0x80);
lcd_str("            ");
```

```
play=1;
__delay_ms(100);
RC0=0;
}
}
k=0;
RCIE=1;
GIE=1;
}
}

unsigned int ADC_Read(unsigned char channel)
{
  if(channel > 7)          //If Invalid channel selected
  while(GO_nDONE);       //Wait for A/D Conversion to complete
  return ((ADRESH<<8)+ADRESL);       //Returns Result

}
```

```
void lcd_init()
{
lcd_com(0x38);
lcd_com(0x0c);
lcd_com(0x06);
lcd_com(0x80);
}


void lcd_com(unsigned char com)
{
lcd=com;
rs=0;
en=1;
delay();
en=0;
delay();
}
void lcd_data(unsigned char dat)
{
```

```
lcd=dat;
rs=1;
en=1;
delay();
en=0;
delay();
}
void lcd_str(unsigned char *dat)
{
while(*dat)
{
lcd_data(*dat++);
}
}
void delay()
{
unsigned char i;
for(i=0;i<255;i++);
}
```

```
void UART_INIT()
{
TXSTA=0X24;
RCSTA=0X90;
TXREG=0X00;
RCREG=0X00;
SPBRG=0X81;
//SPBRG=25;
PEIE=1;
}

void uart_sendstring(unsigned char *str)
{
while(*str)
{
uart_sendchar(*str++);
for(int i=0;i<2000;i++);
}
}
```

```
void uart_sendchar(unsigned char a)
{
while(!TXIF);
TXREG=a;
}

char UART_getchar()
{
while(RCIF == 0);
    return RCREG;
}

void val(unsigned int re)
{
d1=(re/1000);
d2=((re-d1*1000)/100);
d3=((re-(d1*1000+d2*100))/10);
d4=(re-(d1*1000+d2*100+d3*10));
lcd_data(d1+0x30);
```

```
lcd_data(d2+0x30);
lcd_data(d3+0x30);
lcd_data(d4+0x30);
}



static void interrupt isr(void)
{
if(RCIF)
{
if(k<1)
{
msg[k]=RCREG;
k++;
}
else
{
RCIE=0;
}
```

```
RCIF=0;

OERR=0;

CREN=0;

CREN=1;

}

}
```

CONCLUSION

Thus an efficient internal ship communication is carried out using Li-Fi technology. All the parameters within the ship are monitored and transmitted using lifi module without any delay. All these data are received in captain's cabinet. Nowadays the number of devices connected to a server or a hub is very large in number resulting in heavy traffic. This can be solved by using Li-Fi wherein no bandwidth of a spectrum is required. Added advantage of Li-Fi technology is that they can be used even underwater where no other means of communication would be reliable.

REFERENCE

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[5]. Yussoff, Y.; Abidin, H.Z.; Rahman, R.A.;Yahaya, F.H., "Development of a PIC-based wireless sensor node utilizing X-Bee technology" The2nd IEEE International Conference on Information Management And Engineering (ICIME), 2010

[6]. Absar-ul-Hasan, Ghalib A. Shah &Ather Ali," Intrusion DetectionSystem using Wireless Sensor Networks 2010" on EJSE International Special Issue.

EXPENDITURES

S.NO	WORK	PLACE	COST
1	MILD STEEL PURCHASED, BENDING , WELDING	SHANMUGAVEL, S & S ENGINNERING WORKS KANCHANWADI, CHENNAI	11,000
2	PLUMBING	KANATHUR HARDWARE SHOPS	2300
3	REMOTE CONTROL CIRCUIT	SPIRO, CVR COMPLEX, SINAGARAVELU STREET, T.NAGAR, CHENNAI.	4500
4	ACRYLIC SHEET	ALMO PLAST, PARIS,CHENNAI	1000
5	PAINTING WORKS	KANATHUR NEAR MAYAJAAL	2000
6	PUMPS	LUMINO AQUIRIUM PANAIYUR, CHENNAI	1600
7	TRANSPORT		2000
	TOTAL		24400.00

AMET
ACADEMY OF MARITIME EDUCATION AND TRAINING
DEEMED TO BE UNIVERSITY
(Under Section 3 of UGC Act 1956)

DEADMAN ALARM SYSTEM

AN INTERNSHIP REPORT

SUBMITTED BY

BE ME -16

PROJECT GUIDE: PROF. VENKATAGANESH

PROJECT MEMBERS

1. **NITHESH KUMAR. N (2323B)**
2. **PANGARU. S (2324B)**
3. **PATAM SUNNEL KUMAR (2325B)**
4. **POOVARASAN. V (2326B)**

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INTERNSHIP EVALUATION REPORT 2019-20

Name of the Department: MARINE ENGINEERING

(In view of advisory from the AICTE, internships for the year 2019-20 are offered by the Department itself to facilitate the students to take up required work from their home itself during the lock down period due to COVID-19 outbreak)

Name of the Student	NITISH KUMAR. N
Register No and Roll No	AME16114
Programme of study	BE-MARINE
Year and Batch/Group	FINAL YEAR
Semester	II / IV / VI / VIII
Title of Internship	DEADMAN ALARM SYSTEM
Duration of Internship	420 Hours
Mentor of the Student	PROF. VENKATAGANESH

Evaluation by the Department

Sl No.	Criterion	Max. Marks	Marks Allotted
1	Regularity in maintenance of the diary.	10	8
2	Adequacy & quality of information recorded	10	8
3	Drawings, sketches and data recorded	10	9
4	Thought process and recording techniques used	5	4
5	Organization of the information	5	4
6	Originality of the Internship Report	20	18
7	Adequacy and purposeful write-up of the Internship Report	10	8
8	Organization, format, drawings, sketches, style, language etc. of the Internship Report	10	8
9	Practical applications, relationships with basic theory and concepts	10	9
10	Presentation Skills	10	7
Total		100	83

Signature of the Mentor	Signature of the Internal Examiner	Signature of HoD / Programme Head

AMET

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INTERNSHIP EVALUATION REPORT 2019-20

Name of the Department: MARINE ENGINEERING

(In view of advisory from the AICTE, internships for the year 2019-20 are offered by the Department itself to facilitate the students to take up required work from their home itself during the lock down period due to COVID-19 outbreak)

Name of the Student	PANGARU. S
Register No and Roll No	AME 16115
Programme of study	DE-MARINE
Year and Batch/Group	FINAL YEAR
Semester	II / IV / VI / VIII
Title of Internship	DEADMAN ALARM SYSTEM
Duration of Internship	40 Hours
Mentor of the Student	PROF. VENKATALAKSHMANESH

Evaluation by the Department

Sl No.	Criterion	Max. Marks	Marks Allotted
1	Regularity in maintenance of the diary.	10	8
2	Adequacy & quality of information recorded	10	8
3	Drawings, sketches and data recorded	10	8
4	Thought process and recording techniques used	5	4
5	Organization of the information	5	4
6	Originality of the Internship Report	20	18
7	Adequacy and purposeful write-up of the Internship Report	10	8
8	Organization, format, drawings, sketches, style, language etc. of the Internship Report	10	8
9	Practical applications, relationships with basic theory and concepts	10	8
10	Presentation Skills	10	9
Total		100	83

Signature of the Mentor	Signature of the Internal Examiner	Signature of HoD / Programme Head

AMET

ACADEMY OF MARITIME EDUCATION AND TRAINING
DEEMED TO BE UNIVERSITY
(Under Section 3 of UGC Act 1956)

INTERNSHIP EVALUATION REPORT 2019-20

Name of the Department: MARINE ENGINEERING

(In view of advisory from the AICTE, internships for the year 2019-20 are offered by the Department itself to facilitate the students to take up required work from their home itself during the lock down period due to COVID-19 outbreak)

Name of the Student	PATAM SUNEEL KUMAR
Register No and Roll No	AME16116
Programme of study	BE - MARINE
Year and Batch/Group	FINAL YEAR
Semester	II / IV / VI / VIII
Title of Internship	DEADMAN ALARM SYSTEM
Duration of Internship	40 Hours
Mentor of the Student	PROF. VENKATAGANESH

Evaluation by the Department

Sl No.	Criterion	Max. Marks	Marks Allotted
1	Regularity in maintenance of the diary.	10	9
2	Adequacy & quality of information recorded	10	9
3	Drawings, sketches and data recorded	10	9
4	Thought process and recording techniques used	5	4
5	Organization of the information	5	4
6	Originality of the Internship Report	20	18
7	Adequacy and purposeful write-up of the Internship Report	10	9
8	Organization, format, drawings, sketches, style, language etc. of the Internship Report	10	8
9	Practical applications, relationships with basic theory and concepts	10	5
10	Presentation Skills	10	8
Total		100	83

Signature of the Mentor	Signature of the Internal Examiner	Signature of HoD / Programme Head

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INTERNSHIP EVALUATION REPORT 2019-20

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Name of the Student	POOVARASAN.V
Register No and Roll No	AME 16117
Programme of study	BE - MARINE
Year and Batch/Group	FINAL YEAR
Semester	II / IV / VI / VIII
Title of Internship	DEADMAN ALARM SYSTEM
Duration of Internship	40 Hours
Mentor of the Student	PROF. VENKATALAKESH

Evaluation by the Department

Sl No.	Criterion	Max. Marks	Marks Allotted
1	Regularity in maintenance of the diary.	10	8
2	Adequacy & quality of information recorded	10	8
3	Drawings, sketches and data recorded	10	8
4	Thought process and recording techniques used	5	4
5	Organization of the information	5	4
6	Originality of the Internship Report	20	18
7	Adequacy and purposeful write-up of the Internship Report	10	6
8	Organization, format, drawings, sketches, style, language etc. of the Internship Report	10	7
9	Practical applications, relationships with basic theory and concepts	10	8
10	Presentation Skills	10	8
Total		100	79

Signature of the Mentor	Signature of the Internal Examiner	Signature of HoD/Programme Head

AMET

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(Under Section 3 of UGC Act 1956)

DEPARTMENT OF MARINE ENGINEERING

Certificate

This is to certify that.....NITHESH KUMAR.N.....

with Register No. .....AME 16114.....of .....FINAL.....~~Semester~~ / Year

has undergone with an **Internship at Home** titled .....DEADMAN ALARM SYSTEM

.....

and has successfully completed.

Faculty In-Charge

Principal DGS - Courses

AMET

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DEEMED TO BE UNIVERSITY
(Under Section 3 of UGC Act 1956)

DEPARTMENT OF MARINE ENGINEERING

Certificate

This is to certify that.....PANGARU. S.....

with Register No. ..AME 16115.....of .....FINAL.....Semester / Year

has undergone with an **Internship at Home** titled .....DEADMAN ALARM.....

.....SYSTEM.....

and has successfully completed.

Faculty In-Charge

Principal DGS - Courses

AMET

ACADEMY OF MARITIME EDUCATION AND TRAINING
DEEMED TO BE UNIVERSITY
(Under Section 3 of UGC Act 1956)

DEPARTMENT OF MARINE ENGINEERING

Certificate

This is to certify that.....PATAM SUNEEL KUMAR.....

with Register No. ...AME.16116.....of .....FINAL.....Semester / Year ✓

has undergone with an **Internship at Home** titled .....DEAD-MAN ALARM SYSTEM

.....

and has successfully completed.

Faculty In-Charge

Principal DGS - Courses

AMET

ACADEMY OF MARITIME EDUCATION AND TRAINING
DEEMED TO BE UNIVERSITY
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DEPARTMENT OF MARINE ENGINEERING

Certificate

This is to certify that.....POOVARASAN : V.....

with Register No. ....AME 16117.....of .....FINAL.....Semester / Year

has undergone with an **Internship at Home** titled .DEAD-MAN ALARM SYSTEM.

.....

and has successfully completed.

Faculty In-Charge

Principal DGS - Courses

AMET UNIVERSITY
ACADEMY OF MARITIME EDUCATION AND TRAINING UNIVERSITY
(Declared as Deemed to be University u/s 3 of UGC Act 1956)

DEADMAN ALARM SYSTEM

A PROJECT REPORT

SUBMITED BY

BE ME -16

2019-2020

AMET UNIVERSITY
ACADEMY OF MARITIME EDUCATION AND TRAINING UNIVERSITY
(Declared as Deemed to be University u/s 3 of UGC Act 1956)

CERTIFICATE

This is to certify that the project with the title of **"DEADMAN ALARM SYSTEM"** made with the complete dedication by the students of AMET UNIVERSITY, KANATHUR (CHENNAI) during the year 2019 for the partial fulfilment of the requirements for the award of the Degree of Bachelor of a Marine Engineering.

INTERNAL GUIDE

EXTERNAL EXAMINER

HEAD OF THE DEPARTMENT

PLACE : AMET UNIVERSITY,CHENNAI

PROJECT GUIDE : PROF. VENKATAGANESH

PROJECT MEMBERS

1. NITHESH KUMAR N (2323B)
2. PANGARU S (2324B)
3. PATAM SUNNEL KUMAR (2325B)
4. POOVARASAN V (2326B)
5. PRABATH E (2327B)
6. PRAKASH R (2328B)
7. PRAVEEN KUMAR A (2329B)
8. RAGUL GANDHI V (L2418B)

ACKNOWLEDGEMENT

- We would like to thank our **PRINCIPAL Prof BHOOPATHY BASKARAN** for giving us this opportunity to setup a working model of Dead Man alarm System to our ship in campus and to extract the best outcome from us.
- We would like to express our thanks of gratitude to our project in charge **Prof K.R CHIDAMBARAM** for giving us opportunity to test our technical and practical skills as well as the knowledge.

- We would like to thank the facilities of Marine Automation Laboratory who took an interest in our project and kept on motivating us from the start of our work till the completion of our project.

❖We would also like to thank the EEE department for their immense contribution which added more value to our project.

❖ We extend our thanks to all our colleagues for their support.

We also acknowledge with deep sense of reverence, our gratitude towards our parents who has always supported us morally and economically. Any omission in this brief acknowledge doesn’t mean lack of gratitude

CONTENTS

AIM

The aim of this study is to design and analyses the working of dead man alarm system through the internet of things concept. The advancement in information technology enables to create a dead man alarm system as a wireless module which establish connection between the parts of the system through the use of Wi-Fi. However the old method had major drawbacks as it establish connection through the conventional use of wires which results in complexity and various risk factor. The main aim of this project is to modify the conventional module which occupies more space and work into a compact and easy one through the use of automation techniques thereby keeping an eye on the manufacturing side also.

INTRODUCTION

Dead Man Alarm System

A Dead man/Watch Alarm System (also known as Personnel Alarm) is used to monitor the presence of an operator or detect his/her disability that could result in a marine accident.

The system monitors the ability of the duty personnel and automatically alerts the Master or another qualified person if the duty personnel is unable to respond to a series of visual and audio alerts generated by the Watch Alarm System.

Principle of operation: The system can be preset to activate at intervals of 5, 10, 15 or 20 minutes. Upon activation of the Watch Timer, the Watch Alarm System will alert the duty personnel by means of a Pilot Light (or flashing beacon) and an audible alarm (using a buzzer or sounder). The duty personnel will be required to reset the Watch Alarm System by pressing the Reset Pushbutton located on the Main Panel or Reset Panel. If the duty personnel successfully resets the system, the next alarm will be activated at the preset interval. However, if the duty personnel does not reset the system in a pre-defined time, the alarm is escalated to the optional Bridge Panel, Ship Alarm System or any other external alarm system.The Watch Alarm System also allows the duty personnel to summon help from the Wheelhouse /

Master in situations of emergency. This is achieved by pressing and holding down the Reset Pushbutton for more than 3 seconds.

Internet of things (IOT):

There's a lot of noise at the moment about the Internet of Things (or IOT) and its impact on everything from the way we travel and do our shopping to the way manufacturers keep track of inventory. But what is the Internet of Things? How does it work? And is it really that important?

In a nutshell, the Internet of Things is the concept of connecting any device (so long as it has an on/off switch) to the Internet and to other connected devices. The IOT is a giant network of connected things and people – all of which collect and share data about the way they are used and about the environment around them.

That includes an extraordinary number of objects of all shapes and sizes – from smart microwaves, which automatically cook your food for the right length of time, to self-driving cars, whose complex sensors detect objects in their path, to wearable fitness

devices that measure your heart rate and the number of steps you've taken that day, then use that information to suggest exercise plans tailored to you. There are even connected footballs that can track how far and fast they are thrown and record those statistics via an app for future training purposes.

How does it work?

Devices and objects with built in sensors are connected to an Internet of Things platform, which integrates data from the different devices and applies analytics to share the most valuable information with applications built to address specific needs.

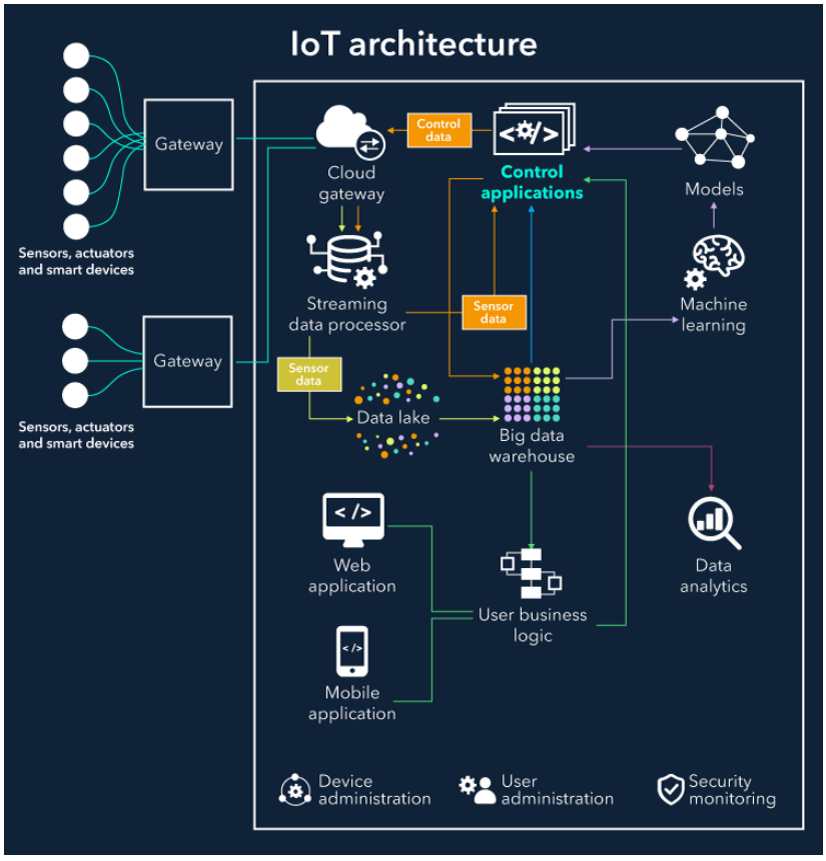
These powerful IoT platforms can pinpoint exactly what information is useful and what can safely be ignored. This information can be used to detect patterns, make recommendations, and detect possible problems before they occur.

For example, if I own a car manufacturing business, I might want to know which optional components (leather seats or alloy wheels, for example) are the most popular. Using Internet of Things technology, I can:

Use sensors to detect which areas in a showroom are the most popular, and where customers linger longest; Drill down into the available sales data to identify which components are selling fastest; automatically align sales data with supply, so that popular items don't go out of stock.

The information picked up by connected devices enables me to make smart decisions about which components to stock up on, based on real-time information, which helps me save time and money.

With the insight provided by advanced analytics comes the power to make processes more efficient. Smart objects and systems mean you can automate certain tasks, particularly when these are repetitive, mundane, time-consuming or even dangerous. Let's look at some examples to see what this looks like in real life.



Scenario #1: IOT in your home

Imagine you wake up at 7am every day to go to work. Your alarm clock does the job of waking you just fine. That is, until something goes wrong. Your train's cancelled and you have to drive to work instead. The only problem is that it takes longer to drive, and you would have needed to get up at 6.45am to avoid being late. Oh, and it's pouring with rain, so you'll need to drive slower than usual. A connected or IoT-enabled alarm clock would reset itself

based on all these factors, to ensure you got to work on time. It could recognize that your usual train is cancelled, calculate the driving distance and travel time for your alternative route to work, check the weather and factor in slower travelling speed because of heavy rain, and calculate when it needs to wake you up so you're not late. If it's super-smart, if might even sync with your IoT-enabled coffee maker, to ensure your morning caffeine's ready to go when you get up.

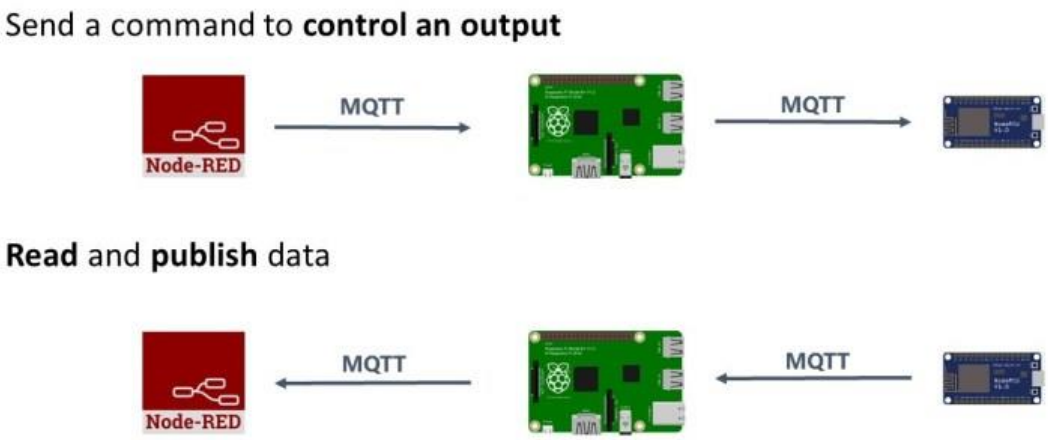
Scenario #2: IOT in transport

Having been woken by your smart alarm, you're now driving to work. On comes the engine light. You'd rather not head straight to the garage, but what if it's something urgent? In a connected car, the sensor that triggered the check engine light would communicate with others in the car. A component called the diagnostic bus collects data from these sensors and passes it to a gateway in the car, which sends the most relevant information to the manufacturer's platform. The manufacturer can use data from the car to offer you an appointment to get the part fixed, send you directions to the nearest dealer, and make sure the correct replacement part is ordered so it's ready for you when you show up.

What is MQTT and How It Works

We're going to introduce you to the MQTT protocol. MQTT stands for **M**essage **Q**ueuing **T**elemetry **T**ransport.

MQTT – How It Works



It is a lightweight publish and subscribe system where you can publish and receive messages as a client.

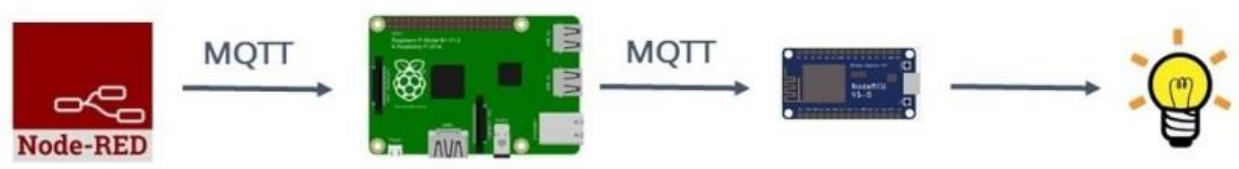
MQTT is a simple messaging protocol, designed for constrained devices with low-bandwidth. So, it's the perfect solution for Internet of Things applications. MQTT allows you to send commands to control outputs, read and publish data from sensor nodes and much more.

Therefore, it makes it really easy to establish a communication between multiple devices.

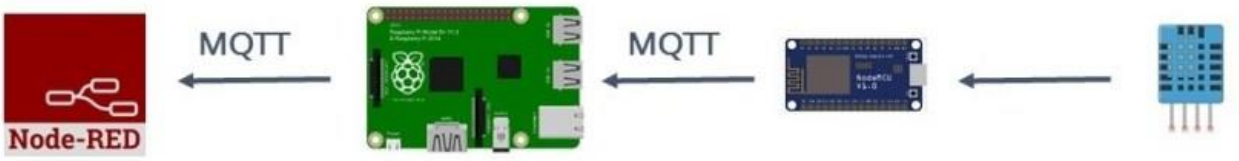
High Level Overview

Here's a quick high level overview of what MQTT allows you to do.

You can **send** a **command** with a client (like Node-RED) to control an **output**:



Or you can **read data** from a **sensor** and **publish** it to a client (like Node-RED):



MQTT Basic Concepts

In MQTT there are a few basic concepts that you need to understand:

- Publish/Subscribe
- Messages
- Topics
- Broker

MQTT – Publish/Subscribe

The first concept is the *publish and subscribe* system. In a publish and subscribe system, a device can publish a message on a topic, or it can be subscribed to a particular topic to receive messages.

- For example **Device 1** publishes on a topic.
- **Device 2** is subscribed to the same topic as **device 1** is publishing in.
- So, **device 2** receives the message.

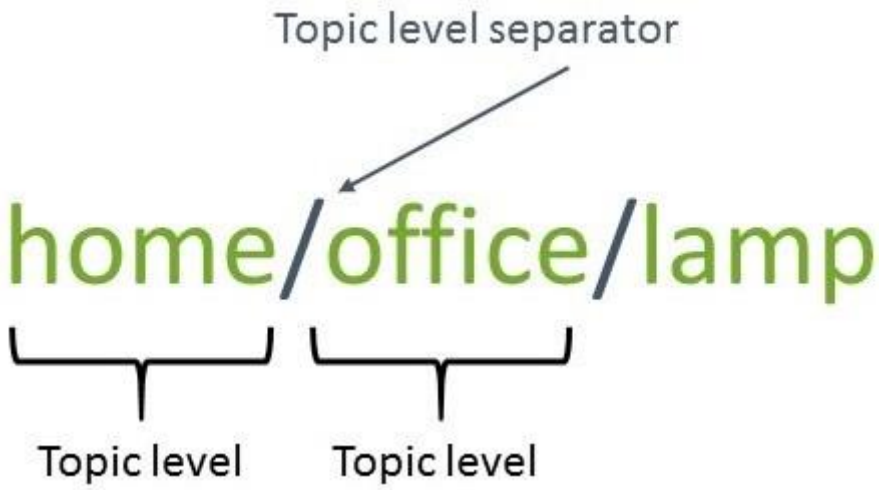
MQTT – Messages

Messages are the information that you want to exchange between your devices. Whether it's a command or data.

MQTT – Topics

Another important concept are the *topics*. Topics are the way you register interest for incoming messages or how you specify where you want to publish the message.

Topics are represented with strings separated by a forward slash. Each forward slash indicates a topic level. Here's an example on how you would create a topic for a lamp in your home office:



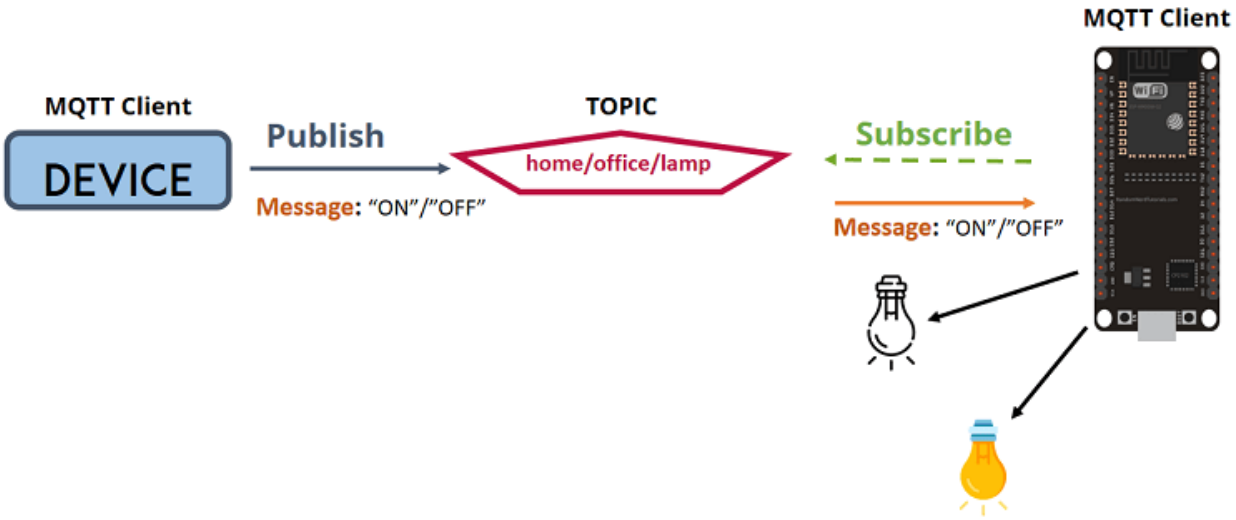
Note: topics are case-sensitive, which makes these two topics different:

home/office/lamp

≠

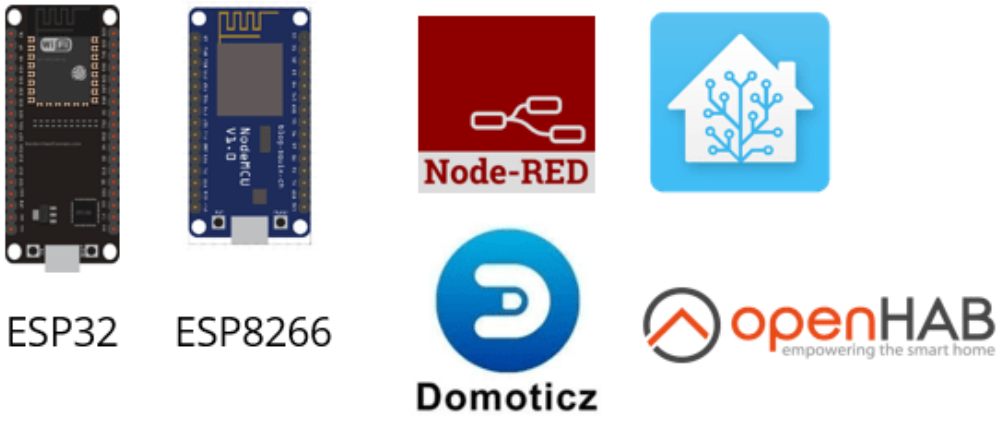
home/office/LAmp

If you would like to turn on a lamp in your home office using MQTT you can imagine the following scenario:



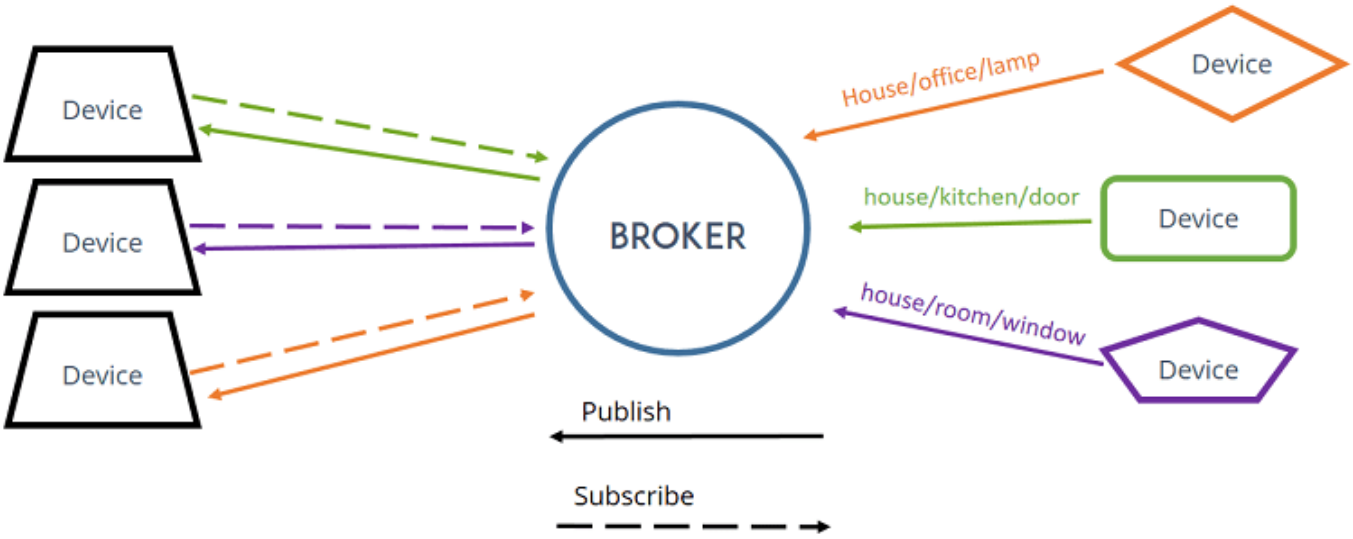
1. You have a device that publishes “on” and “off” messages on the **home/office/lamp** topic.
2. You have a device that controls a lamp (it can be an ESP32, ESP8266, or any other board). The ESP32 that controls your lamp, is subscribed to that topic: **home/office/lamp**.
3. So, when a new message is published on that topic, the ESP32 receives the “on” or “off” message and turns the lamp on or off.

This first device, can be an ESP32, an ESP8266, or an Home Automation controller platform like Node-RED, Home Assistant, Domoticz, or OpenHAB, for example.



MQTT – Broker

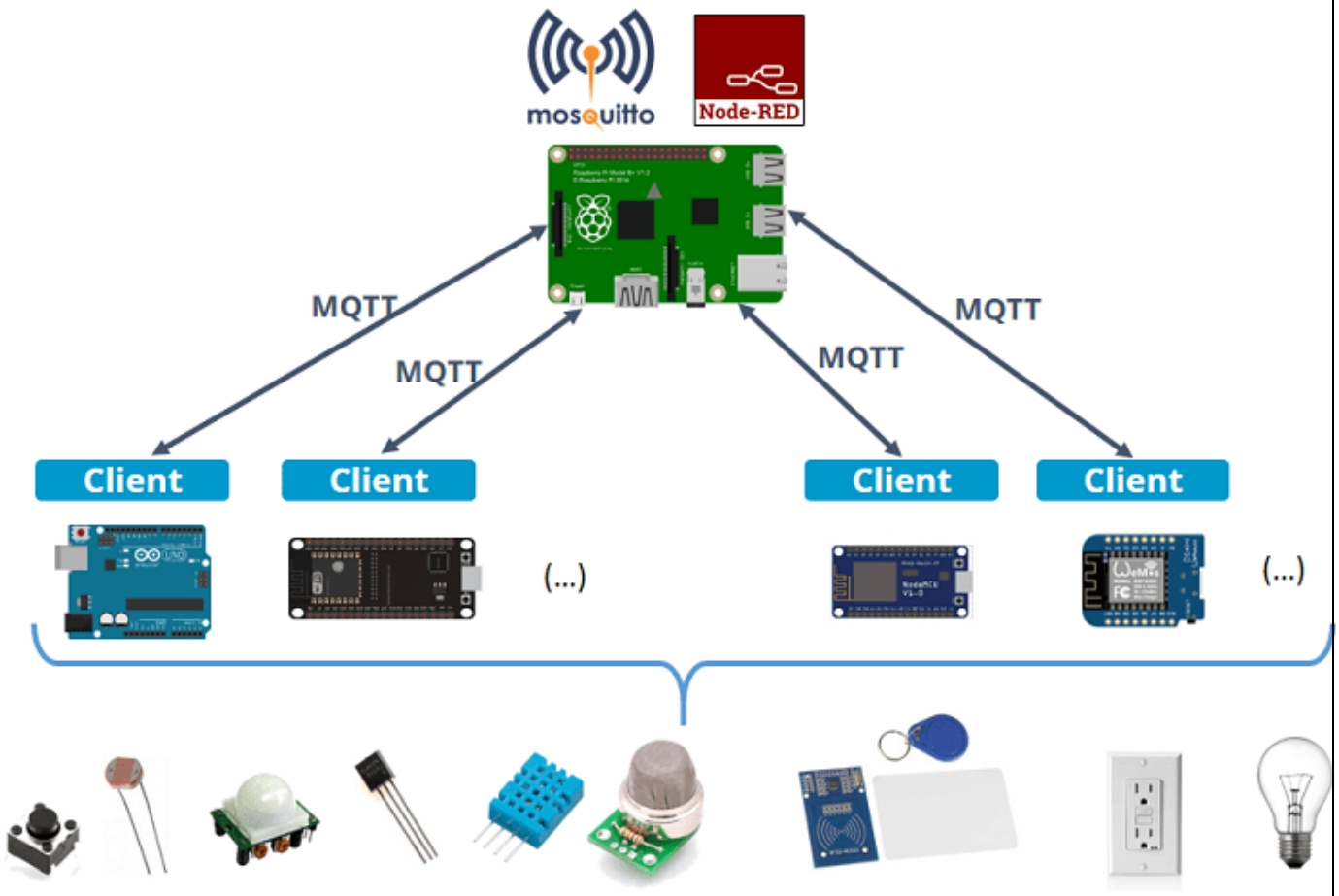
At last, you also need to be aware of the term *broker*.
The broker is primarily responsible for **receiving** all messages, **filtering** the messages, **decide** who is interested in them and then **publishing** the message to all subscribed clients.



There are several brokers you can use. In our home automation projects we use the Mosquitto broker which can be installed in the Raspberry Pi. Alternatively, you can use a cloud MQTT broker.

How to Use MQTT in Home Automation and IoT Projects

As we've seen previously, MQTT is great for home automation and internet of things projects. If you want to start making your own projects using MQTT here's an example of what you can do.



Here's the steps you should follow:

1) Set up your Raspberry Pi. Follow our Getting Started Guide with Raspberry Pi.
2) Enable and Connect your Raspberry Pi with SSH.
3) You need Node-RED installed on your Pi and Node-RED Dashboard.
4) Install the Mosquito broker on the Raspberry Pi.

5) Add the ESP8266 or the ESP32 to this system.

Working of our Project:

'X' enters the room, sees the panel..turns it ON ..Now he has to set the Time Delay ..he sets that using A button which he can press and set the time which will be displayed in LCD display. After these steps the system active light turns on.

Case: When he doesn't hit reset button

A LED light in the panel turns red and an alarm is triggered in engine room.

Now a time delay is kept and if even after that the reset button is not pressed. Notification is sent to the duty engineer's cabin I.e. an alarm is triggered in his cabin. If he also doesn't acknowledge after a predefined time, an alarm in the bridge is triggered

Working explained in accordance with Mqtt needed for the project:

Protocol: MQTT

Topics: ship/emergency/engine room, ship/emergency/noack

Working:

When he fails to press reset button, a message is published to the topic ship/emergency/engine room

Now the duty engineer's module which is subscribed to the topic ship/emergency/engine room, gets the message and an alarm is triggered.

When he fails to acknowledge, a message is published to ship/emergency/noack by his module. Whole ship's alarm system

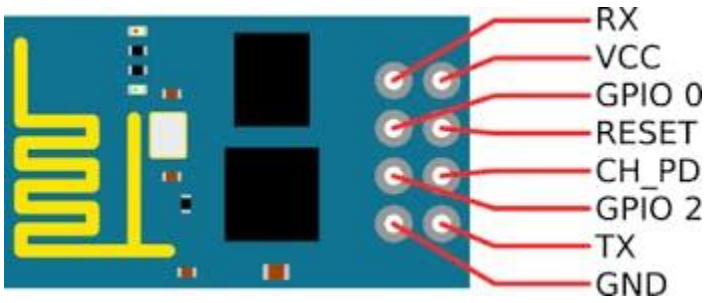
module is subscribed to the topic ship/emergency/noack, when it gets a message the whole ship's alarm is triggered.

HARDWARE COMPONENTS:

MICROCONTROLLER (ESP8266)

ESP8266 is a 3V Wi-Fi module very popular for its Internet of Things applications. ESP 8266 maximum working Voltage is 3.6V and it’s very important to note. You must know how to power it, how to serial-connect it with Arduino safely, how to ping and many other things. You should use software like Circuito.io, Tinker cad, Fritzing to simulate and work with the board safely. You should also use Logic Level Controller to use with ESP8266 module.

ESP 8266 Pinout



ESP8266 has 8 pins, namely:

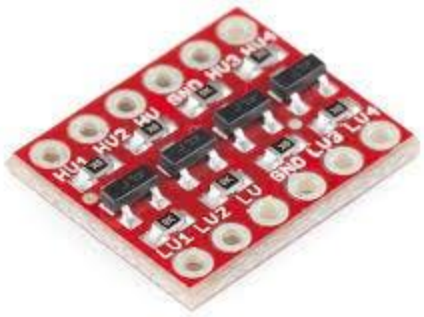
- RX
- VCC
- GPIO 0
- RESET
- CH_PD

- GPIO 2
- TX
- and GND

VCC and GND are powering pins. RX and TX are used to communicate.

Powering ESP 8266

There are many ways to power ESP8266 Wi-Fi module: you can use 2 AA sized batteries for powering, PC port if you have a TTL-Serial-to-USB adapter *(Don't try to connect the module to a PC serial port directly, you could cause damage to the module or to your computer!).* You can use LIPO batteries to power the ESP Dev Thing board. You can use LM117 3.3V voltage regulator.

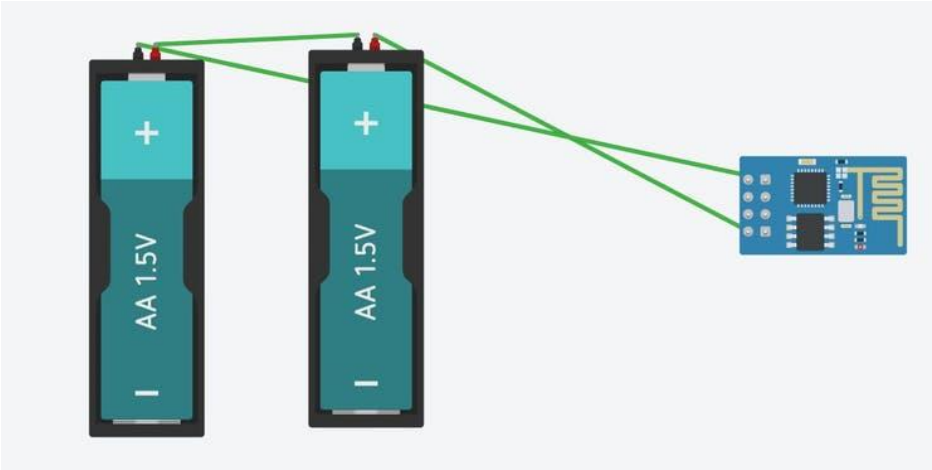


Logic Level Controller

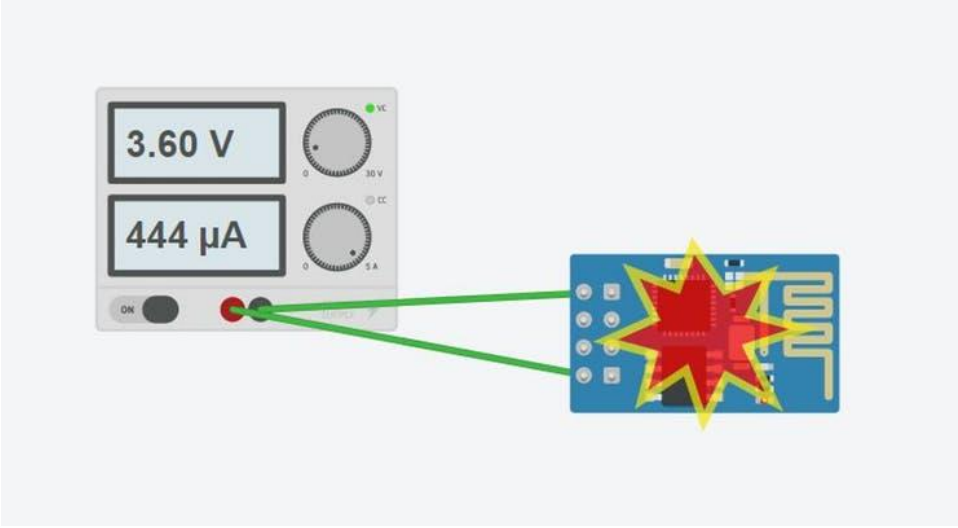
The ESP8266's maximum voltage is 3.6V, so the thing has an onboard 3.3V regulator to deliver a safe, consistent voltage to the IC. That means the ESP8266's I/O pins also run at 3.3V, you'll need to Logic Level Controller any 5V signals running into the IC.

Alternatively, if you have an external, regulated supply you'd like to deliver directly to the ESP8266, you can supply that voltage

through the *3V3* pin (on the I2C header). While this voltage doesn't have to be 3.3V, it must be within the range of **1.7-3.6V**.

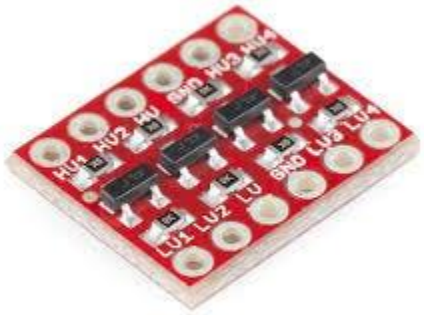


You can also power ESP using two AA batteries. Positive from batteries to VCC of ESP and GND to GND of ESP 8266.



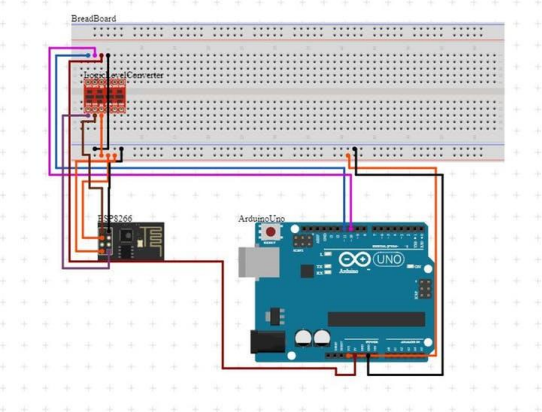
I have used Tinkercad to show how the board can't handle even 0.1 extra. The maximum voltage you can give is 3.5V. You should use such simulation software to look that the power you are delivering to ESP is safe or not.

Using Logic Level Controller



The level converter is very easy to use. The board needs to be powered from the two voltages sources (high voltage and low voltage) that your system is using. High voltage (5V for example) to the ‘HV’ pin, low voltage (3.3V for example) to ‘LV’, and ground from the system to the ‘GND’ pin.

Communicating ESP 8266 Via Arduino UNO



To communicate with ESP8266 via Arduino UNO you will need a Logic Level Controller in between to safely work with ESP8266.

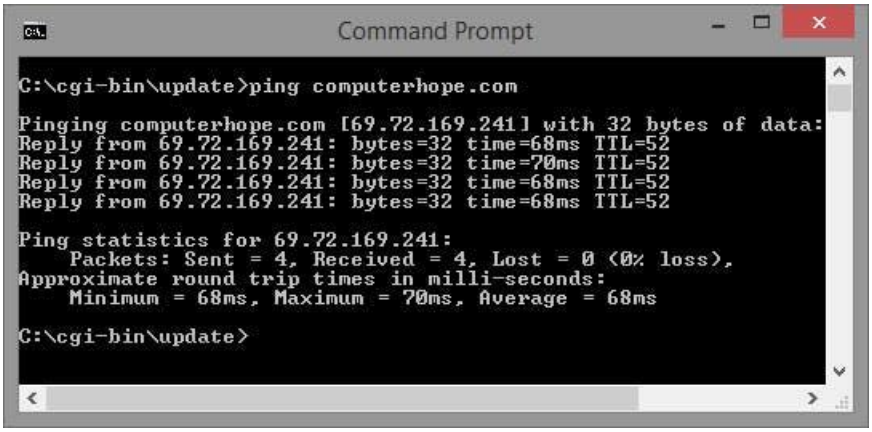
Connections:

For Connecting ESP TO Arduino, Connect ESP8266 RX to Logic Level Controller Level 1.

- Connect ESP TX to Logic Level Controller Level 2.
- ESP VCC to Arduino UNO 3.3V
- Logic Level Controller Level to Arduino 3.3V.
- Logic Level Controller GND To Arduino GND.
- ESP GND to Arduino GND.
- ESP CH_PD To Arduino 5V.
- Logic level Controller HV to Arduino 5V.
- Logic Level Controller HV1 to Arduino 11th pin.
- Logic Level Controller HV2 to Arduino 10th pin.

Test code is given in code section below.

Communicating With ESP 8266 Module



Click on Start, Run, and type **CMD** and press enter. Type **IPCONFIG** and press enter. Type PING and the IP address of your module. A successful PING request will always return a set of numbers. If you get "Request Time Out" messages it means that something isn't communicating.

PUSH BUTTONS

A push button is a simple type of switch that controls an action in a machine or some type of process. Most of the time, the buttons are plastic or metal. The shape of the push button may conform to fingers or hands for easy use, or they may simply be flat. It all depends on the individual design. The push button can be normally open or normally closed.

Push button switches have three parts. The actuator, stationary contacts, and the grooves. The actuator will go all the way through the switch and into a thin cylinder at the bottom. Inside is a movable contact and spring. When someone presses the button, it touches with the stationary contacts, causing the action to take place. In some cases, the user needs to keep holding the button, or to press it repeatedly, for an action to take place. With

other push buttons, a latch connects and keeps the switch on until the user presses the button again.

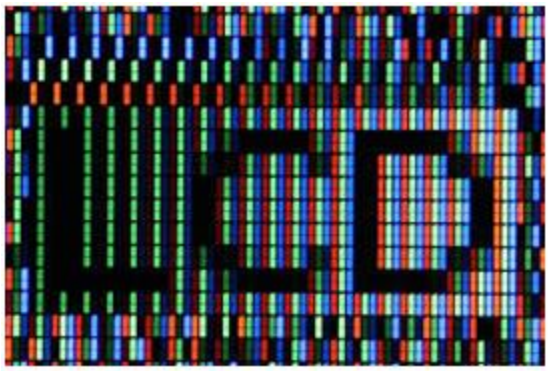
Push button switches are popular in a variety of different applications, including calculators, push button phones, and many home appliances. You can find them in the home, the office, and in industrial applications today. They can turn machines on and off, or cause the devices to perform specific actions, as is the case with calculators. In some cases, specifically for commercial and industrial usage, the buttons can connect through mechanical linkage, which means that pushing one button can actually cause another button to release.

In many cases, the buttons will have specific coloration to help denote their actions. This ensures that the chance of someone pushing the button by mistake is lower. Red will usually indicate stopping, while green generally indicates starting a machine. Emergency stop buttons, which tend to be large push buttons, are generally red, and they typically have larger heads for easier use.

LCD DISPLAY

A liquid crystal display or LCD draws its definition from its name itself. It is combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. Liquid crystal displays are super-thin technology display screen that are generally used in laptop computer screen, TVs, cell phones and portable video games. LCD's technologies allow displays to be much thinner when compared to cathode ray tube (CRT) technology.

Liquid crystal display is composed of several layers which include two polarized panel filters and electrodes. LCD technology is used for displaying the image in notebook or some other electronic devices like mini computers. Light is projected from a lens on a layer of liquid crystal. This combination of colored light with the grayscale image of the crystal (formed as electric current flows through the crystal) forms the colored image. This image is then displayed on the screen.



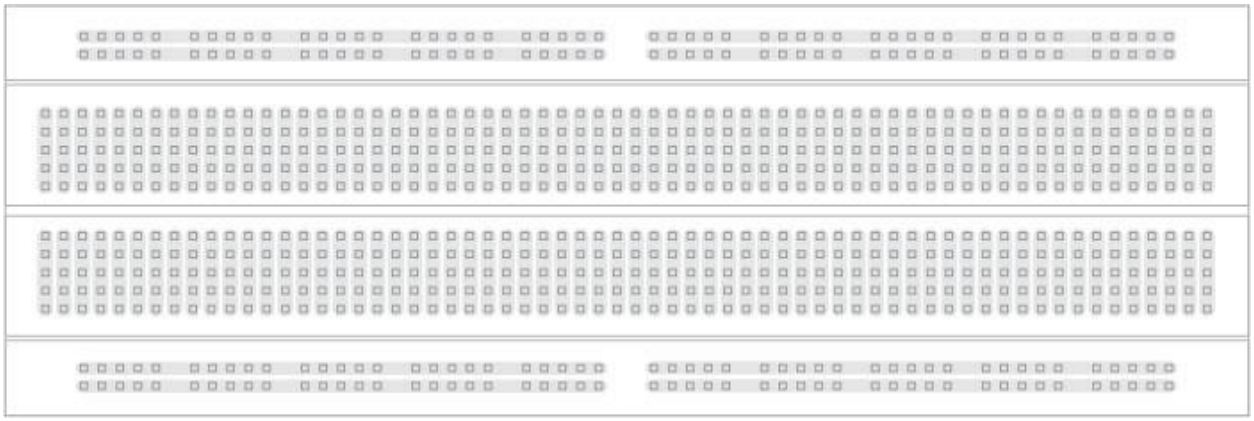
An LCD is either made up of an active matrix display grid or a passive display grid. Most of the Smartphone's with LCD display technology uses active matrix display, but some of the older displays still make use of the passive display grid designs. Most

of the electronic devices mainly depend on liquid crystal display technology for their display. The liquid has a unique advantage of having low power consumption than the LED or cathode ray tube.

Liquid crystal display screen works on the principle of blocking light rather than emitting light. LCD's requires backlight as they do not emits light by them. We always use devices which are made up of LCD's displays which are replacing the use of cathode ray tube. Cathode ray tube draws more power compared to LCD's and are also heavier and bigger.

BREADBOARD

A breadboard is a solderless device for temporary prototype with electronics and test circuit designs. Most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making connections through wires where appropriate. The breadboard has strips of metal underneath the board and connect the holes on the top of the board. The metal strips are laid out as shown below. Note that the top and bottom rows of holes are connected horizontally and split in the middle while the remaining holes are connected vertically.



BATTERIES

Batteries are a collection of one or more cells whose chemical reactions create a flow of electrons in a circuit. All batteries are made up of three basic components: an anode (the '-' side), a cathode (the '+' side), and some kind of electrolyte (a substance that chemically reacts with the anode and cathode).

When the anode and cathode of a battery is connected to a circuit, a chemical reaction takes place between the anode and the electrolyte. This reaction causes electrons to flow through the circuit and back into the cathode where another chemical reaction takes place. When the material in the cathode or anode is consumed or no longer able to be used in the reaction, the battery is unable to produce electricity. At that point, your battery is "dead."

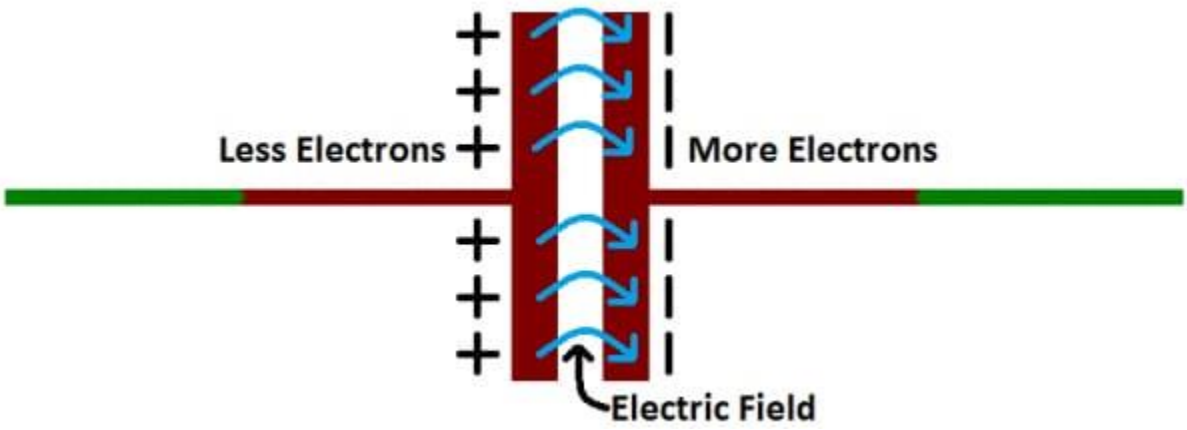
Batteries that must be thrown away after use are known as **primary batteries**. Batteries that can be recharged are called **secondary batteries**.

CAPACITOR

A capacitor is a two-terminal, electrical component. Along with resistors and inductors, they are one of the most fundamental passive components we use. You would have to look very hard to find a circuit which didn't have a capacitor in it.

What makes capacitors special is their ability to store energy; they're like a fully charged electric battery. Caps, as we usually refer to them, have all sorts of critical applications in circuits. Common applications include local energy storage, voltage spike suppression, and complex signal filtering.How a Capacitor Works

Electric current is the flow of electric charge, which is what electrical components harness to light up, or spin, or do whatever they do. When current flows into a capacitor, the charges get "stuck" on the plates because they can't get past the insulating dielectric. Electrons -- negatively charged particles -- are sucked into one of the plates, and it becomes overall negatively charged. The large mass of negative charges on one plate pushes away like charges on the other plate, making it positively charged.

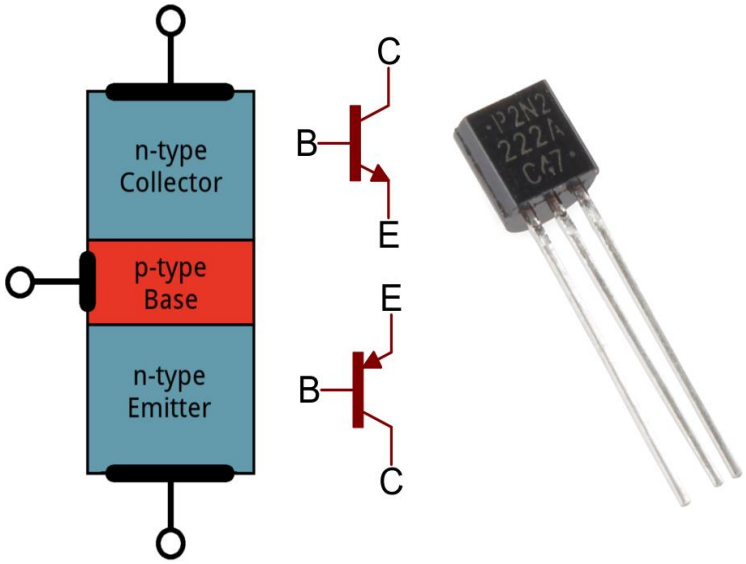


The positive and negative charges on each of these plates attract each other, because that's what opposite charges do. But, with the dielectric sitting between them, as much as they want to come together, the charges will forever be stuck on the plate (until they have somewhere else to go). The stationary charges on these plates create an electric field, which influence electric potential energy and voltage. When charges group together on a capacitor like this, the cap is storing electric energy just as a battery might store chemical energy.

TRANSISTORS

Transistor is a semiconductor device that can both conduct and insulate. A transistor can act as a switch and an amplifier. It converts audio waves into electronic waves and resistor, controlling electronic current. Transistors have very long life, smaller in size, can operate on lower voltage supplies for greater safety and required no filament current. The first transistor was fabricated with germanium. A transistor performs the same function as a vacuum tube triode, but using semiconductor

junctions instead of heated electrodes in a vacuum chamber. It is the fundamental building block of modern electronic devices and found everywhere in modern electronic systems.



Transistor Basics:

A transistor is a three terminal device. Namely,

Base: This is responsible for activating the transistor. Collector: This is the positive lead. Emitter: This is the negative lead.

The basic idea behind a transistor is that it lets you control the flow of current through one channel by varying the intensity of a much smaller current that’s flowing through a second channel.

Soldering Equipment and Accessories

Soldering is a difficult skill to master and the old saying "practice makes perfect" most certainly applies. For those who have never soldered before, it can be intimidating dealing with high heat and electronics, but there is nothing more rewarding than completing a clean soldering job. Anyone can become a pro-solderer but it will take some practice.

It's time to graduate from **wire-wrapping** and get started in soldering. Step one is putting together an electronics workbench with the right gear. This article will review the tools and equipment you'll need to quickly become a soldering professional.

Soldering Irons and Stations

Choosing between a **soldering iron** and **soldering station** depends on how big of a project you're working on and how much space you have available. Soldering irons are more convenient for both small projects that require a few solder joints as well as fast and easy storage.

Stand-alone soldering irons are powered by simply plugging into the wall outlet, which does not allow users to adjust the temperature of the iron. Most soldering irons include a **soldering stand** , but some may not. Stands are important for keeping the soldering tip clean and, of course, for safety reasons (you wouldn't want an 800°F iron balancing on the edge your desk). Jameco carries a variety of soldering irons from **butane-powered irons** and **SMD tweezer irons** to the **traditional soldering iron**.

16 to 30W Variable Temperature Soldering Iron XYTronic XY-258

Soldering stations come with a soldering stand and allow for temperature adjustment for more precise controlled soldering. Stations will take up more space on your workbench, but they're also much more convenient for bigger projects where you would need to use it on a consistent basis. Most new soldering stations have a **digital display** showing the exact temperature of the iron, but you can still find **analog stations**, which are usually available at a lower price. For those who want a heavy-duty station, there are high-powered soldering/desoldering stations with enough power to handle any job. They come equipped with everything you will need except the solder.

120W High Frequency Soldering Station
XYTronic LF-3200

900W Lead-Free Multifunction Rework Station
XYTronic LF-853D

Solder

Solder comes in many shapes and sizes: solder bars, rolls, coils, just to name a few. The type and composition of the solder is really all that matters. You can perform **lead-free** soldering if your application calls for it, or you can go industrial-size and use some **solder bars** with a solder pot. **Solder pots** can melt a larger quantity of solder and have it ready to be used immediately. They are helpful with larger projects that require lots of solder.

1.1 pound Solder Roll Jameco VP 8PK-033P

0.031" Diameter Rosin Core 99.3% Tin 0.7% Copper Solder Tube

Soldering Accessories

There are plenty of accessories available to make your soldering experiences as fun, quick and simple as possible.

Workstations such as third hands and vises keep your project board still and steady while you handle the iron. **Solder spool stands** keep rolls of solder neatly in place while giving you access to as much or as little as you want. **Tweezers** , **strippers** and **cutters** are available individually or as sets so you can move the sensitive components on your board without having to touch them with your bare hands.

Third Hand with Magnifying Lens
Jameco BP GCB-695

Panavise Jr. Mini Circuit Board Holder

Panavise 220

Solder flux allows solder to flow more easily and creates better contact between the solder and the board, which is especially helpful with surface-mount soldering.

If you happen to make a mistake and need to desolder, Jameco has high-quality **desolder braids** and **desoldering pumps** that will soak up the solder in seconds, leaving a nice clean work surface.

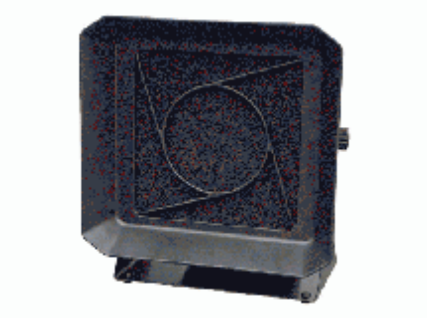
Rosin Flux Soldering Paste

5-Foot Solder Wick

High-Vacuum Manual Desolder Pump

There are also **formula solder paste fluxes** that help make desoldering and reworking easy. It comes in a syringe with plunger and nozzle for easy and clean application.

Fume extractors take away the noxious fumes that soldering can produce. You should always solder in a well-ventilated area whenever possible, but when it isn't, use a fume extractor, or **build your own fume extractor**.



22 Watt 115 CFM Fume Extractor

DIY Fume Extractor Kit (MINI FUME EXT)

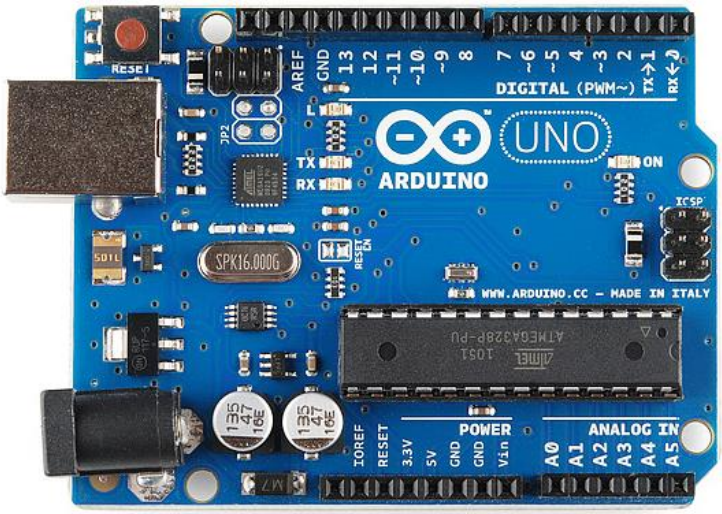
Software components

Arduino

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

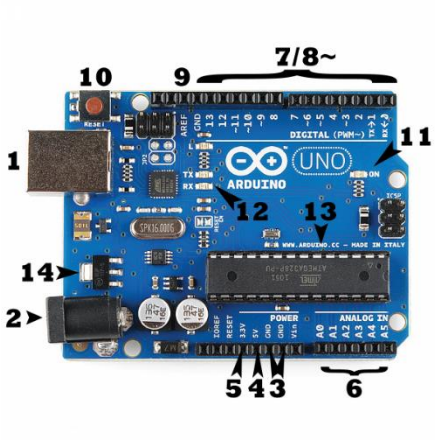
The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board -- you can simply use a USB cable.

Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.



What's on the board?

There are many varieties of Arduino boards (explained on the next page) that can be used for different purposes. Some boards look a bit different from the one below, but most Arduinos have the majority of these components in common:



Power (USB / Barrel Jack)

Every Arduino board needs a way to be connected to a power source. The Arduino UNO can be powered from a USB cable coming from your computer or a wall power supply (like this) that is terminated in a barrel jack. In the picture above the USB connection is labeled **(1)** and the barrel jack is labeled **(2)**.

The USB connection is also how you will load code onto your Arduino board. More on how to program with Arduino can be found in our Installing and Programming Arduino tutorial.

NOTE: Do NOT use a power supply greater than 20 Volts as you will overpower (and thereby destroy) your Arduino. The recommended voltage for most Arduino models is between 6 and 12 Volts.

Pins (5V, 3.3V, GND, Analog, Digital, PWM, AREF)

The pins on your Arduino are the places where you connect wires to construct a circuit (probably in conjuction with a breadboard and some wire. They usually have black plastic 'headers' that allow you to just plug a wire right into the board. The Arduino has several different kinds of pins, each of which is labeled on the board and used for different functions.

- **GND (3)**: Short for ‘Ground’. There are several GND pins on the Arduino, any of which can be used to ground your circuit.
- **5V (4) & 3.3V (5)**: As you might guess, the 5V pin supplies 5 volts of power, and the 3.3V pin supplies 3.3 volts of power. Most of the simple components used with the Arduino run happily off of 5 or 3.3 volts.
- **Analog (6)**: The area of pins under the ‘Analog In’ label (A0 through A5 on the UNO) are Analog In pins. These pins can read the signal from an analog sensor (like a temperature sensor) and convert it into a digital value that we can read.
- **Digital (7)**: Across from the analog pins are the digital pins (0 through 13 on the UNO). These pins can be used for both digital input (like telling if a button is pushed) and digital output (like powering an LED).
- **PWM (8)**: You may have noticed the tilde (~) next to some of the digital pins (3, 5, 6, 9, 10, and 11 on the UNO). These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM). We have a tutorial on PWM, but for now, think of these pins as being able to simulate analog output (like fading an LED in and out).
- **AREF (9)**: Stands for Analog Reference. Most of the time you can leave this pin alone. It is sometimes used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

Reset Button

Just like the original Nintendo, the Arduino has a reset button **(10)**. Pushing it will temporarily connect the reset pin to ground and restart any code that is loaded on the Arduino. This can be very useful if your code doesn’t repeat, but you want to test it multiple times. Unlike the original Nintendo however, blowing on the Arduino doesn't usually fix any problems.

Power LED Indicator

Just beneath and to the right of the word “UNO” on your circuit board, there’s a tiny LED next to the word ‘ON’ **(11)**. This LED should light up whenever you plug your Arduino into a power source. If this light doesn’t turn on, there’s a good chance something is wrong. Time to re-check your circuit!

TX RX LEDs

TX is short for transmit, RX is short for receive. These markings appear quite a bit in electronics to indicate the pins responsible for serial communication. In our case, there are two places on the Arduino UNO where TX and RX appear -- once by digital pins 0 and 1, and a second time next to the TX and RX indicator LEDs **(12)**. These LEDs will give us some nice visual indications whenever our Arduino is receiving or transmitting data (like when we’re loading a new program onto the board).

Main IC

The black thing with all the metal legs is an IC, or Integrated Circuit **(13)**. Think of it as the brains of our Arduino. The main IC on the Arduino is slightly different from board type to board type, but is usually from the ATmega line of IC’s from the ATMEL company. This can be important, as you may need to know the IC type (along with your board type) before loading up a new program from the Arduino software. This information can usually be found in writing on the top side of the IC. If you want to know more about the difference between various IC's, reading the datasheets is often a good idea.

Voltage Regulator

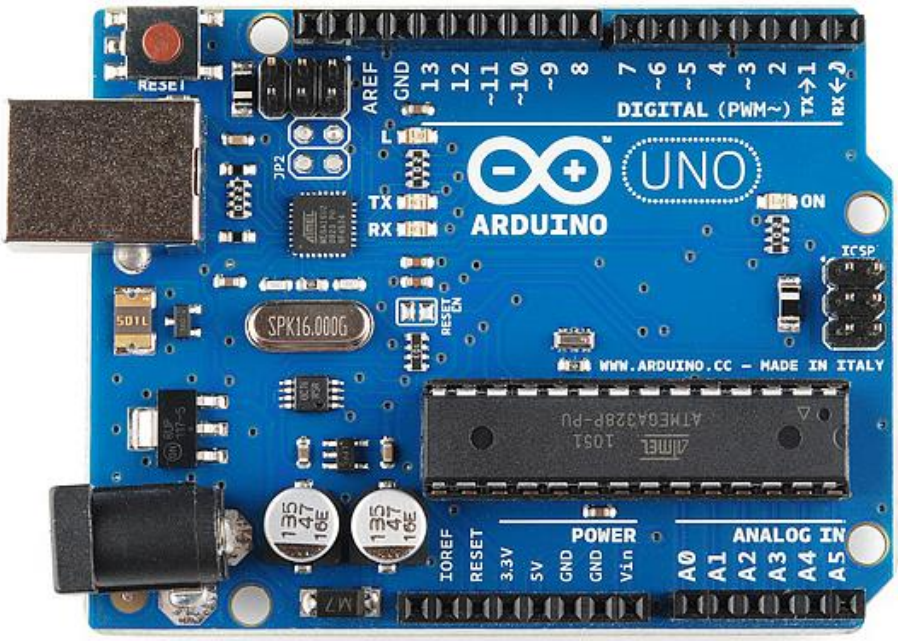
The voltage regulator **(14)** is not actually something you can (or should) interact with on the Arduino. But it is potentially useful to know that it is there and what it's for. The voltage regulator does exactly what it says -- it controls the amount of voltage that is let into the Arduino board. Think of it as a kind of gatekeeper; it will turn away an extra voltage that might harm the circuit. Of course, it has its limits, so don't hook up your Arduino to anything greater than 20 volts.

The Arduino Family

Arduino makes several different boards, each with different capabilities. In addition, part of being open source hardware means that others can modify and produce derivatives of Arduino boards that provide even more form factors and functionality. If you're not sure which one is right for your project, check this guide for some helpful hints. Here are a few options that are well-suited to someone new to the world of Arduino:

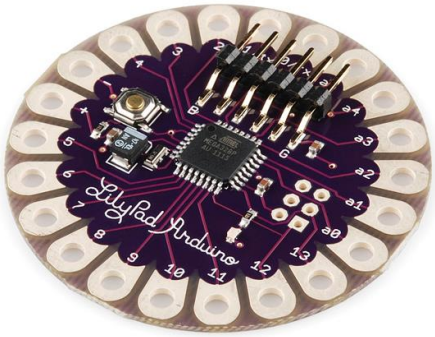
Arduino Uno (R3)

The Uno is a great choice for your first Arduino. It's got everything you need to get started, and nothing you don't. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a USB connection, a power jack, a reset button and more. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.



LilyPad Arduino

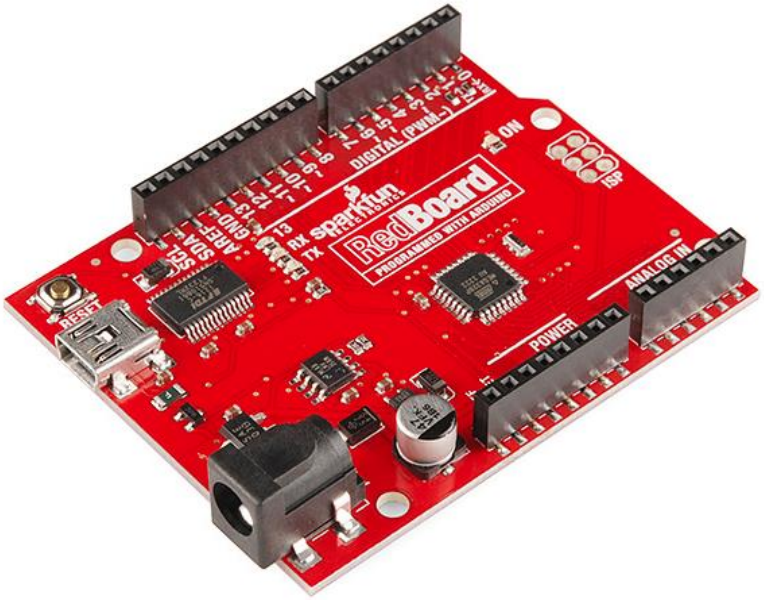
This is LilyPad Arduino main board! LilyPad is a wearable e-textile technology developed by Leah Buechley and cooperatively designed by Leah and SparkFun. Each LilyPad was creatively designed with large connecting pads and a flat back to allow them to be sewn into clothing with conductive thread. The LilyPad also has its own family of input, output, power, and sensor boards that are also built specifically for e-textiles. They're even washable!



RedBoard

At SparkFun we use many Arduinos and we're always looking for the simplest, most stable one. Each board is a bit different and no one board has everything we want -- so we decided to make our own version that combines all our favorite features.

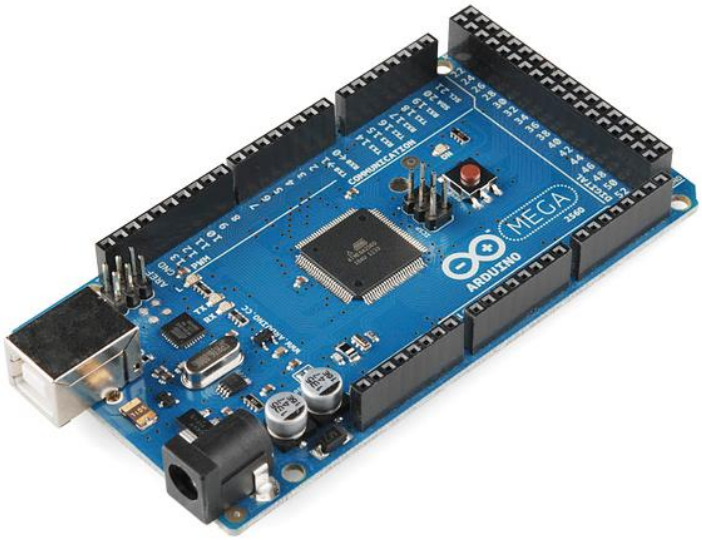
The RedBoard can be programmed over a USB Mini-B cable using the Arduino IDE. It'll work on Windows 8 without having to change your security settings (we used signed drivers, unlike the UNO). It's more stable due to the USB/FTDI chip we used, plus it's completely flat on the back, making it easier to embed in your projects. Just plug in the board, select "Arduino UNO" from the board menu and you're ready to upload code. You can power the RedBoard over USB or through the barrel jack. The on-board power regulator can handle anything from 7 to 15VDC.



Arduino Mega (R3)

The Arduino Mega is like the UNO's big brother. It has lots (*54!*) of digital input/output pins (14 can be used as PWM outputs), 16 analog inputs, a USB connection, a power jack, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable

or power it with a AC-to-DC adapter or battery to get started. The large number of pins make this board very handy for projects that require a bunch of digital inputs or outputs (like lots of LEDs or buttons).



Arduino Leonardo

The Leonardo is Arduino's first development board to use one microcontroller with built-in USB. This means that it can be cheaper and simpler. Also, because the board is handling USB directly, code libraries are available which allow the board to emulate a computer keyboard, mouse, and more!

BILL OF MATERIALS:

Component Name	Quantity
Microcontroller(Esp8266)	4
Resistor 1kohm	10
Breadboard	5
Buzzer (24V, 9V,5V)	5
Soldering kit	1
Connecting wires	as required
Lcd display	2
Battery (9V)	8
Led	2
LCD display	2
Lcd drive	2
Npn Transistor	1
Capacitor	2
Circuit boards	as required
Cardboad caring	as required
Adaptors	5

HARDWARE TESTING:

CONTINUITY TEST:

In electronics, a continuity test is the checking of an electric circuit to see if current flows (that it is in fact a complete circuit). A continuity test is performed by placing a small voltage (wired in series with an LED or noise-producing component such as a piezoelectric speaker) across the chosen path. If electron flow is inhibited by broken conductors, damaged components, or excessive resistance, the circuit is "open". Devices that can be used to perform continuity tests include multi meters which measure current and specialized continuity testers which are cheaper, more basic devices, generally with a simple light bulb that lights up when current flows.

An important application is the continuity test of a bundle of wires so as to find the two ends belonging to a particular one of these wires; there will be a negligible resistance between the "right" ends, and only between the "right" ends.

This test is the performed just after the hardware soldering and configuration has been completed. This test aims at finding any electrical open paths in the circuit after the soldering. Many a times, the electrical continuity in the circuit is lost due to improper soldering, wrong and rough handling of the PCB, improper usage of the soldering iron, component failures and presence of bugs in the circuit diagram. We use a multi meter to perform this test. We keep the multi meter in buzzer mode and connect the ground terminal of the multi meter to the ground. We connect both the terminals across the path that needs to be checked. If there is continuation then you will hear the beep sound.

POWER ON TEST:

This test is performed to check whether the voltage at different terminals is according to the requirement or not. We take a multi meter and put it in voltage mode. First of all check the voltage across the battery terminal whether it is fully charged or not, the battery used in this project is 12V, so touch the ‘red terminal’ of battery with ‘red probe’ of multi meter and touch ‘black terminal’ of battery with ‘black probe’ of multi meter, if 12V is being displayed on multi meter screen then we can proceed for next steps.

Now that the power supply is available, no IC should be inserted in the base, first apply power and check whether proper voltage is reaching at ‘vcc’ and ‘gnd’ pins of each IC base or not. If proper voltages appear at the supply pins of IC bases then insert IC and check the required output.

Now we have to check whether the LEDs are in working condition or not, Red LED or IR LED or Photo diode has got one ‘longer leg’ and one ‘shorter leg’. Longer leg is positive terminal of LED and shorter leg is negative terminal. Now keep the multi meter in ‘buzzer mode or continuity mode’ and touch ‘red probe’ of multi meter to the ‘longer leg’ of LED and ‘black probe’ of multi meter to the ‘shorter leg’ of LED, if LED glows in such case that means it’s working. Now solder Red LED into PCB, remember ‘longer leg’ of LED should be inserted into positive marking on PCB and ‘shorter leg’ should be inserted into other hole of LED marking on PCB. Now after soldering LED with a series resistor apply battery voltage to the board and see whether the LED is glowing or not.

The black LED is photodiode and white LED is IR diode even these components have got longer leg and shorter leg, insert longer leg into +ve marking hole on PCB and insert shorter leg into other hole of LED marking on Printed Circuit Board.

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(Under Section 3 of UGC Act 1956)

COOLER CUM HEATER (USING PELTIER MODULE)

AN INTERNSHIP REPORT

SUBMITTED BY

BE ME -16

PROJECT GUIDE: PROF. VENKATAGANESH

PROJECT MEMBERS

1. **TEJAS SINGAL (AME16175)**
2. **THEJAS. A. NAIR (AME16176)**
3. **TRINETHRA REDDY. V (AME16177)**
4. **TUNGANA ANIL KUMAR (AME16178)**

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INTERNSHIP EVALUATION REPORT 2019-20

Name of the Department: MARINE ENGINEERING

(In view of advisory from the AICTE, internships for the year 2019-20 are offered by the Department itself to facilitate the students to take up required work from their home itself during the lock down period due to COVID-19 outbreak)

Name of the Student	TEJAS SINGAL
Register No and Roll No	AME 16175
Programme of study	BE - MARINE
Year and Batch/Group	FINAL YEAR
Semester	II / IV / VI / VIII
Title of Internship	COOLER CUM HEATER
Duration of Internship	40 Hours
Mentor of the Student	PROF. VENKATAGANESH

Evaluation by the Department

Sl No.	Criterion	Max. Marks	Marks Allotted
1	Regularity in maintenance of the diary.	10	8
2	Adequacy & quality of information recorded	10	8
3	Drawings, sketches and data recorded	10	8
4	Thought process and recording techniques used	5	4
5	Organization of the information	5	4
6	Originality of the Internship Report	20	18
7	Adequacy and purposeful write-up of the Internship Report	10	9
8	Organization, format, drawings, sketches, style, language etc. of the Internship Report	10	9
9	Practical applications, relationships with basic theory and concepts	10	9
10	Presentation Skills	10	8
Total		100	85

Signature of the Mentor	Signature of the Internal Examiner	Signature of HoD / Programme Head

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INTERNSHIP EVALUATION REPORT 2019-20

Name of the Department: .....MARINE ENGINEERING.....

(In view of advisory from the AICTE, internships for the year 2019-20 are offered by the Department itself to facilitate the students to take up required work from their home itself during the lock down period due to COVID-19 outbreak)

Name of the Student	THEJAS A NAIR
Register No and Roll No	AME 16176
Programme of study	BE MARINE
Year and Batch/Group	FINAL YEAR
Semester	II / IV / VI / VIII
Title of Internship	COOLER CUM HEATER
Duration of Internship	.....60.....Hours
Mentor of the Student	PROF. VENKATAGANESH

Evaluation by the Department

Sl No.	Criterion	Max. Marks	Marks Allotted
1	Regularity in maintenance of the diary.	10	8
2	Adequacy & quality of information recorded	10	8
3	Drawings, sketches and data recorded	10	8
4	Thought process and recording techniques used	5	4
5	Organization of the information	5	4
6	Originality of the Internship Report	20	18
7	Adequacy and purposeful write-up of the Internship Report	10	8
8	Organization, format, drawings, sketches, style, language etc. of the Internship Report	10	8
9	Practical applications, relationships with basic theory and concepts	10	8
10	Presentation Skills	10	8
Total		100	82

Signature of the Mentor	Signature of the Internal Examiner	Signature of HoD / Programme Head

AMET

ACADEMY OF MARITIME EDUCATION AND TRAINING
DEEMED TO BE UNIVERSITY
(Under Section 3 of UGC Act 1956)

INTERNSHIP EVALUATION REPORT 2019-20

Name of the Department: .....MARINE ENGINEERING.....

(In view of advisory from the AICTE, internships for the year 2019-20 are offered by the Department itself to facilitate the students to take up required work from their home itself during the lock down period due to COVID-19 outbreak)

Name of the Student	TRINETHRA REDDY .V
Register No and Roll No	AME16177
Programme of study	BE - MARINE
Year and Batch/Group	FINAL YEAR
Semester	II / IV / VI / VIII
Title of Internship	COOLER CUM HEATER
Duration of Internship	.....40.....Hours
Mentor of the Student	PROF. VENKATA GANESH

Evaluation by the Department

Sl No.	Criterion	Max. Marks	Marks Allotted
1	Regularity in maintenance of the diary.	10	8
2	Adequacy & quality of information recorded	10	8
3	Drawings, sketches and data recorded	10	8
4	Thought process and recording techniques used	5	4
5	Organization of the information	5	4
6	Originality of the Internship Report	20	17
7	Adequacy and purposeful write-up of the Internship Report	10	8
8	Organization, format, drawings, sketches, style, language etc. of the Internship Report	10	9
9	Practical applications, relationships with basic theory and concepts	10	8
10	Presentation Skills	10	8
Total		100	82

Signature of the Mentor	Signature of the Internal Examiner	Signature of HoD / Programme Head

AMET

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INTERNSHIP EVALUATION REPORT 2019-20

Name of the Department: .....MARINE ENGINEERING.....

(In view of advisory from the AICTE, internships for the year 2019-20 are offered by the Department itself to facilitate the students to take up required work from their home itself during the lock down period due to COVID-19 outbreak)

Name of the Student	TUNGANA ANIL KUMAR
Register No and Roll No	AME16178
Programme of study	BE - MARINE
Year and Batch/Group	FINAL YEAR
Semester	II / IV / VI / VIII
Title of Internship	COOLER CUM HEATER
Duration of Internship	.....400.....Hours
Mentor of the Student	PROF. VENKATA GANESH.

Evaluation by the Department

Sl No.	Criterion	Max. Marks	Marks Allotted
1	Regularity in maintenance of the diary.	10	8
2	Adequacy & quality of information recorded	10	8
3	Drawings, sketches and data recorded	10	8
4	Thought process and recording techniques used	5	4
5	Organization of the information	5	4
6	Originality of the Internship Report	20	18
7	Adequacy and purposeful write-up of the Internship Report	10	8
8	Organization, format, drawings, sketches, style, language etc. of the Internship Report	10	8
9	Practical applications, relationships with basic theory and concepts	10	8
10	Presentation Skills	10	8
Total		100	82

Signature of the Mentor	Signature of the Internal Examiner	Signature of HoD / Programme Head

AMET

ACADEMY OF MARITIME EDUCATION AND TRAINING
DEEMED TO BE UNIVERSITY
(Under Section 3 of UGC Act 1956)

DEPARTMENT OF MARINE ENGINEERING

Certificate

This is to certify that.....TEJAS SINGAL.....

with Register No. .....AME.16175.....of .....FINAL.....~~Semester~~ / Year ✓

has undergone with an **Internship at Home** titled ....COOLER CUM HEATER.....

.....(USING PELTIER MODULE).....

and has successfully completed.

Faculty In-Charge

Principal DGS - Courses

AMET

ACADEMY OF MARITIME EDUCATION AND TRAINING
DEEMED TO BE UNIVERSITY
(Under Section 3 of UGC Act 1956)

DEPARTMENT OF MARINE ENGINEERING

Certificate

This is to certify that.....THEJAS....A..NAIR.....

with Register No. ...AME16176.....of .....FINAL.....Semester / Year

has undergone with an **Internship at Home** titled ..COOLER..CUM HEATER.....

.....(USING..PELTIER..MODULE).....

and has successfully completed.

Faculty In-Charge

Principal DGS - Courses

AMET

ACADEMY OF MARITIME EDUCATION AND TRAINING
DEEMED TO BE UNIVERSITY
(Under Section 3 of UGC Act 1956)

DEPARTMENT OF MARINE ENGINEERING

Certificate

This is to certify that.....J.RINETHRA REDDY. V.....

with Register No. ....AME16177.....of .....FINAL.....Semester / Year

has undergone with an **Internship at Home** titled .....COOLER CUM HEATER.....

.....(USING PELTIER MODULE).....

and has successfully completed.

Faculty In-Charge

Principal DGS - Courses

AMET

ACADEMY OF MARITIME EDUCATION AND TRAINING

DEEMED TO BE UNIVERSITY

(Under Section 3 of UGC Act 1956)

DEPARTMENT OF MARINE ENGINEERING

Certificate

This is to certify that.....TUNGANA ANIL KUMAR.....

with Register No. ....AME16178.....of .....FINAL.....~~Semester~~ / Year

has undergone with an **Internship at Home** titled ...COOLER CUM HEATER.....

.....(USING PELTIER MODULE).....

and has successfully completed.

Faculty In-Charge

Principal DGS - Courses

AMET UNIVERSITY
ACADEMY OF MARITIME EDUCATION AND TRAINING UNIVERSITY
(Declared as Deemed to be University u/s 3 of UGC Act 1956)

COOLER CUM HEATER

A PROJECT REPORT

SUBMITED BY

BE ME -16

2019-20

CERTIFICATE

This is to certify that the project entitled **"COOLER CUM HEATER"** is to bonafide work carried out by the students of AMET UNIVERSITY, KANATHUR (CHENNAI) during the year 2019 - 2020 for the partial fulfillment of the requirements for the award of the Degree of Bachelor of a Marine Engineering.

INTERNAL GUIDE

EXTERNAL EXAMINER

HEAD OF THE DEPARTMENT

PLACE : AMET UNIVERSITY

BE MARINE ENGINEERING

PROJECT GUIDE

Prof. Venkataganesh (Chief Engineer)

PROJECT MEMBERS:

TEJAS SINGAL	**AME16175**
THEJAS A NAIR	**AME16176**
TRINETHRA REDDY V	**AME16177**
TUNGANA ANIL KUMAR	**AME16178**

ABSTRACT:

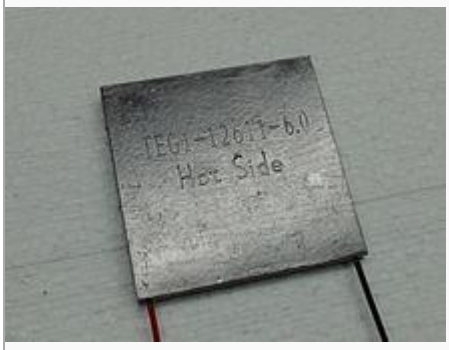
It can be used as a Air conditioning system to reduce the room temperature and also used as a Heater to Heat the Water for Domestic purpose in a single unit.

INTRODUCTION:

In this system we use peltier effect as a principle, in which Temperature Difference is created by transferring heat between two electrical junction so that when the current flows heat is removed at one side of the peltier and cooling occurs in the other side of the peltier and the peltier works in DC supply of 12V and 5W.In this system we use the heat which has been removed from one side of the junction is transferred to the water and we have provided Baffles for the water flow. In this system we have used one fan which runs on AC supply and it has been fitted to the cooling side of the Peltier.The fan which is being connected to a cooling side of the peltier or thermo electric cooler will supply cool air to the atmosphere.

Now in the heating side of the peltier we have provided baffles for the water flow and remove remove heat from the peltier so that heat transfer takes place efficiently and for circulating the water we have used a DC pump.

Thermoelectric effect



Principles

Thermoelectric effect
Seebeck effect
Peltier effect
Thomson effect
Seebeck coefficient
Ettingshausen effect
Nernst effect

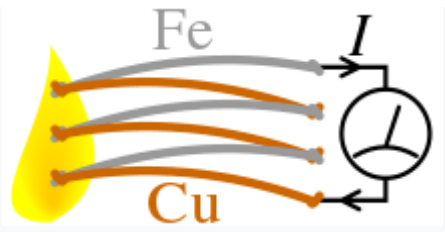
The **thermoelectric effect** is the direct conversion of temperature differences to electric voltage and vice versa via a thermocouple.[1] A thermoelectric device creates voltage when there is a different temperature on each side. Conversely, when a voltage is applied to it, heat is transferred from one side to the other, creating a temperature difference. At the atomic scale, an applied temperature gradientcauses charge carriers in the material to diffuse from the hot side to the cold side.

This effect can be used to generate electricity, measure temperature or change the temperature of objects. Because the direction of heating and cooling is determined by the polarity of the applied voltage, thermoelectric devices can be used as temperature controllers.

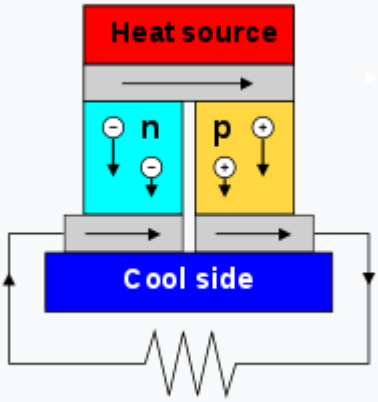
The term "thermoelectric effect" encompasses three separately identified effects: the **Seebeck effect**, **Peltier effect**, and **Thomson effect**. The Seebeck and Peltier effects are different manifestations of the same physical process; textbooks may refer to this process as the **Peltier–Seebeck effect** (the separation derives from the independent discoveries by French physicist Jean Charles Athanase Peltier and Baltic German physicist Thomas Johann Seebeck). The Thomson effect is an extension of the Peltier–Seebeck model and is credited to Lord Kelvin.

Joule heating, the heat that is generated whenever a current is passed through a resistive material, is related, though it is not generally termed a thermoelectric effect. The Peltier–Seebeck and Thomson effects are thermodynamically reversible,[2] whereas Joule heating is not.

Seebeck effect



Seebeck effect in a thermopilemade from iron and copper wires



A thermoelectric circuit composed of materials of different Seebeck coefficients (p-doped and n-doped semiconductors), configured as a thermoelectric generator. If the load resistor at the bottom is replaced with a voltmeter, the circuit then functions as a temperature-sensing thermocouple.

The **Seebeck effect** is the conversion of heat directly into electricity at the junction of different types of wire. Originally discovered in 1794 by Italian scientist Alessandro Volta,[3][note 1] it is named after the Baltic German physicist Thomas Johann Seebeck, who in 1821 independently rediscovered it.[4] It was observed that a compass needle would be deflected by a closed loop formed by two different metals joined in two places, with a temperature difference between the joints. This was because the electron energy levels in each metal shifted differently and a potential difference between the junctions created an electrical current and therefore a magnetic field around the wires. Seebeck did not recognize that there was an electric current involved, so he called the phenomenon "thermomagnetic effect". Danish physicist Hans Christian Ørsted rectified the oversight and coined the term "thermoelectricity".[5]

The Seebeck effect is a classic example of an electromotive force (emf) and leads to measurable currents or voltages in the same way as any other emf. Electromotive forces modify Ohm's law by generating currents even in the absence of voltage differences (or vice versa); the local current density is given by where is the local voltage,[6] and is the local conductivity. In general, the Seebeck effect is described locally by the creation of an electromotive field

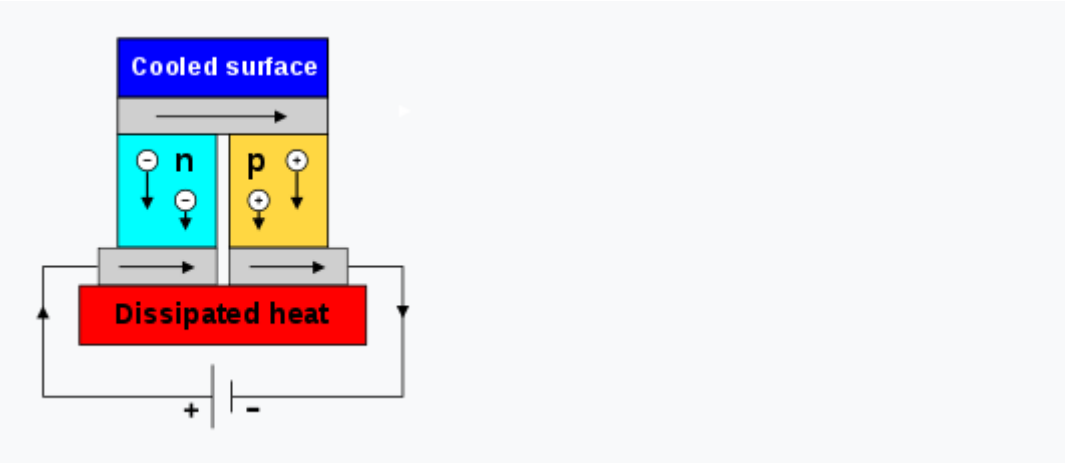
where is the Seebeck coefficient (also known as thermopower), a property of the local material, and is the temperature gradient.

The Seebeck coefficients generally vary as function of temperature and depend strongly on the composition of the conductor. For ordinary materials at room temperature, the Seebeck coefficient may range in value from −100 μV/K to +1,000 μV/K (see Seebeck coefficient article for more information).

If the system reaches a steady state, where , then the voltage gradient is given simply by

the emf: . This simple relationship, which does not depend on conductivity, is used in the thermocouple to measure a temperature difference; an absolute temperature may be found by performing the voltage measurement at a known reference temperature. A metal of unknown composition can be classified by its thermoelectric effect if a metallic probe of known composition is kept at a constant temperature and held in contact with the unknown sample that is locally heated to the probe temperature. It is used commercially to identify metal alloys. Thermocouples in series form a thermopile. Thermoelectric generators are used for creating power from heat differentials.

Peltier effect[edit]



The Seebeck circuit configured as a thermoelectric cooler

The **Peltier effect** is the presence of heating or cooling at an electrified junction of two different conductors and is named after French physicist Jean Charles Athanase Peltier, who discovered it in 1834.[7] When a current is made to flow through a junction between two conductors, A and B, heat may be generated or removed at the junction. The Peltier heat generated at the junction per unit time is

where and are the Peltier coefficients of conductors A and B, and is the electric current (from A to B). The total heat generated is not determined by the Peltier effect alone, as it may also be influenced by Joule heating and thermal-gradient effects (see below).

The Peltier coefficients represent how much heat is carried per unit charge. Since charge current must be continuous across a junction, the associated heat flow will develop a

discontinuity if and are different. The Peltier effect can be considered as the back-action counterpart to the Seebeck effect (analogous to the back-emf in magnetic induction): if a simple thermoelectric circuit is closed, then the Seebeck effect will drive a current, which in turn (by the Peltier effect) will always transfer heat from the hot to the cold junction. The close relationship between Peltier and Seebeck effects can be seen in the direct connection

between their coefficients: (see below).

A typical Peltier heat pump involves multiple junctions in series, through which a current is driven. Some of the junctions lose heat due to the Peltier effect, while others gain heat. Thermoelectric heat pumps exploit this phenomenon, as do thermoelectric cooling devices found in refrigerators.

Thomson effect[edit]

In different materials, the Seebeck coefficient is not constant in temperature, and so a spatial gradient in temperature can result in a gradient in the Seebeck coefficient. If a current is driven through this gradient, then a continuous version of the Peltier effect will occur. This **Thomson effect** was predicted and subsequently observed in 1851 by Lord Kelvin (William Thomson).[8] It describes the heating or cooling of a current-carrying conductor with a temperature gradient.

If a current density is passed through a homogeneous conductor, the Thomson effect predicts a heat production rate per unit volume

where is the temperature gradient, and is the Thomson coefficient. The Thomson coefficient is related to the Seebeck coefficient as (see below). This equation, however, neglects Joule heating and ordinary thermal conductivity (see full equations below).

Full thermoelectric equations[edit]

Often, more than one of the above effects is involved in the operation of a real thermoelectric device. The Seebeck effect, Peltier effect, and Thomson effect can be gathered together in a consistent and rigorous way, described here; the effects of Joule heating and ordinary heat conduction are included as well. As stated above, the Seebeck effect generates an electromotive force, leading to the current equation.

To describe the Peltier and Thomson effects the flow of energy must be considered. To start, the dynamic case where both temperature and charge may be varying with time can be considered. The full thermoelectric equation for the energy accumulation, is[9]where is the thermal conductivity. The first term is the Fourier's heat conduction law, and the second

term shows the energy carried by currents. The third term, , is the heat added from an external source (if applicable).

In the case where the material has reached a steady state, the charge and temperature

distributions are stable, so one must have both and . Using these facts and the second Thomson relation (see below), the heat equation then can be simplified to

The middle term is the Joule heating, and the last term includes both Peltier (at

junction) and Thomson (in thermal gradient) effects. Combined with the Seebeck

equation for , this can be used to solve for the steady-state voltage and temperature profiles in a complicated system.

If the material is not in a steady state, a complete description will also need to include dynamic effects such as relating to electrical capacitance, inductance, and heat capacity.

Thomson relations[edit]

In 1854, Lord Kelvin found relationships between the three coefficients, implying that the Thomson, Peltier, and Seebeck effects are different manifestations of one effect (uniquely characterized by the Seebeck coefficient).[10]

The first Thomson relation is[9]

where is the absolute temperature, is the Thomson coefficient, is the Peltier coefficient, and is the Seebeck coefficient. This relationship is easily shown given that the Thomson effect is a continuous version of the Peltier effect. Using the second relation (described next), the first Thomson relation becomes .The second Thomson relation is

This relation expresses a subtle and fundamental connection between the Peltier and Seebeck effects. It was not satisfactorily proven until the advent of the Onsager relations, and it is worth noting that this second Thomson relation is only guaranteed for a time-reversal symmetric material; if the material is placed in a magnetic field or is itself magnetically ordered (ferromagnetic, antiferromagnetic, etc.), then the second Thomson relation does not take the simple form shown here.[11]

The Thomson coefficient is unique among the three main thermoelectric coefficients because it is the only one directly measurable for individual materials. The Peltier and Seebeck coefficients can only be easily determined for pairs of materials; hence, it is difficult to find values of absolute Seebeck or Peltier coefficients for an individual material.

If the Thomson coefficient of a material is measured over a wide temperature range, it can be integrated using the Thomson relations to determine the absolute values for the Peltier and Seebeck coefficients. This needs to be done only for one material, since the other values can be determined by measuring pairwise Seebeck coefficients in thermocouples containing the reference material and then adding back the absolute Seebeck coefficient of the reference material. For more details on absolute Seebeck coefficient determination, see Seebeck coefficient.

Applications

Thermoelectric generators

The Seebeck effect is used in thermoelectric generators, which function like heat engines, but are less bulky, have no moving parts, and are typically more expensive and less efficient. They have a use in power plants for converting waste heat into additional electrical power (a form of energy recycling) and in automobiles as automotive thermoelectric generators (ATGs) for increasing fuel efficiency. Space probes often use radioisotope thermoelectric generators with the same mechanism but using radioisotopes to generate the required heat difference. Recent uses include stove fans,[12] body-heat—powered lighting[13] and a smartwatch powered by body heat.[14]

Peltier effect

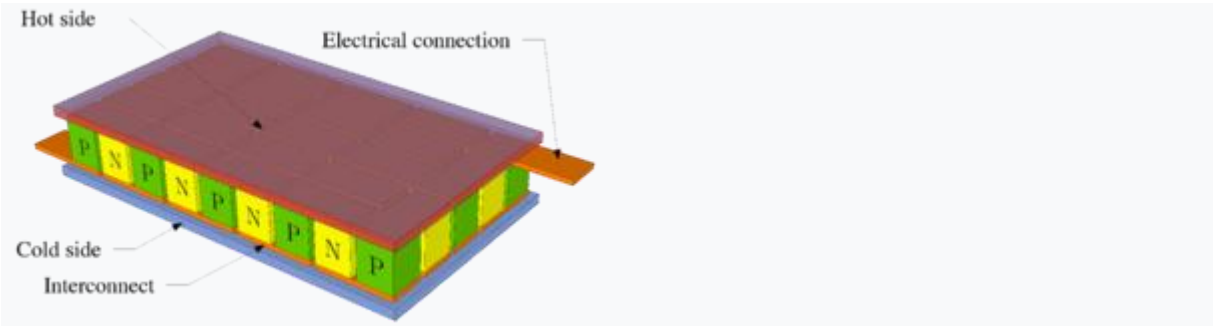
The Peltier effect can be used to create a refrigerator that is compact and has no circulating fluid or moving parts. Such refrigerators are useful in applications where their advantages outweigh the disadvantage of their very low efficiency. The Peltier effect is also used by

many thermal cyclers, laboratory devices used to amplify DNA by the polymerase chain reaction (PCR). PCR requires the cyclic heating and cooling of samples to specified temperatures. The inclusion of many thermocouples in a small space enables many samples to be amplified in parallel.

Temperature measurement

Thermocouples and thermopiles are devices that use the Seebeck effect to measure the temperature difference between two objects. Thermocouples are often used to measure high temperatures, holding the temperature of one junction constant or measuring it independently (cold junction compensation). Thermopiles use many thermocouples electrically connected in series, for sensitive measurements of very small temperature difference.

Operating principle



Peltier element schematic. Thermoelectric legs are thermally in parallel and electrically in series.

Main article: Thermoelectric effect

Thermoelectric coolers operate by the Peltier effect (which also goes by the more general name thermoelectric effect). The device has two sides, and when a DC electric current flows through the device, it brings heat from one side to the other, so that one side gets cooler while the other gets hotter. The "hot" side is attached to a heat sink so that it remains at ambient temperature, while the cool side goes below room temperature. In some applications, multiple coolers can be cascaded together for lower temperature.

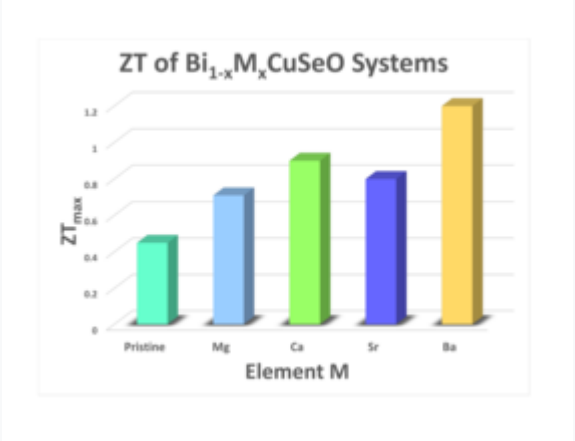
Construction[edit]

Design[edit]

Two unique semiconductors, one n-type and one p-type, are used because they need to have different electron densities. The semiconductors are placed thermally in parallel to each other and electrically in series and then joined with a thermally conducting plate on each side. When a voltage is applied to the free ends of the two semiconductors there is a flow of DC current across the junction of the semiconductors causing a temperature difference. The side with the cooling plate absorbs heat which is then moved to the other side of the device where the heat sink is. Thermoelectric Coolers, also abbreviated to TECs are typically connected

side by side and sandwiched between two ceramic plates. The cooling ability of the total unit is then proportional to the number of TECs in it.

Materials[edit]



ZT values for various materials

Current semiconductors being explored for TEC applications are antimony and bismuth alloys.[2] So far, they are the materials that have led to the largest efficiency TEC systems. This is because they have a combination of low thermal conductivity and high electrical conductivity. These two factors, when combined, increase the system's figure of merit (ZT), which is a measure of the system's efficiency. The equation for ZT can be found below, where alpha is the Seebeck coefficient.[3]

There are very few other materials that could be used for TEC applications since the relationship between thermal and electrical conductivity is usually a positive correlation. If these two values decrease or increase together, however, the overall effect is a net zero and the ZT value would remain too low for commercial applications.[3]

Strengths and weaknesses

Despite it being such a new technology, there are many factors motivating further research on TEC including lower carbon emissions and ease of manufacturing. However, as the exploration of this technology is furthered, several challenges have arisen.

Benefits

One of the most significant benefits of TEC systems is that they have no moving parts. This lack of mechanical wear increases the lifespan of the system and lowers the maintenance requirement. Current technologies show the mean time between failures (MTBF) to exceed 100,000 hours at ambient temperatures.[4] Additionally, concerns such as fatigue and fracture become far less applicable to a stationary system.

Another benefit of TEC is that it does not use refrigerants in its operation. Some refrigerants such as chlorofluorocarbons (CFCs) were once used liberally in many cooling technologies, and prior to their phaseout contributed significantly to ozone depletion. Many refrigerants also have significant global warming potential.[5]

The fact that TEC systems are current-controlled lead to another series of benefits. The first is that temperature control to within fractions of a degree can be achieved. This accuracy is a result of the device being powered using standard DC current, allowing the user to adjust

exactly how many hole-electron pairs are recombining and, therefore, how much heat or cooling is being produced.[6] It also facilitates the use of the system itself and makes its size more variable. TEC devices are much more flexible in shape than their more traditional counterparts. They can be used in environments with less space or more severe conditions than a conventional refrigerator.

Disadvantages

The main disadvantage of TEC systems is that only a small amount of heat flux can be dissipated. These systems are used in environments where the temperature difference between either end of the semiconductors is so small that it would not be possible to generate a large heat flux from it. This means that they can only be used for applications that require small flux. In other words, any large scale cooling would be more efficiently done by other technologies.[6] Lastly, TEC systems are not currently as efficient as competing vapor-compression systems. This topic is further discussed in the performance section below.

Performance

A single-stage TEC will typically produce a maximal temperature difference of 70 °C between its hot and cold sides.[7] The more heat moved using a TEC, the less efficient it becomes, because the TEC needs to dissipate both the heat being moved and the heat it generates itself from its own power consumption. The amount of heat that can be absorbed is

proportional to the current and time.

where P is the Peltier coefficient, I is the current, and t is the time. The Peltier coefficient depends on temperature and the materials the TEC is made of.

In refrigeration applications, thermoelectric junctions have about 1/4th the efficiency compared to conventional means (they offer around 10–15% efficiency of the ideal Carnot cyclerefrigerator, compared with 40–60% achieved by conventional compression-cycle systems (reverse Rankine systems using compression/expansion).[8]) Due to this lower efficiency, thermoelectric cooling is generally only used in environments where the solid-state nature (no moving parts, low maintenance, compact size, and orientation insensitivity) outweighs pure efficiency.

Peltier (thermoelectric) cooler performance is a function of ambient temperature, hot and cold side heat exchanger (heat sink) performance, thermal load, Peltier module (thermopile) geometry, and Peltier electrical parameters.[9]

Requirements for thermoelectric materials:[*citation needed*]

- Narrow band-gap semiconductors because of room-temperature operation
- Heavy elements because of their high mobility and low thermal conductivity
- Large unit cell, complex structure
- Highly anisotropic or highly symmetric
- Complex compositions

Common thermoelectric materials used as semiconductors include bismuth telluride, lead telluride, silicon germanium, and bismuth-antimony alloys. Of these bismuth telluride is the most commonly used. New high-performance materials for thermoelectric cooling are being actively researched.

Uses

A USB-powered beverage cooler

Thermoelectric coolers are used for applications that require heat removal ranging from milliwatts to several thousand watts. They can be made for applications as small as a beverage cooler or as large as a submarine or railroad car. TECs have limited life time. Their health strength can be measured by the change of their AC resistance (ACR). When a TEC gets "old" or worn out, the ACR will increase.[*citation needed*]

Consumer products[edit]

Peltier elements are commonly used in consumer products. For example, Peltier elements are used in camping, portable coolers, cooling electronic components and small instruments. The cooling effect of Peltier heat pumps can also be used to extract water from the air in dehumidifiers. A camping/car type electric cooler can typically reduce the temperature by up to 20 °C (36 °F) below the ambient temperature. Climate-controlled jackets are beginning to use Peltier elements.[10][11] Thermoelectric coolers are used to augment heat sinks for microprocessors. They are also used for wine coolers.

Industrial[edit]

Thermoelectric coolers are used in many fields of industrial manufacturing and require a thorough performance analysis as they face the test of running thousands of cycles before these industrial products are launched to the market. Some of the applications include laser equipment, thermoelectric air conditioners or coolers, industrial electronics and telecommunications,[12] automotive, mini refrigerators or incubators, military cabinets, IT enclosures, and more.

Science and imaging[edit]

Peltier elements are used in scientific devices. They are a common component in thermal cyclers, used for the synthesis of DNA by polymerase chain reaction (PCR), a common molecular biological technique, which requires the rapid heating and cooling of the reaction mixture for denaturation primer annealing and enzymatic synthesis cycles.

With feedback circuitry, Peltier elements can be used to implement highly stable temperature controllers that keep desired temperature within ±0.01 °C. Such stability may be used in precise laser applications to avoid laser wavelength drifting as environment temperature changes.

The effect is used in satellites and spacecraft to reduce temperature differences caused by direct sunlight on one side of a craft by dissipating the heat over the cold shaded side, where it is dissipated as thermal radiation to space.[13] Since 1961, some unmanned spacecraft (including the Curiosity Mars rover) utilize radioisotope thermoelectric generators(RTGs) that convert thermal energy into electrical energy using the Seebeck effect. The devices can last several decades, as they are fueled by the decay of high-energy radioactive materials.

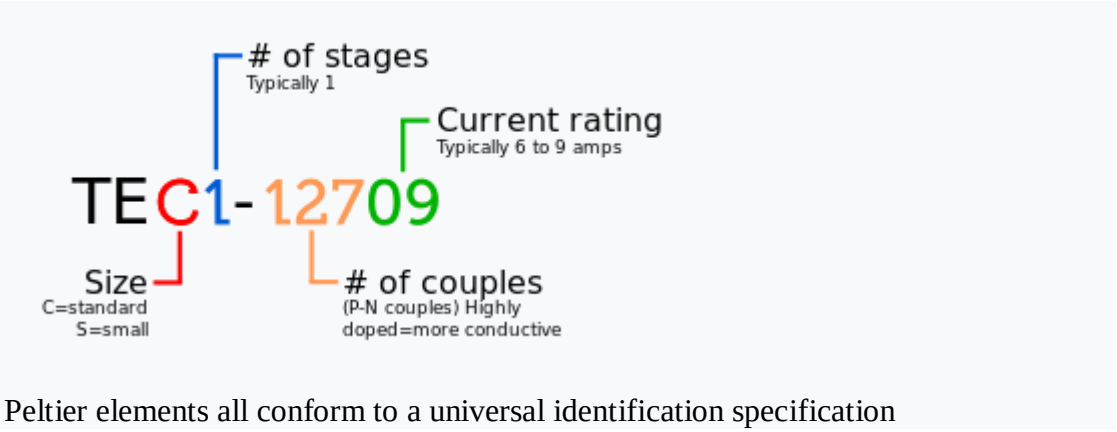
Photon detectors such as CCDs in astronomical telescopes, spectrometers, or very high-end digital cameras are often cooled by Peltier elements. This reduces dark counts due to thermal noise. A dark count occurs when a pixel registers an electron caused by thermal fluctuation rather than a photon. On digital photos taken at low light these occur as speckles (or "pixel noise").[*citation needed*]

Thermoelectric coolers can be used to cool computer components to keep temperatures within design limits or to maintain stable functioning when overclocking. A Peltier cooler with a heat sink or waterblock can cool a chip to well below ambient temperature.[14]

In fiber-optic applications, where the wavelength of a laser or a component is highly dependent on temperature, Peltier coolers are used along with a thermistor in a feedback loop to maintain a constant temperature and thereby stabilize the wavelength of the device.

Some electronic equipment intended for military use in the field is thermoelectrically cooled.[*citation needed*]

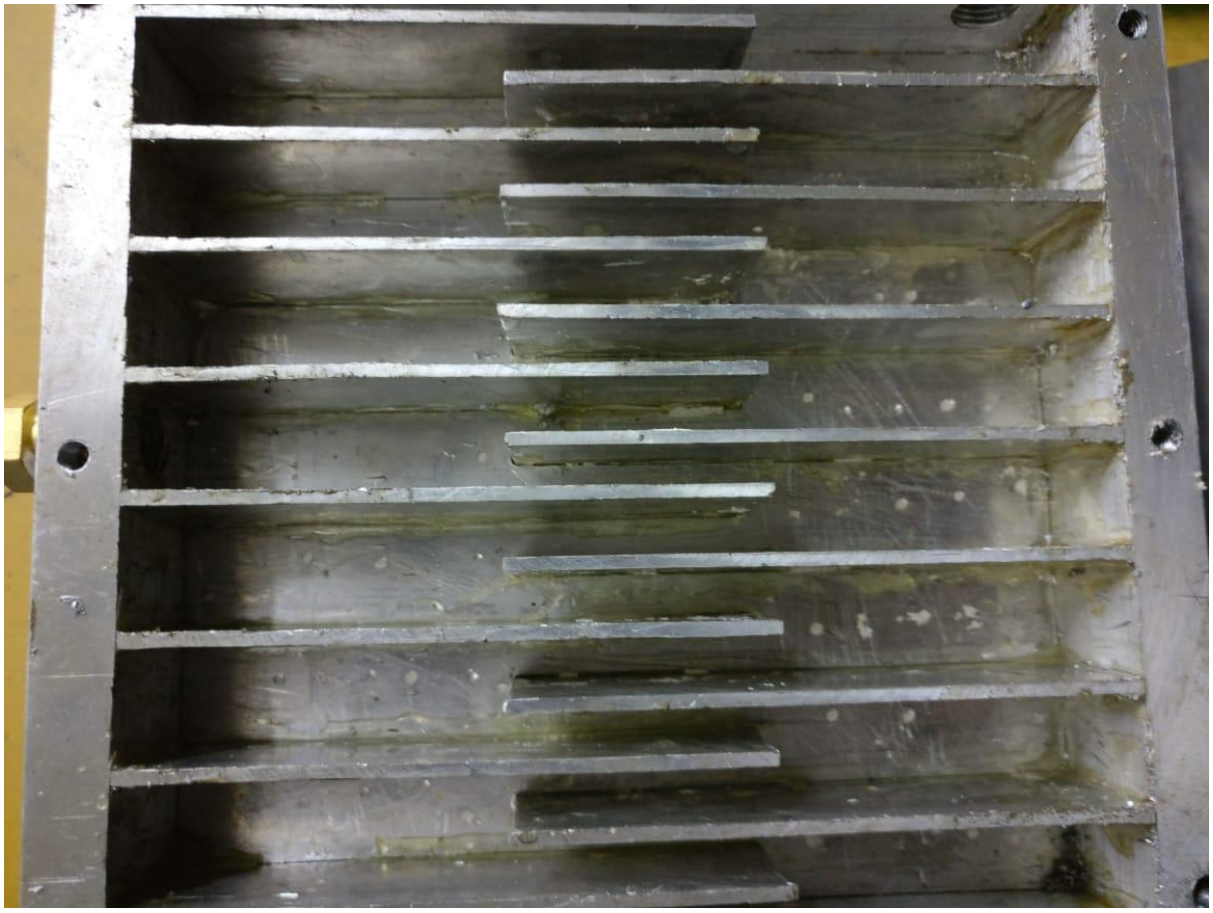
Identification[edit]

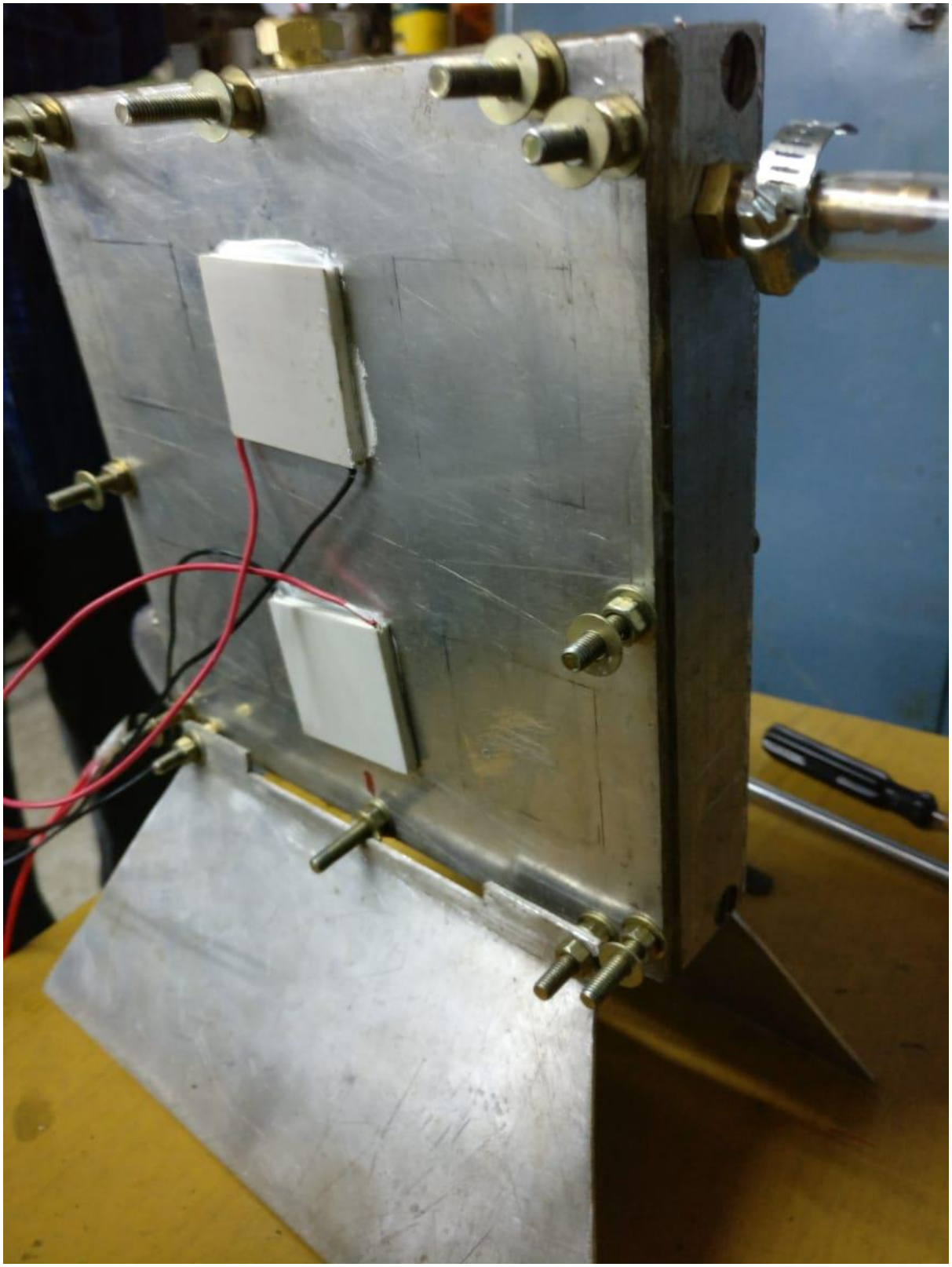


Peltier elements all conform to a universal identification specification

The vast majority of TECs have an ID printed on the cooled side.[9]

These universal IDs clearly indicate the size, number of stages, number of couples, and current rating in amps, as seen in the adjacent diagram.[15]





Materials	Rs 10,000
Peltier	Rs 3150 (9*350)
Power amplifier	Rs 1350
Gasket, Mica, Aluminium	Rs 1200
Pump, Fan	Rs 1800
Book Materials	Rs 250
Travel and other expenses	Rs 3000 (8 times)
Labour Charge	Rs 250
Total	**Rs 21000**