

AN IOT BASED AUTOMATIC WASTE SEGREGATION AND MONITORING SYSTEM

Submitted in partial fulfilment of Requirements for the award of
Bachelor of Engineering in
Electronics and Communication Engineering

by

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SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

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BONAFIDE CERTIFICATE

This is to certify that this project report is the Bonafide work of **MEENIGE CHANDRA SEKHAR REDDY (37130249)** and **MEDAPATI SURENDRANATH REDDY (37130246)** who carried out the project entitled **"AN IOT BASED AUTOMATICWASTE SEGREGATION AND MONITORING SYSTEM"** under our supervision from.

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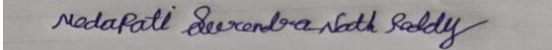
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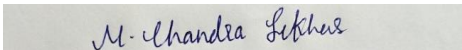
DECLARATION

We **MEENIGE CHANDRA SEKHAR REDDY (37130249)** and **MEDAPATI SURENDRANATH REDDY (37130246)** hereby declare that the Project Report entitled **“AN IOT BASED AUTOMATICWASTE SEGREGATION AND MONITORINGSYSTEM”** done by us under the guidance of **MR.L. MEGALAN LEO Assistant Professor**, Department of Electronics and Communication Engineering at Sathyabama Institute of Science and Technology is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in **ELECTRONICS AND COMMUNICATION ENGINEERING**.

1.



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PLACE:

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ABSTRACT

In the recent years, one of the vital effects of a growing population is environmental hazard. As the world's population continues to rise at an unequal rate, In India garbage are dumped at one place, mixing degradable and non-degradable wastes, causing the spread of a lot of infestation and bad smell. In our daily life, we see the garbage bins being overload and the garbage are run over resulting in pollution. In India, the total generated waste is expected more than 1,50,000 metric tons per day in 2019. This automated waste sorting bin is a project undertaken by us to make it more efficient, in line with our Honorable Prime Minister's Swachh Bharath Scheme to make India clean and green. These rapid technical advancements have resulted in low initial costs and expected obsolescence, resulting in an increasingly growing waste surplus worldwide. People spill waste along roadsides, and the people in charge of the new model do not collect it on a regular basis. This application proposes An IOT based smart segregation and management which segregates wastes by manually as degradable wastes and non-degradable wastes with the help of sensors like ultrasonic and color sensor and Servomotors, interfaced with Node MCU ESP8266 Node MCU consist of WIFI module along with The Arduino can take place in an effectively closed manner. The entire waste process, including level and separation, is monitored and controlled by configurable IO sensors, reducing open degradation of organic waste and thus the growth of Micro Organisms. This application is the effective method for the waste management and segregation process

TABLE OF CONTENT

CHAPTER NO	TITLE	PAGENO
1	Introduction	1-2
	Overview	1-2
	1.1. Objective	1
	1.2. Introduction	1-2
2	Literature Survey	3-6
	2.1. Existing System	5
3	Proposed system	6-7
	3.1. Hardware Used	7
	3.2. Software Used	7
4	Materials and Methods	8-45
	4.1. Node MCU ESP8266	8
	4.1.1. ESP8266 Pinout	11
	4.1.2. Other Development Boards	12-13
	4.1.3. Applications	14
	4.2. Smoke Sensor	14-16
	4.3. Servo motor	16-21
	4.3.1. Types of Servo motors	17
	4.3.2. DC servo motor	17
	4.3.1.1. Series motor	18
	4.3.1.2. Split series motor	18
	4.3.1.3. Shunt control motor	18
	4.3.3. Principle of working	18
	4.3.4. Mechanism of servomotor	19

	4.3.5. Working of servomotors	19
	4.3.6. Controlling of servomotors	20
	4.3.7. Applications	20
	4.4. ultrasonic sensor	21-27
	4.4.1. Generating Ultrasonic Wave	24
	4.4.2. Importance of Ultrasonic Sensors	25-27
	4.5. Colour sensor	28-30
	4.5.1. Working Principle of Colour Sensor	28
	4.5.2. Applications	29
	4.5.3. Examples	29
	4.6. Protection Classes	31-32
	4.7. Arduino UNO And Its Programming	33-42
	4.7.1. Writing Sketches	35-36
	4.7.2. File	37
	4.7.3. Edit	38
	4.7.4. Sketch	39
	4.8. UBIDOTS Explorer	43-46
	4.8.1. Introduction	42-45
	4.8.2. HTTP requests	46-47
5	Result	48-51
6	Conclusion	52
7	References	53

LIST OF FEATURES

FIG NO	TITLE	PAGE NO
3.1.0	Block Diagram	6
4.1.0	Node MCU Esp8266	9
4.1.1	Node MCU Esp8266 Pinout	11
4.1.2	Esp8266	12
4.2.0	Smoke Sensor	14
4.3.0	Servomotor	16
4.3.2	DC servo motor	17
4.4.0	Ultrasonic Transducers	21
4.4.1	Frequency Ranges	23
4.4.2	Ultrasonic	27
4.5.0	Colour sensor	28
4.5.1	Selection Criteria	30
4.7.1	Arduino	34
4.7.4	Language Support	40
5.1.0	Demonstration	49
5.1.1	Result 2	50
5.1.2	Result Values	50
5.1.3	Result 3	51

CHAPTER 1

INTRODUCTION

OVERVIEW

1.1. Objective

A smart city is a difficult challenge that requires a variety of agencies, including power distribution, waste management, traffic control, smart housing, and soon. The primary focus of this project is on waste separation systems that will help to clean and depollute the region. We want to have a waste separation and control system under waste management that reduces manual Job and helps in the prevention of unnecessary waste materials for people who are sick. In this Application we want to separate the waste into Dry and wet or degradable and Non degradable waste separation of any type of waste like Electronic waste and medical waste. It contributes to the development of a friendly atmosphere in the region as well as the protection of a healthy, pollution-free climate.

1.2. INTRODUCTION

Since the planet is being updated, we must face one vexing issue. What a waste! In our daily lives, we see images of waste bins that are overflowing and releasing all of the waste. This increases the number of diseases spread by insects and mosquitoes. Solid waste management is a big issue in urban areas not only in India, but in most countries around the world. Intelligent waste management is a concept that can deal with many harmful problems that plague society, such as pollution and infectious diseases. As a result, a system that can eliminate or at least mitigate this problem has been created.

The project offers us one of the most effective ways to maintain a safe and green climate. The intelligent city concept is still new in India, but in few years our current Premier has given the idea of constructing 100 smart cities across India a lot of publicity. Now, the coming number of intelligent cities also need a large number of responsibilities. The primary demand for an intelligent lifestyle starts with cleanliness. Only if the dustbins are well installed and collected would a community get its waste dispatched properly. Smart dustbins may largely monitor the widespread spread of many diseases by preventing garbage accumulation along the roadside. It can avoid

contamination and prevent street animals from consuming the distribution of garbage. Today, the GCV collects waste twice or three times in one week, just as it is in [3]. Therefore, the problem is the waste stream on the highways. There are several tools available to manage and manage waste, but the lack of knowledge collection is a major challenge [4]. This recommends an intelligent means of surveillance and disposal.

In this article, we attempted to improve a minor but critical component of the urban waste management system, namely the dustbin. With the advancement in technology, it is now past time to employ the best waste management technologies. As we've seen, analytical technology has made the world a better place to live by being used in fields such as GM, insurance, marketing, manufacturing, and banking. We have integrated analytics and electronics in this paper so that the conventional waste collection approach can be optimally modified with the large amount of data produced by smart bin systems.

For example, in most of the Indian cities, the principal problem of the existing waste management system is the unhealthy condition of dustbins. For example, the weight sensor as proposed in [5] could be used to detect waste. In the dustbin it gives the weight of the waste. It does not, however, provide details on the waste level. This is a major disadvantage as the sensor threshold level is not crossed if the waste in the bins overflow and the residues are less weighty. As a consequence, even though the basket is overflowing, the disposal process will not be started. We therefore used ultrasonic and colour sensors for the detection of waste in this article. The ultrasound sensor notes the waste poured into the container and thus prevents the container from overflowing. Colour sensor is used to detects the colour of the bag in Which manually segregated like Degradable wastes and Non degradable wastes which is automatically segregated by the colour sensor. Smoke sensor which is used for the Garbage bin to check the level of odour and poisonous gas in the garbage bin.

These sensors are connected to the Node MCU ESP8266 via jumper wires. The IOT framework is open source. Free/Libre/Open Source (FLOSS), a large number of useful Software communities have grown, and everyone with a computer has access to such software. Internet of Things (IoT) refers to a platform of interoperable protocols that contains smart space networks. The identities are physical and virtual. ESP 8266 and low-priced WIFI network wireless sensor. The machine uses IEEE 802.11n protocol.

CHAPTER 2

LITERATURE SURVEY

As you may be aware, each town has large containers that serve as the town's waste disposal facility. The waste management team collects waste from those key baskets in their trucks. Our hardware model will be introduced, and clever bins will be created in these central bins. This is why we divided the waste bin into three levels based on the volume of waste. The amounts would then be indicated via SMS, which would be sent to the central office. The central office of the waste management department will now track each waste bin filled in real time when sitting in its office. These insights will now steer them in an efficient manner to dispatch trucks to empty the dustbin with significant levels. The hardware used to create the whole package at the lowest possible cost by using some very basic electronics. The designed hardware can be mounted at any size and height dustbin and is therefore portable to any container.

The idea did not exist for many years, because the IoT sector has been taking control of our lives. This is not an innovative idea for the introduction of Intelligence waste bins. However, this is an original plan for building a smart basin containing Ultrasonic, Colour and Wi-Fi data transmission systems.

[1]. Dr. Prasun Choudhary, Ritika Sen, Dhruva Roy, Purushottama Roy and Souradeep Sarkar GARBAGE SMART CITY USING IOT 2018 MONITORING AND DISPOSAL SYSTEM.

This paper develops about a smart segregation by Clean and secure approach Ultrasonic sensors in public space. Ultrasound sensors on the containers are used to detect the waste level and equate it to the depth of the trash containing.

[2] P. Suresh (Dan., R.H. Ashwini, and Dr. V. Parthasarathy): State of the Art summary of the Internet of Things. It introduced the concept of IoT and provided additional IoT data. The appropriate intelligent climate.

[3] Dr. N. Sathish Kumar, B. Vijayalakshmi, R. Jenifer, and A. Shankar proposed the IOT-based alarm system with Arduino UNO.

An RFID reader is connected to the Arduino to test the process. When an RFID tag interferes with an RFID reader, the ultrasonic sensor checks the dustbin status and sends it to the web server. This is a very complicated task that cannot be

automated. Another disadvantage is the project's low cost-effectiveness. RFID readers can also earn \$200-\$300, up to \$750, depending on the work.

[4] The Internet of Things: Issues and Cutting-Edge Internet-Level Solutions Sensor Information Management. This paper has given us information on mobile analysis and sensor information management, which aids in the separation of data from various dustbins.

[5] Theodoros Anagnostopoulos, Alexey Medvedev, and Sergei concentrated on the complex scheduling of IOT-enabled small-town waste.

It defined the dynamic scheduling needed for dustbin cleaning, and the Top-k question led to the development of a dustbin prioritization GSM and RF(Zigbee) City Waste collection predictor. This paper described the module required for data transmission on the project's recipient side as well as the main channel. Initially, we used GSM technology in our project, but we later decided to use the Wi-Fi module to enable data transmission.

[6] P. Aravind Raman, B. A. Aravind Raman, B. A. Ara IoT Waste Management Monitoring System Creation, 2019.

[7] In this work, we will obtain the approximate period when the bin will be filled with its current filled status and the data will be sent to the person's email. Real-time and forecasted data will be available. Formal paraphrase Smart Bin – Sanjana Sharma, Vaishnavi V, and Vandana Bedi propose an ultrasonic sensor-based solution to cleaning and securing public spaces.

If the waste level exceeds the authority-intimated threshold, the waste bin status is uploaded into the cloud. This project is rather economic and resource optimisation, but both Arduino and Wi-Fi-module are part of the methodology used for this project. This can be reduced as proposed in our project to a NODEMCU module.

2.1. EXISTING SYSTEM

- Waste management systems are mostly systems control rather than device management. The presence of waste and waste in the waste containers is only detected.
- In a smart bin using some kind of sensor like IR, Ultrasonic and MQ4sensor is used to identify the bin is filled or not and odor of the bin by using MQ4 sensor
- If the bin reaches to threshold level send message to garbage management contractor or office in IOT technology or GSM based technology.
- This is already existing technology.

CHAPTER 3

PROPOSED SYSTEM

- In proposed system it divides the waste into dry waste, wet waste and e-waste by using color sensor.
- Using ultrasound sensor used to detect the level of waste in garbage bin. When the bin filled with 50% then alert messages send to the ward member, and it will fill with 90% the alert message send to the government.
- The bin is continuously monitoring the level of garbage the status of the garbage bin will be uploaded in the cloud if it's full means it gives alert to Government Corporation. When a corporation separate the waste for recycle process.
- After the recycling process is completed when a government organization gives notification to some corporate company, NGO etc.
- It is also have another advantage to reduce environmental pollution and it increase the financial support in government organization.

Block diagram

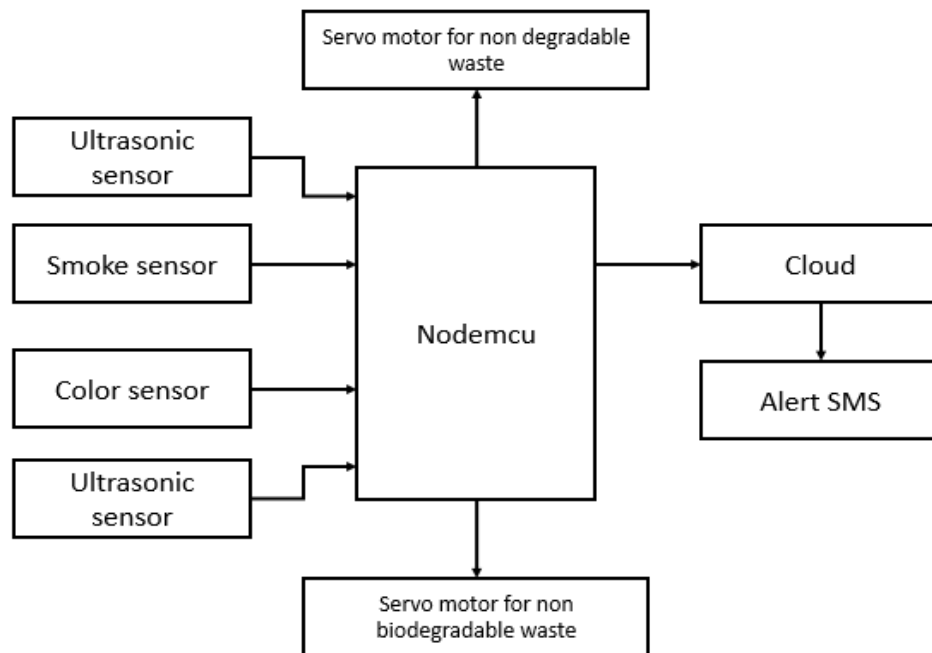


Fig 3.1.0. Block Diagram of proposed system

3.1. HARDWARE USED

- Node MCU
- Ultrasound sensor
- Colour sensor
- Smoke sensor
- Servo motor

3.2. SOFTWARE USED

Arduino c

CHAPTER 4

MATERIALS AND METHODS

A host computer is used by the microcontrollers to design and compile programs. On the host computer, software is classified as an integrated development environment (IDE). The Arduino development environment is based on the Open source processing framework (www.processing.org), which is described as a "programming language and environment" for people who want to create software with images, animation, and interactions. Arduino makes use of an Open source project known as wiring Language (wiring.org.co). The Arduino programming language is based on the traditional C programming language. If you don't know this language, don't worry; it's not difficult to learn, and the Arduino IDE offers feedback when you make mistakes in your programs.

The Arduino Uno has many communication facilities with a computer, a different Arduino or other microcontrollers. UART TTL (5V), available on digital pins 0 (RX) and 1, is supplied by the ATmega328 (TX). This serial communication on the USB is provided on the board by an ATmega16U2 which appears as a virtual com port for software. The 16U2 firmware utilizes normal USB COM drivers and does not require an external driver. The program includes a serial monitor which allows the transmission to and from the Arduino board of simple text information. When data is transmitted via USB to serial chip and USB link to device, the RX and TX LEDs on the board are flashed (but not for serial communication on pins 0 and 1).

A piece of software the serial library allows serial communication on any digital Uno pin. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino Program includes the Wire, which makes it easier to use the I2C bus. To interact with the SPI, use the SPI library.

Repositories that expand programming's core features. Libraries allow you to reuse code without having to copy and paste it into each of your programs. Other libraries can be downloaded from Arduino support pages and other websites that publish Arduino library code, as well as many standard Arduino software installations.

```
#include <Servo.h>
```

This instructs the Arduino IDE to use the Servo library in your design. The library's functions can now be used to control one or more servers with its various functions.

The write function, for example, can be used to rotate a servo from 0 to 180 degrees and position it in a specific location. My Servo's code is below. Writing [90]; Shifts a servo 90 degrees to its central point or position. The Arduino sketches are structured in such a way that they are very plain, readable, and understandable. In Arduino, there are two important sections: setup () and loop (). There are some programming features that are named after them: Configure () modifies Arduino's hardware, such as the I/O lines you want to use and if you want to use a shield.

It's a choice between inputs and outputs. The loop () cycle is repeated indefinitely while the Arduino is running.

The Arduino IDE is used to create and upload the software to the Arduino board.

4.1. Node MCU ESP8266

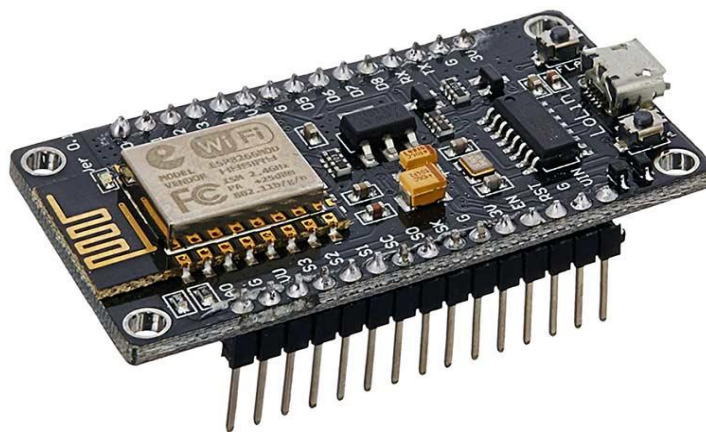


Fig 4.1.0. Node MCU ESP8266

Pin Category	Name	Description
Power	Micro-USB, 3.3V, GND, Vin	Micro-USB: Node MCU can be powered through the USB port 3.3V: Regulated 3.3V can be supplied to this pin to power the board GND: Ground pins Vin: External Power Supply
Control Pins	EN, RST	The pin and the button resets the microcontroller
Analog Pin	A0	Used to measure analog voltage in the range of 0-3.3V
GPIO Pins	GPIO1 to GPIO16	Node MCU has 16 general purpose input-output pins on its board
SPI Pins	SD1, CMD, SD0, CLK	Node MCU has four pins available for SPI communication.
UART Pins	TXD0, RXD0, TXD2, RXD2	Node MCU has two UART interfaces, UART0 (RXD0 & TXD0) and UART1 (RXD1 & TXD1). UART1 is used to upload the firmware/program.
I2C Pins		Node MCU has I2C functionality support but due to the internal functionality of these pins, you have to find which pin is I2C.

4.1.1. Node MCU ESP8266 Pinout

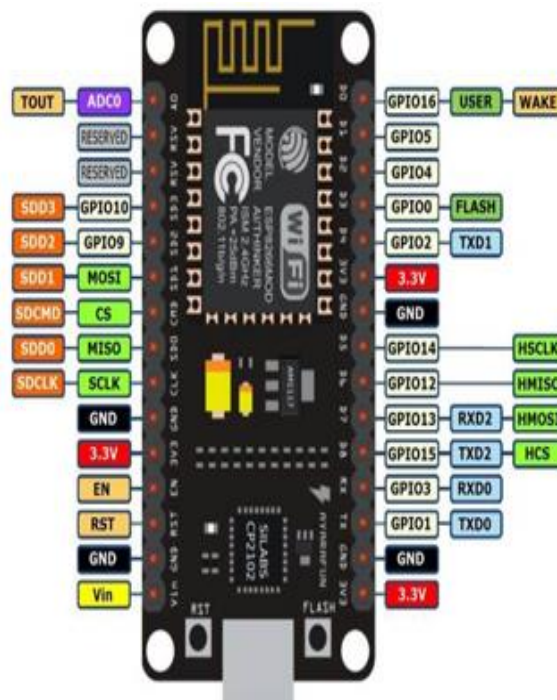


Fig 4.1.1. Node MCU ESP8266 Pinout

Node MCU is an open-source Lua-oriented, IoT based Apps firmware and development board. It includes firmware on Express if Systems' ESP8266 Wi-Fi SoC and hardware on the ESP-12 module.

Specifications & Functions MCU Node ESP8266

Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106

Operating Voltage: 3.3V

Input Voltage: 7-12V

Digital I/O Pins (DIO): 16

Analog Input Pins (ADC): 1

UARTs: 1

SPIs: 1

I2Cs: 1

Flash Memory: 4 MB

SRAM: 64 KB

Clock Speed: 80 MHz

USB-TTL based on CP2102 is included onboard, Enabling Plug n Play

PCB Antenna

Small Sized module to fit smartly inside your IoT projects

4.1.2. Other Development Boards

AVR Development Board, MSP430 Lance-Pad, Intel Edison, Beagle Bone Arduino, Raspberry Pi, PIC Development Board, Letter About MCU ESP8266 Node. ESP-12E Module with ESP8266 chip with 32-bit LX106 RISC microprocessor is provided on the ESP-12E Node MCU ESP8266 development board. It supports RTOS with an adjustable frequency of 80 MHz to 160 Mhz. The MCU Node has 128 KB of RAM and 4 MB of flash storage. It is suitable for IoT projects due to its high processing energy with built-in Wi-Fi/Bluetooth and Deep Sleep Operational functions.

Micro USB jack and VIN pin will power node MCU (External Supply Pin). UART, SPI and I2C interface are supported.

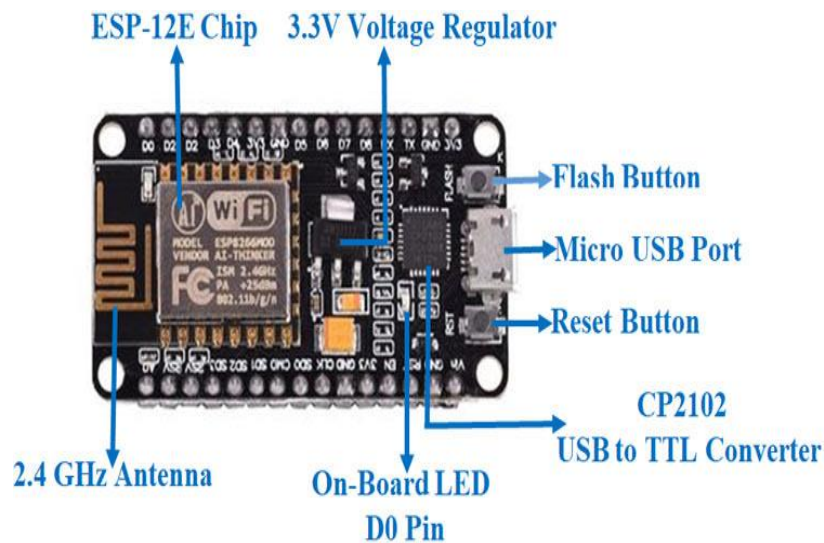


Fig 4.1.2. ESP8266

Programming Node MCU ESP8266 with Arduino IDE

The Arduino IDE is simple to use and enables the Node MCU Development Board to be configured. It will not take 5-10 minutes to program the MCU node with Arduino IDE. The Arduino IDE, a USB cable and the Node MCU board are all needed. To prepare your Arduino IDE for Node MCU, you can check the start of this node MCU tutorial.

Uploading your first program

Once the Arduino IDE is installed on a computer, connect the board to the system using the USB cable. Then launch the Arduino IDE and select the appropriate board via Tools>Boards>Node MCU1.0 (ESP-12E Module) and the appropriate port via Tools>Port. Select Files>Examples>Basics>MCU to begin with the board node MCU and blink the built-in LED. Blink to see an example of code. Load the sample code into your browser. After you've loaded the example code into your IDE, press the 'Upload' button in the top bar. When the upload is done, the integrated LED on the board should start blinking.

4.1.3. Applications of Node MCU

- Prototyping of IoT devices
- Low power battery operated applications
- Network project.
- Projects that need various Wi-Fi and Bluetooth interfaces.

4.2. smoke sensor module

Monitoring of emitted gases is very critical in today's technology scenario. It's really important to track the natural gas from home appliances like air-conditioning systems to electric chimneys and safety systems. These systems have gas sensors that are very critical. Gas sensors, small like a nose, respond spontaneously to the gas present, thus keeping the device up to date on all changes occurring in the gas molecular concentration.



Fig 4.2. Smoke Sensor

Gas sensors are available in a wide range of specifications, depending on the degree of sensitivity, gas quality, physical measurements, and a variety of other factors. This perspective is about a methane gas sensor that can detect gases such as methane and ammonia. When a gas communicates with this sensor, it first ionizes it before being adsorbed into its components by the sensing element. This adsorption

results in a potential difference in the variable, which is transmitted to the processor unit through current output pins. What role does Sensing play? Is it held or displayed in a room? How is it kept up to date, and how is it removed? Let's find out in this Insight!!!

A steel exoskeleton, with a sensing feature, is included in the gaseous sensor module. This sensing aspect is subjected by connecting leads to current. It is known as the heating current, which ionizes gases that approach the sensing element and is absorbed by the sensing element. This changes the resistance of the sensing element, which changes its value.

This picture shows externals of the regular gas sensor module: a mesh of steel, a copper tightening ring and connecting lines. The top component is a mesh of stainless steel that is supported by:

Filtering out the suspended particles so that only gaseous elements are able to pass to insides of the sensor.

- A non-explosion network keeps the sensor module operating at high temperatures and gas pressures.
- The sensor module is undamaged.
- In order to handle the functions mentioned above effectively, the steel mesh is divided into two layers. A clamping ring made of copper binds the mesh to the rest of the body.
- THE TERM The sensor's connecting conduits are thick, allowing the sensor to be firmly connected to the circuit while still providing adequate heat in the inner part. They are made of copper and are tin-plated. Four of the six conduits (A, B, C, D) fetch the signal, while the sensor elements can provide sufficient heat with two (1, 2) conduits. The pins are mounted on a Bakelite frame, which acts as a solid insulator and keeps the sensor firmly connected to the link leads.
- The top of the gas sensor is removed to access the internal parts of the sensor: sensing section and link wiring. The hexapod structure is composed of a sensor and six linking legs that extend beyond the bake lite base. The use of a ceramic substrate increases heating efficiency and tin oxide; sensitivity to adsorption of the desired gas components (methane and products in this case) is adequate for sensing.

- A well-known conductive alloy, nickel-chromium, connects the leads for heating the sensing component. Platinum wires link the output signals, which transmit small changes in the current passing through the sensing element. The platinum wires are connected to the sensing section, while the nickel-chromium wires' hollow structure passes through.

While other wires are connected to the element's external body, nickel chromium wires have the form of a spring inside the element. This illustration shows the coiled section of the wire inside the ceramic hole.

4.3. Servomotor

A servomotor is a revolving actuator or engine that can adjust angle, acceleration, and speed precisely. Certain features, in particular, are lacking in a standard engine. It employs a standard engine and a location feedback sensor

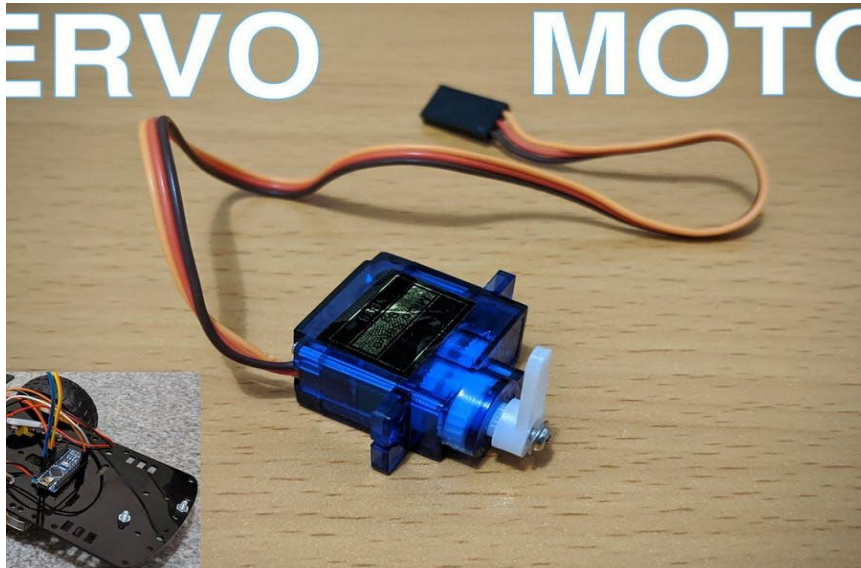


Fig 4.3. Servomotor

4.3.1. Types of servo motors

Based on their uses, servo motors can be of various forms. Among them, the most important are AC servo engine, DC servo engine, brushless DC servo engine, positional servomotors, permanent servo, servo rotation and linear servo motor. A typical servomotor is made up of three wires: fuel, control and ground. These motors shape and size depend on how they work.

4.3.2. DC servo motor

The basic operating principle of the DC engine is the same as that of other electromagnetic motors. There are distinct architecture, design, and operational modes. This form of rotator is long and has a smaller diameter rotor length. Their scale is greater than that of conventional engines with comparable fuel ratings.



Fig 4.3.2.DC Servomotor

There are various types of dc servo motors which are:

3.4.1.1. *Series motors*

The motors in the series are powerful and powerful in starting torque. The speed control of this engine type is bad.

3.4.1.2. *Split series motor*

The motors are the ones with a fractional kilowatt field density. The Split Series Engine has a conventional torque curve. The curve depicts a high torque stagnation followed by a rapid torque decrease.

3.4.1.3. *Shunt control motor*

It has two separate windings:

1.field winding – on the stator.

2.Armature winding – The machine's rotor. Both windings are connected to a source of supply DC.

3. Permanent magnet shunt motor: It is a fixed excitement engine with a permanent magnet supplying the field. In addition, the output is identical to the fixed field motor armature operated.

4.3.3. Principle of working

The Servo motor uses the PWM principle, meaning that the pulse rotation angle is regulated by the pulse length applied to its PIN control. The main component of the servo engine is the DC motor operated by a variable (potentiometer) resistor and some gears.

4.3.4. Mechanism of servomotor

A servo engine is basically a closed-loop servomechanism that uses position feedback to monitor its motion and final location. The control input is also a signal (either analog or digital) that represents the output shaft's commanded position. The engine contains some kind of encoder to provide input on position and rpm. We just evaluate the position in the most basic scenario. The determined output position is compared to the controller's external input, the control position. Right here. Right now. An error signal is produced when the position of the output differs from the expected location. This enables the engine to turn in any direction, and the output shaft to be positioned accordingly. As the location approaches, the error signal is reduced to zero. Finally, the engine fails.

Only a potentiometer and an engine bang-bang control can detect the very basic servomotors. Furthermore, the engine is already fully rotated. Although this type of servomotor has few applications in industrial motion control, it serves as the foundation for simple and low-cost radio control models. Servomotors are often used in optical rotating encoders for the calculation of output shaft speed and a variable-speed drive to control engine speed. When paired with a PID control algorithm, this now allows the servomotor to run quicker and more accurately with less overflow.

4.3.5. Working of servomotors

Servo motors control very precisely the location and speed. The mechanical location of the shaft is now felt by a potentiometer. This makes it pairs by gears with the motor shaft. The current location of the shaft is transformed by potentiometer into an electric signal and compared to the input signal command. The location of the shaft is perceived on modern servo engines, electronic encoders or sensors.

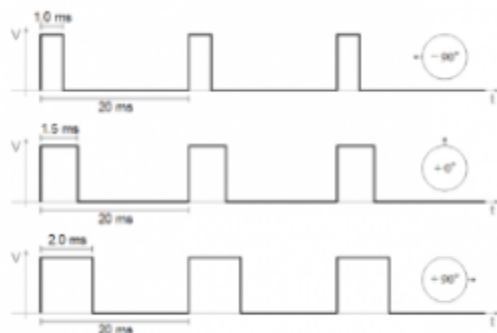
We enter the control input based on the shaft position. If the feedback signal deviates from the given input, the user is alerted to an error signal. This error signal is amplified and used as the engine entrance, causing the motor to reverse direction. If the shaft reaches the proper position and the engine remains stationary, the error signal becomes zero. The control's input is in the form of an electric pulse. Since the real motor input is the difference between the feedback signal (current position) and the

appropriate signal, the motor speed is proportional to the difference between the current and required positions.

4.3.6. Controlling of servomotors

A servomotor usually turns 90 degree, so maximum rotation can be 180 degrees. In either direction. However, a standard servo engine cannot rotate to a mechanical stop build. We take three wires out of a positive servo, ground and wire power. By transmitting a pulse width (PWM) signal through the control wire, the servo motor is operated. For 20 milliseconds a pulse is dispatched. Pulse width determines the shafted position.

for example, At-90 degrees, the shaft will travel anticlockwise with a pulse of 1ms, the shaft will move with a pulse of 0 degrees and the shaft's pulse is moved clockwise with a pulsation of 2ms at +90 degrees.



variable pulse width control servo motor

When we instruct a servo motor to use the appropriate pulse distance, the shaft is moved to and maintained in the required position. However, the engine is unable to turn. Pulses must be repeated for the motor to hold the position.

4.3.7. Applications

1. Robotics: A servomotor is connected to each joint of the robot. As a result, the robot arm has a specific angle.
2. Conveyor belts: Servo motors drive, stop, and start conveyor belts that transport products to different levels, such as product packaging and labeling.
3. Camera auto focus: A camera lens is corrected by a highly precise servo motor built into the camera to sharpen out-of-focus photographs.
4. Solar tracking system: Servo motors change solar panel angles all day long and so every panel continues to face the sun to maximize sunrise energy.

4.4. Ultrasonic (UV) Sensors or Ultrasound Sensors

Bats are amazing creatures. It is blind to your eyes but has such a detailed vision that it can tell the difference between a moth and a broken leaf even while flying at full height. The vision is undeniably clearer than ours, and it is unfathomably beyond human comprehension. Ultrasound is a tool used by bats and many other animal species in the animal world for navigation. We humans have not only understood but also successfully imitated and maximized nature's ability to gain an advantage over all in an attempt to emulate the ways in which nature can gain an advantage over all.

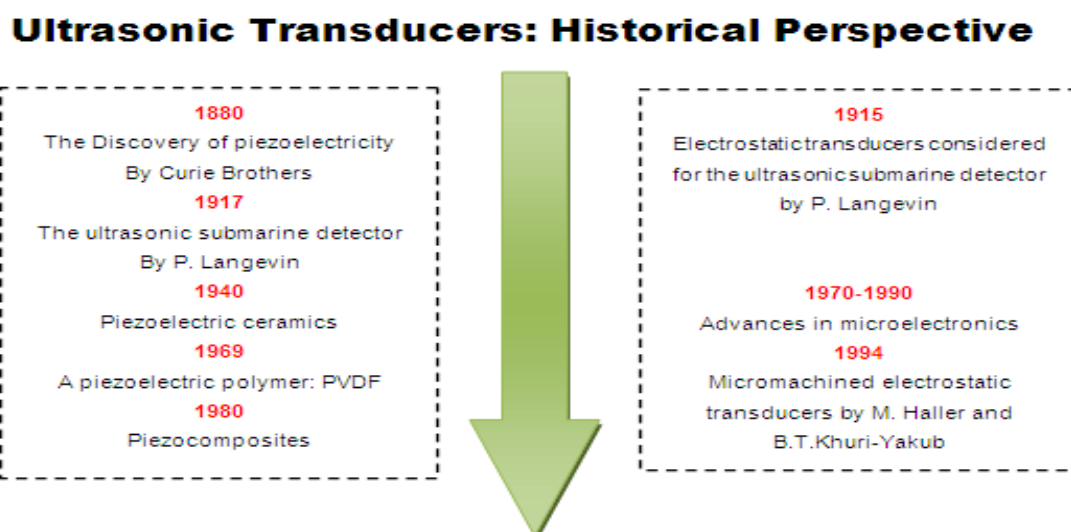


Fig 4.4.0. Ultrasonic Transducers

Lazzaro Spallanzani first discovered that bats flew using their ears rather than their eyes in 1790. In 1826, Jean-Daniel Cal used an underwater bell to effectively and accurately detect sound level. Experiments and research in this field were later carried out slowly and steadily until the discovery of Pierre Curie in 1881. He discovered the link between crystalline material strain and electric voltage. Because of the tragic Titanic disaster, Paul Langevin invented the hydrophone to monitor icebergs in that location. It was the first ultrasound transducer. During World War I, the hydrophone, which could send and receive low frequency sonic waves, was used in underwater detection.

Along with the SONAR, medical studies started to take an interest in ultrasound. In the late 1930s, DR. Karl Dussik's used a technique called hyper phonography to capture ultrasonic wave pulses on sensitive paper. It was used to create ultrasound images of the brain to help in tumour detection and the development of ultrasound imaging. Following this, several researchers, including Ian Donald, Douglas, Joseph Holmes, John Wild, and John Reid, created various aspects of the ultrasound method to treat stomach cancers, ovarian cysts, twin pregnancies, tumours, and other conditions. In the medical sector. Industry, too, has not been slow in sapping the car, with techniques such as ultrasonic soldering and non-destructive testing being implemented as early as the 1960s.

How Ultrasonic Sensors work?

Ultrasonic sensors are electrical-mechanical transformers which measure distance from the sensor to the target object, with mechanical energy being used as ultrasonic waves. Ultrasonic waves are mechanical longitudinal waves which pass along wave propagation directed through the medium as a succession of compressions and rarefactions. Per sound wave above the 20,000 Hz human hearing range is known as ultrasound. The frequency spectrum was widely classified according to the form of application as shown in the following figure:

The Frequency Ranges of the Sound

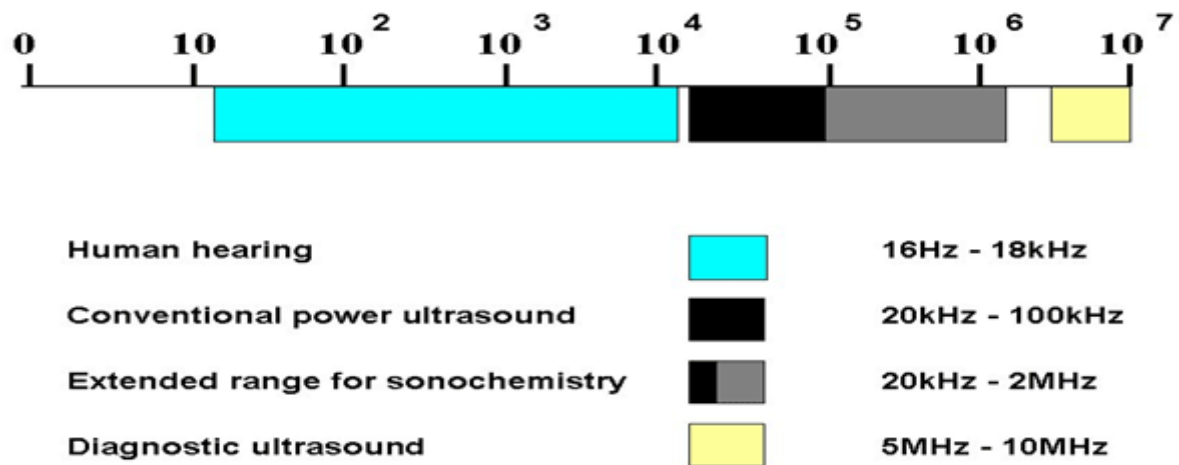
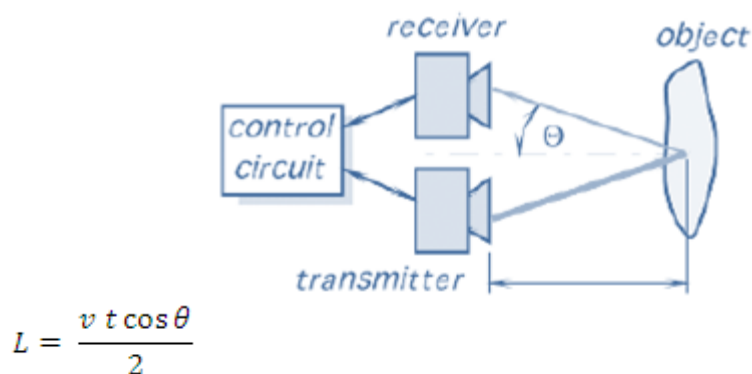


Fig 4.4.1. Frequency ranges

As ultrasonic waves occur on an object, a large, solid angle that can be 180 degrees diffused reflection of the energy takes place. Thus a fraction of the incident energy is reflected and detected back to the transducer as pulses. The distance to the object (L) may be determined in the medium by a relation with the speed of ultrasonic waves (v)

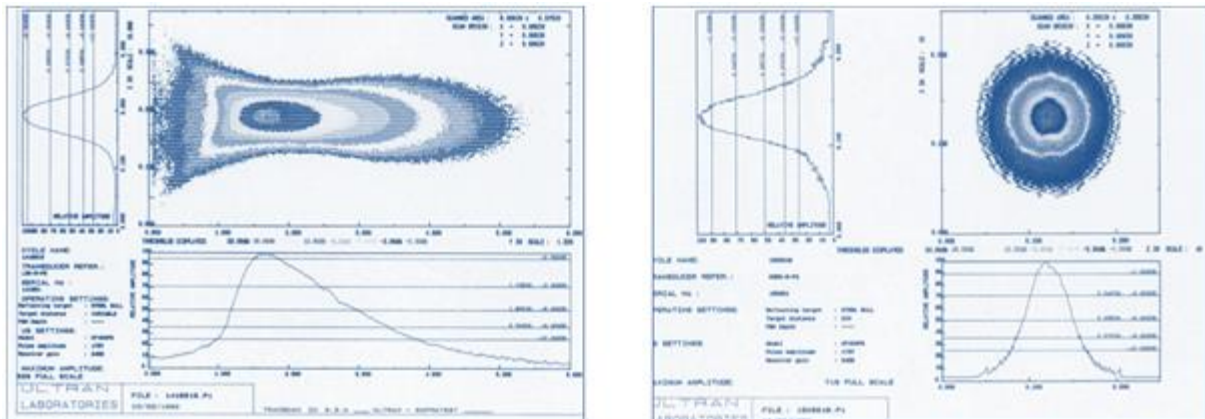


Where θ is the angle from the horizontal to the direction shown in the figure, and t is the wave time to reach the sensor. Doppler-based instruments are used while the target is moving. The Ultrasonic Sensors Work Insight-How page has details on the internal structure and function of an ultrasonic sensor.

4.4.1. Generating Ultrasonic Waves

In order to generate such mechanical waves, a surface must change like a diaphragm, causing a compression and rarefaction movement in the medium opposite it. Ultrasonic wave generation at frequency ranges of 1-20 MHz and 20-40 kHz was widely used with piezoelectric materials operating in motor mode and magnetostrict materials. Sensors are made of piezoelectric ceramic transducers, which flex when an electrical signal is applied to them. They are linked to an electronic oscillator, the output of which generates the correct frequency for the oscillating voltages. Lead zirconate titanate is a popular piezoelectric material used in medical ultrasound imaging. For better output, the applied oscillation frequency must be the natural frequency of the ceramic, which readily produces oscillations by resonance. It offers the highest level of sensitivity and efficiency.

These sensors are typically parameterised by tracking the reflected and transmitted signals from the side of a transducer axial movement while maintaining a target in a certain medium (water in general). The sound beam differs quickly, so the transducer generates as few beams as possible. More sensitive is the sensor, the narrower the beam pattern. However, with beam width, it increases the potential angle between the transducer and the floor. The following beam patterns are observed: The following:



Axial and Cross Sectional beam profiles

Bandwidth, attenuation, dynamic range and resolution, such as grayscale, axial and lateral resolution form the parameters to calculate the performance of an ultrasonic sensor. Other parameters include nominal frequency, peak frequency, frequency bandwidth core, pulse duration, signal and noise ratios (SNR).

4.4.2. Importance of Ultrasonic Sensors

Many other sensors, such as optical range finders and microwave-based instruments, are based on different physical transduction principles. Why, then, do you begin with ultrasonic transducers, whose sonic speed is much slower than the electromagnetic wave speed? The response is in the question itself. Since devices based on EM waves are too fast. The time taken by ultrasonic waves is much longer than that used by EM waves, and therefore its measurement is simpler and less expensive. Since they are built on sound waves rather than EM waves, they can operate at locations where the latter does not.

In the case of transparent object detections and calculating liquid levels or high-brightness conditions, for example, light-based sensors can have a major impact due to the propagation of the target or translucent media. Ultrasonic systems will remain virtually unchanged based on sound propagation. These are also effective in wet environments, where optical beams are distorted by water droplet refraction in the atmosphere. Because of their range and precision, ultrasound sensors can be positioned between two EM wave sensor systems, the infrared range sensor on the lower end and the LIDAR on the upper end.

Ultrasonics are less reliable and have a shorter range than LIDARs, but they are more susceptible to environmental conditions and need recalibration while changing environments. Furthermore, as opposed to MRI or X-ray scans, this medical imaging equipment is less expensive and more compact. In contrast to X-rays or radioactivity-dependent methods, no adverse effects of ultrasonic waves at the intensity levels used were observed, making them particularly suitable for imaging soft tissues.

Applications

Ultrasonic sensor systems can be categorized according to the property they use. You may summarize these as:

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

Ultrasound sensor problems have been solved through research, especially in medical imaging, where ultrasound is well established. Acoustic sensors, such as Acoustic Shadowing and Acoustic Enhancement, use objects to differentiate solid from cystic tissues. Industry has benefited from ultrasonic sensors in applications such as plastic welding, joystick purification, telecommunication and remote sensing, parking systems, and so on. Robotics has been identified as the most effective tool for ultrasonic screen remoteness and mapping. Ultrasonic sensors are used in the fashion designing in hair styling.

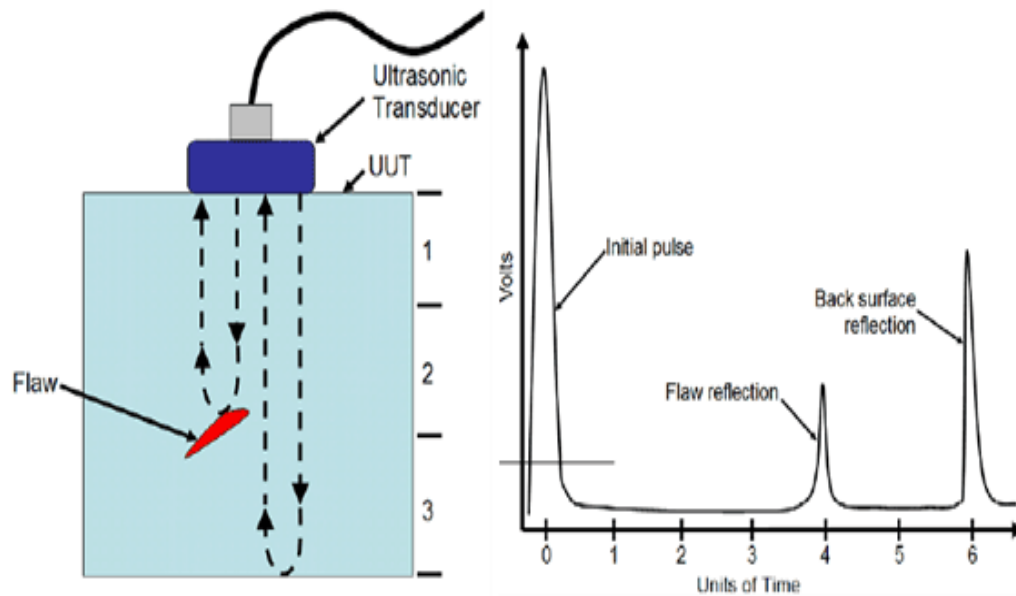


Fig 4.4.2. Ultrasonic

Future

Ultrasonic waves in various modes, such as Longitudinal (L-Wave) and Shear (S-Wave), have been used in non-destructive testing and defect detection to detect material faults. New materials, such as capacitive micromachined transducers, are being developed in the light of scientific advancement to provide higher bandwidth and improved integration capacity with electronic circuits at low voltages (CMUTs).

These instruments offer Non Invasive methods for identifying problems in a wide range of items, whether they are living tissues or manufactured goods. Since ultrasound sensors have identified several problems that would otherwise have left doctors dazzled and the problem untreated, ultrasound sensors will make great efforts, even in the coming days. The environmental and psychological effects of EM-radiation under scanners are expected to flourish and provide a significant alternative to current technologies. Ultrasonic devices are also expected to grow in popularity.

4.5. COLOUR SENSOR

White light is a mixture of three basic colours known as primary colours. It comes in three colours: red, blue, and green. These colours have different wavelengths. At different proportions, these colour combinations contain different types of colours. As white light strikes a surface, some wavelengths of the light are absorbed, while others are mirrored by the surface's material properties. The colour of the material is detected as these reflected wavelengths fall on the human eye. A material that reflects red light wavelengths appears. The colour sensor is the component responsible for colour detection.

What is a Color Sensor?

A sensor Color senses the material color. Typically this sensor detects RGB-scale color. The color can be divided into red, blue or green by this sensor. The sensors also have filters to reject the unwanted IR and UV illumination.



Fig 4.5.0. COLOR SENSOR

4.5.1. Working Principle of Colour Sensor

Three key types of equipment are needed to detect the colour of the material. An illumination source that illuminates the surface of the material and its colour must be observed, as well as the recipients that can measure wavelengths. A white light emitter to illuminate the surface is used in colour sensors. Three 580nm, 540nm and 450nm wavelength filters to measure the colours red, green and blue respectively.

Another method of color detection is by a red, blue and green LED illumination of the material surface. In this case the sensor does not include filters, but light to converting voltage. In order to detect the color, the highest amount of light reflected back by the material surface is measured.

4.5.2. Applications

To measure color sensors, the Color of the surfaces is detected. These sensors are applicable in commercial, medical and safety systems for a large number of applications. The light color assessment, RGB LED control, medical diagnostic systems, medical fitness systems, industrial process control, etc... These are some of the applications.

4.5.3. Examples

Color sensors AS73211, TCS3200, TCS3400, TCS34715, TCS34727, Color PAL from parallax, SEN-1195, Lego Mindstorms EV3 are some examples of these available in the market.

In addition to RGB, certain color sensors can also detect various colors. In order to determine the exact color of the sample, IR and UV radiation shall be filtered out. Sensors also have frequency converter light programmable. These sensors are also very small and can be interfaced easily with a microcontroller.

SELECTION CRITERIA

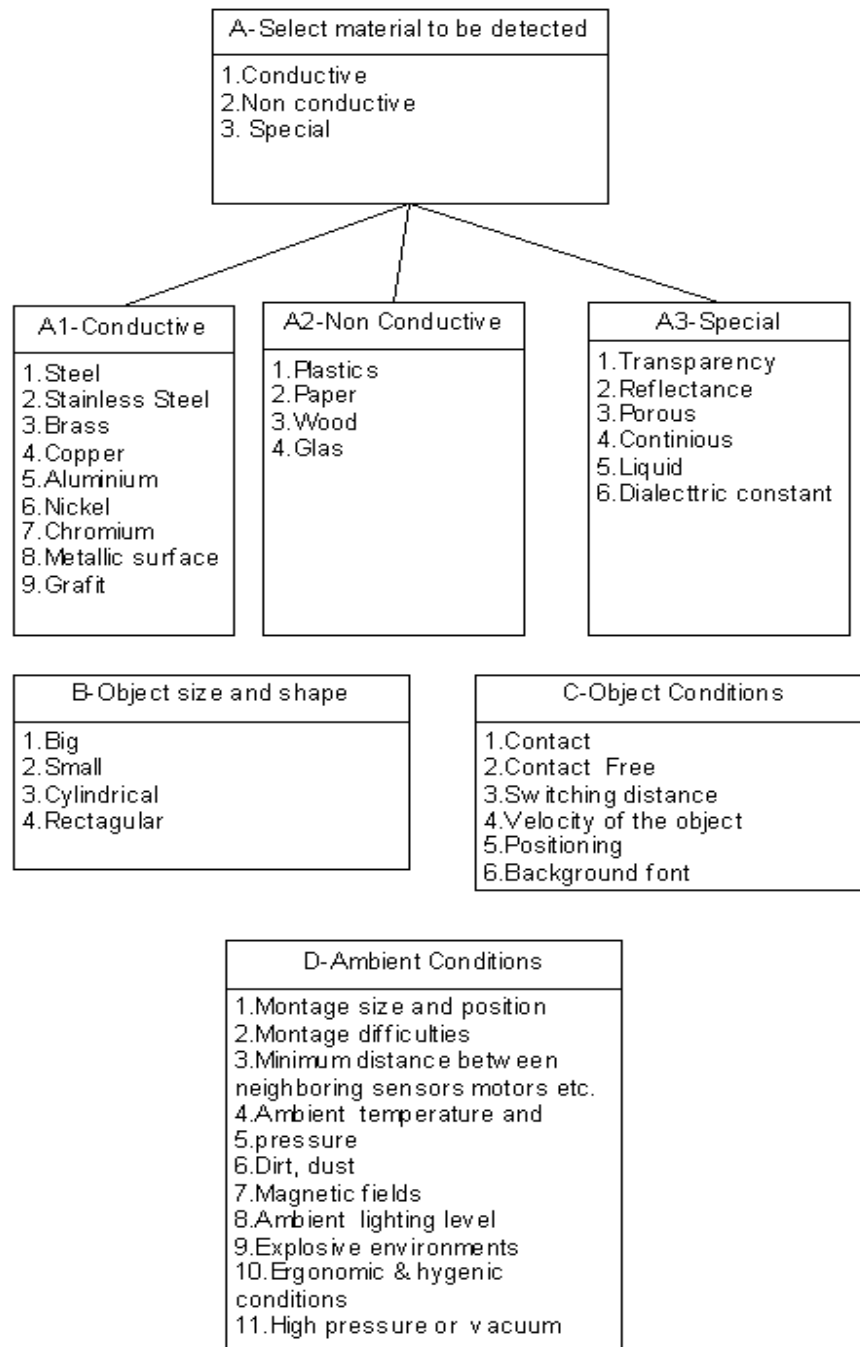


Fig 4.5.1. Selection Criteria

4.6. PROTECTION CLASSES

The protection classes of the mechanical elements are defined in DIN 40050. For example, IP67 represents a device with protection against contact and foreign material according to 6 (Table A1) and against water and humidity according to 7 (Table A2).

First digit	Protection Class
0	No special protection
1	Protection against solid objects larger than 50 mm diameter. Unprotected against forced contacts (EG. via hand). Should be kept apart from the body
2	Protection against solid objects larger than 12 mm diameter. Should be kept apart from the fingers
3	Protection against solid objects larger than 2.5 mm diameter. Should be kept apart from the devices (wire, hand tools etc.)
4	Protection against solid objects larger than 1 mm diameter. Should be kept apart from the devices (wire, hand tools etc.)
5	Protection against hazardous dust accumulation. Dust protection is not totally achieved, but inner dust accumulation does not affect functioning of the device. Full protection against forced contact.
6	Full protection against dust accumulation. Full protection against forced contact.

Table A1: Protection against dust & forced contact.

Second digit	Protection Class
0	No special protection
1	Protection against vertically tipping water. The water has no hazardous effects (tipping water).
2	Protection against vertically tipping water at 15 ° to the normal of the device surface. The water has no hazardous effects (inclined tipping water).
3	Protection against water tipping at 60° to the normal of the device. The water has no hazardous effects (sprinkling water)
4	Protection against water from any direction to the device. The water has no hazardous effects (flowing water)
5	Protection against water from a nozzle coming from any direction to the device. The water has no hazardous effects (flowing water)
6	Protection against water forced water coming from any direction to the device. The water has no hazardous effects (forced water)
7	Protection against water in case of immersion at certain pressure for a specific time Leakage of the water into the device is avoided.
8	Full protection against water in case of immersion for a predetermined period of time (permanent immersion).

Table A2: Protection against water

4.7. ARDUINO UNO AND ITS PROGRAMMING

Instead of a computer, Arduino is a machine tool that detects and controls the physical world. It is an open-source physical data platform that is built around a basic microcontroller board and a board software development environment.

By taking input from a variety of switches or sensors, the Arduino can be used to construct interactive objects as well as control a variety of lights, motors, and other physical outputs. Arduino projects can stand alone or communicate with software on your device. The boards can be assembled manually or pre-assembled; the IDE is free to download.

The Arduino programming language is based on the Multimedia programming environment, which is an application of Wiring, a physical computing platform similar to Arduino.

The Arduino Microcontroller is a simple but powerful computer that has had a massive effect on the hobby and business markets. Arduino is open source, which means that the hardware is reasonably priced and the development software is free. This guide is intended for students in ME 2011 or elsewhere who are encountering the Arduino for the first time. For advanced Arduino users who want to access the Internet, there are many resources available.

This Guide is ideal for students and educators, and it includes the Arduino Uno Board (Spark fun DEV -09950, \$29,95). The Arduino board allows you to write programs and create interface circuits to read and track motors and lights, switches, and other sensors with minimal effort. Many of the photos and drawings in this guide were taken from the documentation.

This is what the Arduino ide looks like.



Fig 4.7.1. Arduino

The Duemilanove board includes a 5 V Atmel AT mega 328 microcontroller with 2 kb RAM, 32 kb flash disk memory, and 1 kb EEPROM for parameter storage. The clock speed is 16 MHz, which equates to approximately 300,000 lines of C source code per second. The frame has 14 I/O optical pins and 6 Analog pins. Though not connected to the host, a USB connector and a DC power jack can be attached to the host computer for connecting an external 6-20V energy source, such as a 9V battery. For the I/O pins, interfaced headers with 22 g of solid wire or header connectors are allowed.

The Arduino programming language is a simplified version of C/C++. You will be able to program the Arduino if you are familiar with C. You don't need to worry if you know C because you just need to perform a few functions with a few commands. One of the most useful aspects of the Arduino is the ability to create and download an Arduino control program on the host machine. Remove the USB cable from the PC, and the machine will continue to run from the top each time you push the reset button. Remove the battery and store it in a closet for six months. If you reconnect the battery, the last program you saved will run. This means that you connect the board to the host PC in order to create and debug the software, but once done, you no longer need to run the program.

Arduino Software (IDE)

- Writing Sketches
 - File
 - Edit
 - Sketch
 - Tools
 - Help
- Sketchbook
- Tabs, Multiple Files, and Compilation
- Uploading
- Libraries
- Third-Party Hardware
- Serial Monitor
- Preferences
- Language Support
- Boards

A text editor for the writing of code, the message field, a text console, a toolbox and toolbars for ordinary functions and a number of menu are provided by the Arduino Integrated Development Environment or Arduino Software (IDE). It links to the hardware Arduino to upload and interact with programs.

4.7.1. Writing Sketches

Programs written with Arduino Software are referred to as sketches. These sketches are in the text editor, and they are saved with the extension. INO. The editor supports cut/paste as well as search/replace text. During storage and export, feedback is provided, and errors are displayed in the Message field. A console with complete error messages and additional information displays text output by Arduino software (IDE). The board and serial port configuration are shown at the bottom right of the window. Using the Toolbar Buttons, you can search, upload, create, open and save sketches, and open a serial monitor.

NB: Arduino Software versions (IDE) saved the. PDE extension sketches before 1.0. You are asked to save the Sketch using the. INO extension to open these files with version 1.0.

Verify

Checks your code for errors compiling it.

Upload

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

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

New

Creates a new sketch.

Open

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

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

Save

Saves your sketch.

Serial Monitor

Opens the serial monitor.

The five menus include: file, edit, skits, tools, and help. Additional commands are included. The menus are context-sensitive, so only things related to the work being performed are accessible.

4.7.2.File

- **New**

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

- **Open**
Allows to load a sketch file browsing through the computer drives and folders.
- **OpenRecent**
Provides a short list of the most recent sketches, ready to be opened.
- **Sketchbook**
Shows the current sketches within the sketchbook folder structure; clicking on any name opens the corresponding sketch in a new editor instance.
- **Examples**
Any example provided by the Arduino Software (IDE) or library shows up in this menu item. All the examples are structured in a tree that allows easy access by topic or library.
- **Close**
Closes the instance of the Arduino Software from which it is clicked.
- **Save**
Saves the sketch with the current name. If the file hasn't been named before, a name will be provided in a "Save as.." window.
- **Saveas...**
Allows to save the current sketch with a different name. Page Setup
It shows the Page Setup window for printing.
- **Print**
Sends the current sketch to the printer according to the settings defined in Page Setup.
- **Preferences**
Opens the Preferences window where some settings of the IDE may be customized, as the language of the IDE interface.
- **Quit**
Closes all IDE windows. The same sketches open when Quit was chosen will be automatically reopened the next time you start the IDE.

4.7.3. Edit

- **Undo/Redo**
Goes back of one or more steps you did while editing; when you go back, you may go forward with Redo.
- **Cut**
Removes the selected text from the editor and places it into the clipboard.
- **Copy**
Duplicates the selected text in the editor and places it into the clipboard.
- **Copy for Forum**
Copies the code of your sketch to the clipboard in a form suitable for posting to the forum, complete with syntax Colouring.
- **Copy as HTML**
Copies the code of your sketch to the clipboard as HTML, suitable for embedding in web pages.
- **Paste**
Puts the contents of the clipboard at the cursor position, in the editor.
- **Select All**
Selects and highlights the whole content of the editor.
- **Comment/Uncomment**
Puts or removes the // comment marker at the beginning of each selected line.
- **Increase/Decrease Indent**
Adds or subtracts a space at the beginning of each selected line, moving the text one space on the right or eliminating a space at the beginning.
- **Find Next**
Highlights the next occurrence - if any - of the string specified as the search item in the Find window, relative to the cursor position.
- **Find Previous**
Highlights the previous occurrence - if any - of the string specified as the search item in the Find window relative to the cursor position.

4.7.4. Sketch

- **Verify/Compile**

Checks your sketch for errors compiling it; it will report memory usage for code and variables in the console area.

- **Upload**

Compiles and loads the binary file onto the configured board through the configured Port.

- **Upload Using Programmer**

This will overwrite the bootloader on the board; you will need to use Tools > Burn Bootloader to restore it and be able to Upload to USB serial port again. However, it allows you to use the full capacity of the Flash memory for your sketch. Please note that this command will NOT burn the fuses. To do so a *Tools -> Burn Bootloader* command must be executed.

- **Export Compiled Binary**

Saves a .hex file that may be kept as archive or sent to the board using other tools.

- **Show Sketch Folder**

Opens the current sketch folder.

- **Include Library**

Adds a library to your sketch by inserting #include statements at the start of your code. For more details, see libraries below. Additionally, from this menu item you can access the Library Manager and import new libraries from .zip files.

Libraries

Libraries have extra features for use in drawings, such as hardware operation and data manipulation. Select the library in a sketch from the Sketch > Import Library menu. This will have one or more `#include` statements at the top of the drawing and compile the library with your drawing. Libraries take up more room on the board since they are submitted with your drawing. If a sketch no longer needs libraries, simply delete their `#include` statements from the top of your file. A list of libraries is included in the guide. Arduino resources are included in some libraries. Others are available for download from a variety of sources, including the Library Manager. Starting with version 1.0.5 of the IDE, you can freely import a library from a zip file and use it. See these instructions for installing the third-party library. See this guide for help with your own library.

Third-Party Hardware

The hardware of your sketch book directory can be added to support third-party hardware. Installed platforms can include board definitions, core libraries, bootloaders and programmer definitions (which are mentioned in the board menu). Installing the hardware directory would then remove the platform from the third party's own sub-directory. (Don't use "Arduino," or bypass the built-in Arduino platform), as the subdirectory name) Remove your directory to uninstall.

Serial Monitor

This shows serial data sent from the Arduino board via USB or serial connector. To send data to the board, type text and press the "Send" button, or press enter. Choose the baud rate that corresponds to the Serial rate from the drop-down menu. Start your drawing. Start your drawing. Please note that when you log in to the serial monitor on Windows, Mac, or Linux, the board is re-set. Please note that your Serial Monitor does not process control characters; if your sketch needs complete control of serial communication with control characters, you can use an external terminal program and connect it to the COM port on your Arduino board.

Preferences

In the preferences dialog some preferences can be set (found under the Arduino menu on the Mac, or File on Windows and Linux). The rest can be found in the preferences file where the preferences dialog shows its location.

Language Support

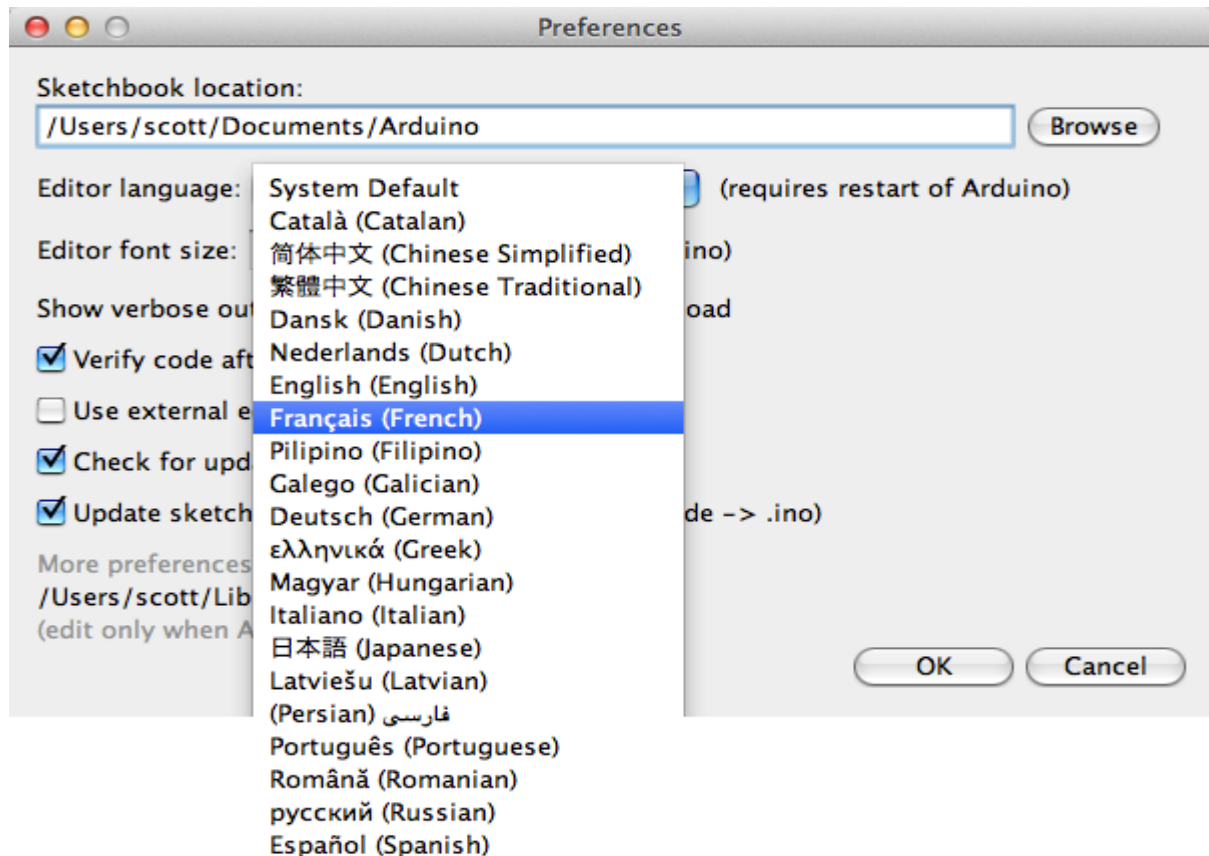


Fig 4.7.4. Language support

The Arduino Software (IDE) has been translated into 30+ languages since version 1.0.1. The IDE will load in your operating system's selected language by default. (Note: this is based on the localization of the currency and date formats on Windows and probably Linux rather than on the language in which the operator scheme appears).

Start Arduino Software (IDE) and open your Preferences window if you want to change your language manually. A drop-down menu of currently supported languages is located next to the Language Editor. From the menu, pick the desired language and restart the program to use the language chosen. The Arduino software (IDE) will be used to English default if your operating system language is not supported.

Boards

Two effects occur on the board selection: It sets the parameters (e.g. the speed of the CPU and the rate of Baud) used for compiling and uploading sketches and sets and the burn boot loader file and file settings. Some board meanings vary only in the above, so that you can verify this before burning the bootloader even if you have successfully uploaded it with a certain set. A comparison table can be found here between the different boards. The built-in support for the boards of the following list, based on the AVR Core, is provided by Arduino Software (IDE). The standard board manager allows the adding of support for the growing number of new boards based on different core components such as Arduino Due, Arduino Zero, Edison and Galileo etc.

4.8. UBIDOTS EXPLORER

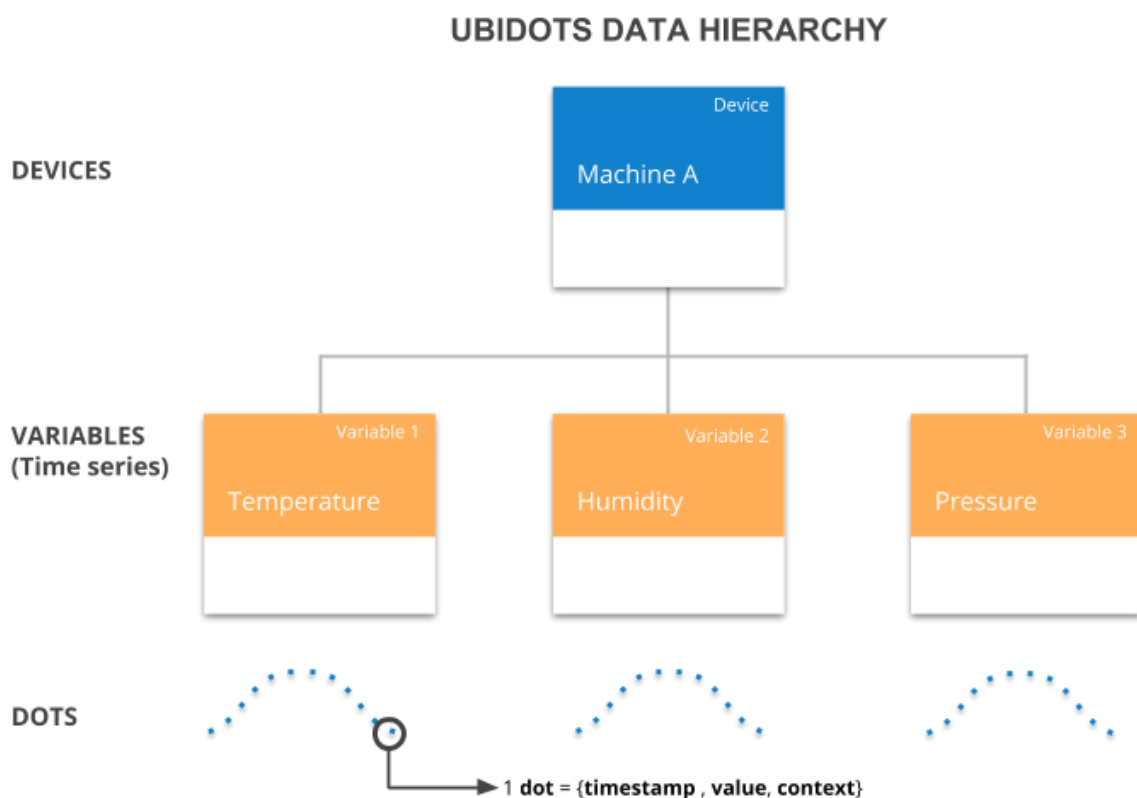
4.8.1. Introduction

Welcome to the hardware documents of the UBIDOTS REST API. Here you can find how data can be sent or extracted through our supported communication protocols from your hardware devices: HTTP, MQTT, and TCP/UDP.

This section helps you to understand what happens behind the scenes when you communicate with UBIDOTS, so that you can reproduce it in your firmware. That is why we stop using libraries to use examples. However, you can search our supported devices and API clients parts for a library (Python, C and more).

How UBIDOTS Works?

A database or "dot" is generated each time a system has updated a sensor value in a variable. UBIDOTS store in variables dots that come from your cameras, which have the appropriate timestamps on them:



Each dot contains these items:

Item	Description	Mandatory
value	A numerical value. Ubidots accepts up to 16 floating-point length numbers.	YES
timestamp	Unix Epoch time, in milliseconds. If not specified, then our servers will assign one upon reception.	NO
context	An arbitrary collection of key-value pairs. Mostly used to store the latitude and longitude coordinates of GPS devices.	NO

As best illustrated here, a timestamp is a way to keep track of time as a number of seconds. The count starts on January 1, 1970, at UTC, during the Unix period. As a result, the Unix time stamp is simply the number of seconds between the date and the Unix period. When submitting data to UBODOTS, you must set the time timeline in milliseconds; even if you receive a time timeline of a dot, it will be in milliseconds.

1537453824000 is the timepiece's serial number.

The time stamp above is 14:30:24 on Thursday, September 20, 2018.

PRO-TIP: Epoch Converter is a useful tool for converting Unix timestamps from time to date.

Context

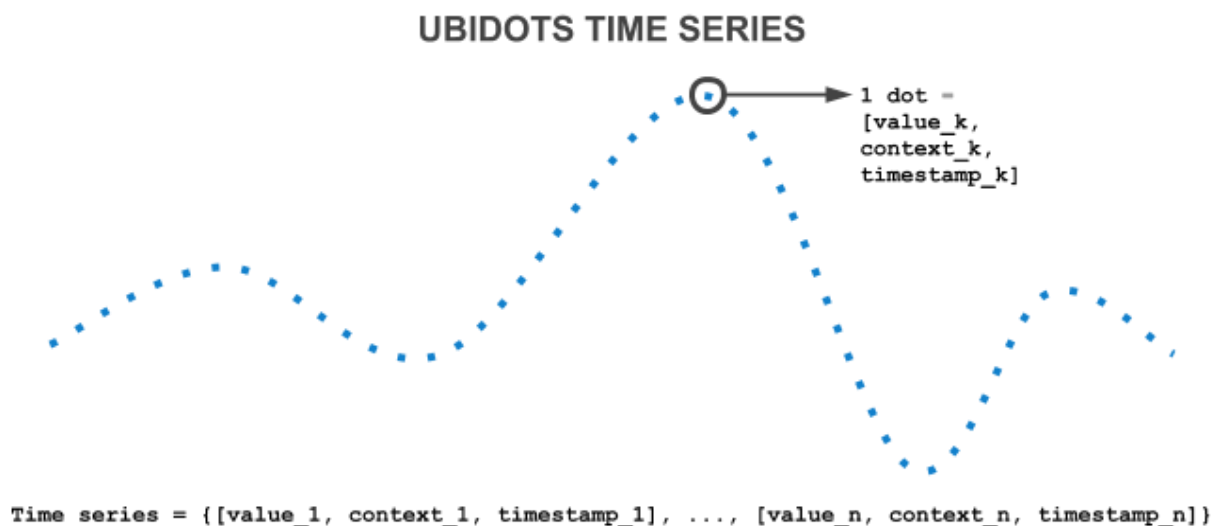
Numerical value is not the only supported data type, and within what we call context you can also store string or char data types. The background is a key value object which allows you to store numerical values as well as string values. The context could be used as an example: "context": {"status": "on" and "weather": "sunny"}

In the GPS/tracking application cases a context is generally used to store your device's latitude and longitude codes. In order to extract cords from your system you simply need to send one dot with values in the variable context in a single dot, instead of sending both latitude and longitude in different variables separately, all UBIDOTS maps use the Lat and LNG keys from the dot context. Below is a standard background with values for coordinates:

```
'CONTECTS': { "la":-6.2,'lng':75.4,.'
```

Time Series

Based on the above, we can illustrate an UBIDOTS time series like this:



- UBIDOTS is an agnostic platform which means that what device you are using doesn't care much as long as at least one of these protocols allows you to communicate with us:
- [HTTP](#)
- [MQTT](#)
- [TCP/UDP](#)

HTTP

HTTP is the Internet's primary protocol for exchanging information. It also allows for data protection, which is known as secure HTTPs or HTTPS. If you use a web browser, you send and receive packages using HTTP or HTTPS (MS Edge, Firefox, Google Chrome...). As a result, it's no surprise that HTTPs is a popular option for data exchange in the IoT.

If a developer wishes to use HTTP, he or she can look for a RESTful Program Application Interface, or REST API, which lists all of the endpoints needed to interact with a third-party application (like UBIDOTS). You will learn how to send and retrieve data from our servers by looking at our REST API in this section.

Note: Our goal is to help you figure out what's going on with UBIDOTS so you can replicate it in your own firmware. This is why we don't allow any examples to use our custom libraries.

4.8.2. HTTP requests

The following methods are specified within the *HTTP* standard:

HTTP Method	Description
GET	Used to retrieve information
POST	Used to create a new element
PATCH	Used to update existing elements
DELETE	Used to delete existing elements

This ensures that any request you make has the answer on the server. HTTP is a request/response protocol. The response includes a number (answer code) and a body. For example, you create a GET request when you request a "(e.g. "Get me the website.html" file)" file. The server usually returns a 200 response code along with the requested file if the request is correct (body).

The following parameters are also required for an HTTP request:

- Host: Specifies to which server you are requesting HTTP.
- Path: usually, this is the remainder of the URL which determines whether a variable or device is a resource you want to use. If an endpoint of API is for example: `industrial.api.ubidots.com/ap/v1.6/devices/my computer`, it will then be `/Ap/v1.6/devices/my device`.

Headers: • Headers: Define the HTTP request's operating parameters for authentication, content-type, content-length, etc.

As JavaScript Obstructions or JSON, UBIDOTS accepts data. JSON is a standard HTTP data form, a name/value pair collection. The object, document, structure, dictionary, hash table, key list or associative array are handled in various programming languages. It is also human legible and independent of language. The following can be cited as an example of a JSON data form UBIDOTS accepts.

CHAPTER 5

RESULTS

Segregation result

Hence, In our Application that is AN IOT BASED AUTOMATIC WASTE SEGREGATION AND MANAGEMENT SYSTEM to detect garbage, we used colour and ultrasonic sensors, as well as servo motors. The unit detects and compares the volume of waste to the depth of the waste containers using ultrasound sensors placed on top of the containers. If the waste level reaches the authority's threshold, the status of the waste bin is uploaded to the cloud, and the data is used to monitor the waste bin in the area. Additional steps are taken by the authorities to clear the bin and avoid garbage overload. Colour sensor is used to detects the colour of the bag in Which manually segregated like Degradable wastes and Non degradable wastes by Two ways of segregation is performed here When a Colour sensor detects Blue Colour Bag it opens one door Rather than Black Colour bag two will be open by using colour sensor. Servo Motor is used for open the dustbin lids that servo motor responds when the Colour sensor detects the colour of the waste bag the servo motor will be respond Smoke sensor which is used for the Garbage bin to check the level of odour and poisonous gas in the garbage bin.

These sensors are linked by jumper wires to the Node MCU ESP8266. This Node MCU consist of both Arduino and WIFI which is used for transfer of data that the WIFI module of the Node MCU it will be connected to Hotspot of a device which used to transfer the data in to the Cloud. The Cloud which is used to store all the data and analysis data when the Garbage bin is filled and we using the UBIDOTS cloud to store the data of the Garbage bin It is an open source IOT platform.



Fig 5.1.0. Demonstration

Fig 5.1.0The image shows the garbage clearing technique

This is the setup of our Project Application where we can see from the figure that in our it is based on the IOT technology where the IOT is used to connect the electronic components and sensor and other internet components each other from the transfer of data information between the components . In the above fig we can see the different components like Ultrasonic sensor and Colour sensor and other component are connected to the Node MCU ESP8266 module which consist of WIFI module for the transfer of data information the cloud and Smoke sensor which is used to detects the odour smell of the garbage bin. This project is used for the for our daily life used which is the for the green and clean Environment.

Ultrasonic Sensor

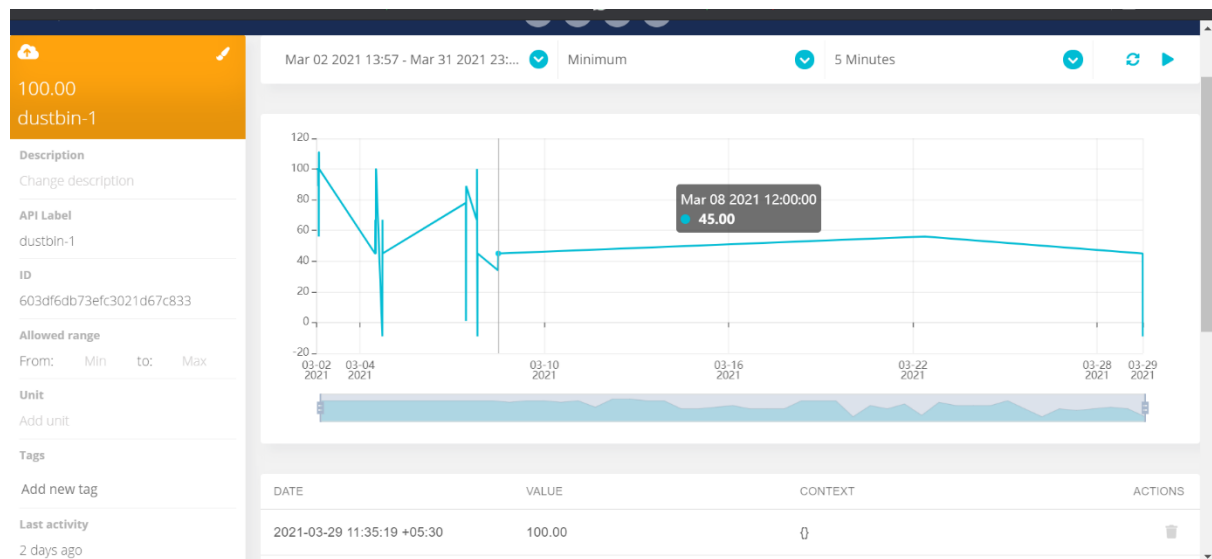


Fig 5.1.1. Result 2

Fig 5.1.1. Result 2: This Graph Shows the Garbage levels of a dustbin and this graph the storage of waste at the Garbage at different days and the waste level by Ultrasonic and different stages.

DATE	VALUE	CONTEXT	ACTIONS
2021-03-29 11:35:19 +05:30	100.00	{}	
2021-03-22 09:21:04 +05:30	56.00	{}	
2021-03-22 09:20:56 +05:30	56.00	{}	
2021-03-08 12:01:51 +05:30	45.00	{}	
2021-03-08 12:01:35 +05:30	56.00	{}	
2021-03-08 11:53:08 +05:30	34.00	{}	
2021-03-08 11:53:01 +05:30	45.00	{}	
2021-03-07 19:50:11 +05:30	45.00	{}	
2021-03-07 19:49:19 +05:30	45.00	{}	
2021-03-07 19:49:13 +05:30	45.00	{}	

Fig 5.1.2. Result values

Fig 5.1.2. Result values: That above fig values by using the ultrasonic sensor the level of the Garbage bin at the different time and days where are values are stored in the UBIDOTS Cloud at every moment of the waste of the Dust bin is stored in the UBIDOTS Cloud.

Remaining Sensors

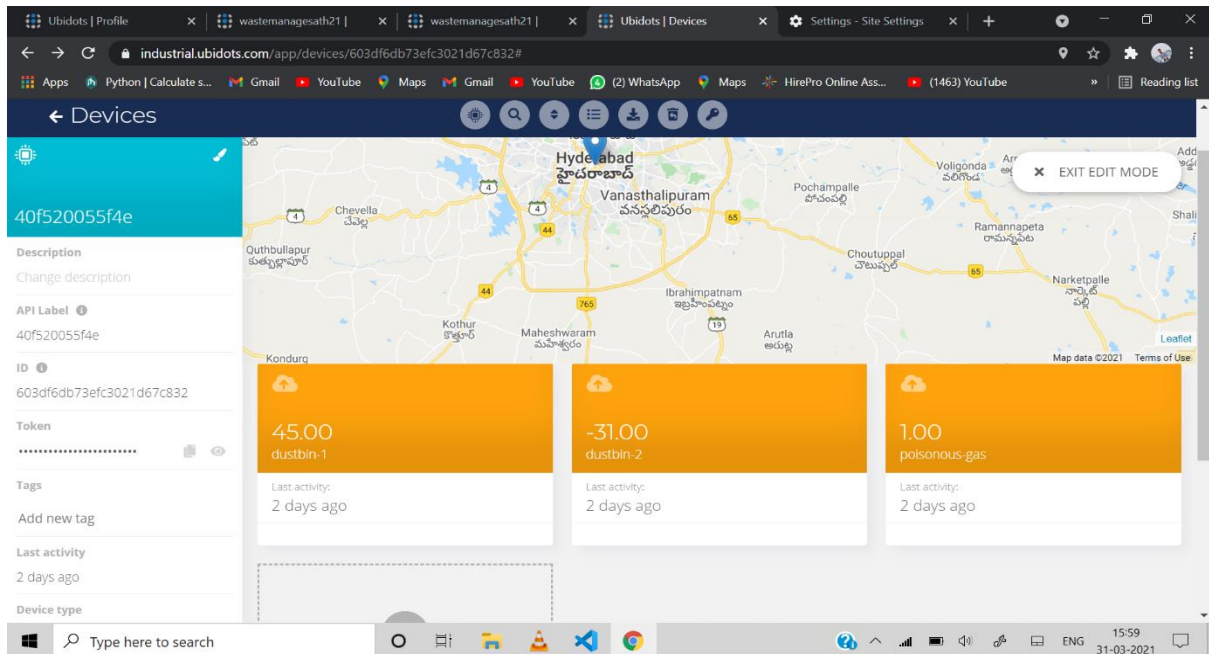


Fig 5.1.3. Result 3

Fig 5.1.2.Result 3: This image show percentage of waste filled in the dustbin

In the above fig result 3 we can see the level of each dustbin 1 and dustbin 2 in the cloud that the cloud is UBIDOTS and that cloud that also show the location of the garbage bin where it is present and it is easy for the Garbage collector vehicles driver to come as speed as possible to collect the garbage bin of the Specific Location and that also intimate mail to the user in that locality for the speed removal of the Disposal of Garbage this the effective way of method .In this garbage bin that smoke sensor detects the odour and poisonous gas of the dustbin and the level of the dustbin. This is the Effective application where we can use for the Garbage disposal collection and which greatly helpful for the surrounding neat and tidy and gas emission and keep the city clean with pollution free environment.

CHAPTER 6

CONCLUSION

Conclusion

In the proposed paper, we have suggested a method of smart waste management and segregation using Internet of Things (IoT). The smart basket helps us reduce pollution. In this system, a 24x7 monitoring system is designed for monitoring dumpsters. Here a smart and organized system is designed for selective clearing. Here we are using color sensor, it is identified the degradable waste bag and biodegradable waste bag based on the color. The servo motor is used to open the door of dust bin when the waste is detected by the color sensor. And the ultrasonic sensor is used to measure the level of the bin, when the bin is filled with 75% then send alert message are sent to higher authorities via mails. Many times, the garbage can is overflowing and a lot of animals like the dog or the mouse enter in or near the trash can. This creates a bad scene. Even some birds also try to remove garbage from the trash. This project can avoid such situations. And the message can be sent directly to the cleaning vehicle instead of the contractor's office. Smoke sensor is used to detect the odour smell of the dustbin. The application greatly aids in the development of a good atmosphere and the preservation of a safe, pollution-free environment in the region.

Further for the further work and to this project we can upgrade further by implementing by using Image processing into bulk waste and it is mainly used in the Segregating of large amount of waste in the Recycle department of Municipality for Recycling of the waste.

CHAPTER 7

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