A PROJECT REPORT ON

"ECO-FRIENDLY WASTE MANAGEMENT"

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF

DIPLOMA IN ELECTRONICS AND COMMUNICATION ENGINEERING

UNDER THE GUIDANCE OF

SRI. N.RAMULU. (M.TECH)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

GOVERNMENT POLYTECHNIC,MASAB TANK

(2019-2022)

CERTIFICATE

This is to certify that the dissertation entitled "ECO-FRIENDLY WASTE MANAGEMENT", is being submitted in partial fulfillment of the requirements for the award of diploma in electronics and communication engineering of DECE finalyear of **GOVERNMENT POLYTECHNIC MASAB TANK, HYDERABAD**

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"ECO-FRIENDLY WASTE MANAGEMENT"

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Requirements for the award of

Diploma in Electronics and Communication Engineering

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By

Yours Sincerely 2019-2022 batch

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TOPICS

Abstract

Waste segregation at the source is the most relevant step that will help the environment and helps to reduce the accumulation of garbage in landfills. Segregation post collection of garbage takes longer, costs more, and can wind up harming the environment if it leads to recyclable waste being sent to landfill.

Wet waste typically refers to organic waste usually generated by eating establishments and Dry waste includes paper, wood, metals, glass, etc. If 100% source segregation is achieved then 80% of it can be recycled.

To overcome this problem a smart dustbin can be used which would differentiate the waste into wet or dry and open up the required block of wet/dry section.It can even send an SMS whenever the dustbin reaches its maximum level.Which would finally help the environment and the biodiversity.

Keywords And Glossary

Keywords :

Arduino, moisture sensor, servo motor, ultrasonic sensor, 16×2 LCD display

Glossary : ,

A

Arduino

Arduino is an open-source computer hardware and software company, project and user community that designs and manufactures kits for building digital devices and interactive objects that can sense and control the physical world.[1] Arduino boards may be purchased preassembled, or as do-it-yourself kits; at the same time, the hardware design information is available for those who would like to assemble an Arduino from scratch.

ATMEGA 328

The ATmega328 is a single chip micro-controller created by Atmel and belongs to the megaAVR series. The Atmel 8-bit AVR RISC-based microcontroller combines 32Â KB ISP flash memory with read-while-write capabilities, 1Â KB EEPROM, 2Â KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughputs approaching 1 MIPS per Mhz.

Moisture sensor

The Soil Moisture Sensor **uses capacitance to measure dielectric permittivity of the surrounding medium**. In soil, dielectric permittivity is a function of the water content. The sensor creates a voltage proportional to the dielectric permittivity, and therefore the water content of the soil..

Ultra sonic

Ultrasonic sensors work **by emitting sound waves at a frequency too high for humans to hear**. They then wait for the sound to be reflected back, calculating distance based on the time required. This is similar to how radar measures the time it takes a radio wave to return after hitting an object.

Liquid crystal display

A 16x2 LCD means **it can display 16 characters per line and there are 2 such lines**. In this LCD each character is displayed in 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data.

Servo motor

A servo motor is a rotary actuator or linear actuator that allows for precise control of angular (or) linear position , velocity and acceleration . It consists of suitable motor coupled to a sensor for position feedback .This provides fast precision position control for closed loop position control applications.

Surveillance

Surveillance is the monitoring of the behavior, activities, or other changing information, usually of people for the purpose of influencing, managing, directing, or protecting them.

Chapter 1

Project Overview

Introduction

Segregation at source is critical to its recycling and disposal. Lack of segregation, collection and transportation of unsegregated mixed waste to the landfills has an impact on the environment. When we segregate waste, it reduces the amount of waste that reaches landfills, thereby taking up less space. Pollution of air and water can be considerably reduced when hazardous waste is separated and treated separately. It is essential that waste is put in separate bins so that it can be appropriately dealt with.

To separate the dry and wet waste we have used moisture sensor which Is interfaced with Arduino. moisture sensor can detect wet waste and can be separated using servo motor which will drive the lid of the bin. Servo motor is also interfaced with arduino. on taking command from Arduino servo motor will rotate either right or left according to the moisture content of substance placed on moisture sensor .we are also using ultrasonic which will indicate the level of waste present in bin which can be displayed on the lcd lcd.

MOTIVATION

Waste segregation at the source is the most relevant step that will help the environment and helps to reduce the accumulation of garbage in landfills. Segregation post collection of garbage takes longer, costs more, and can wind up harming the environment if it leads to recyclable waste being sent to landfill.

OVER VIEW

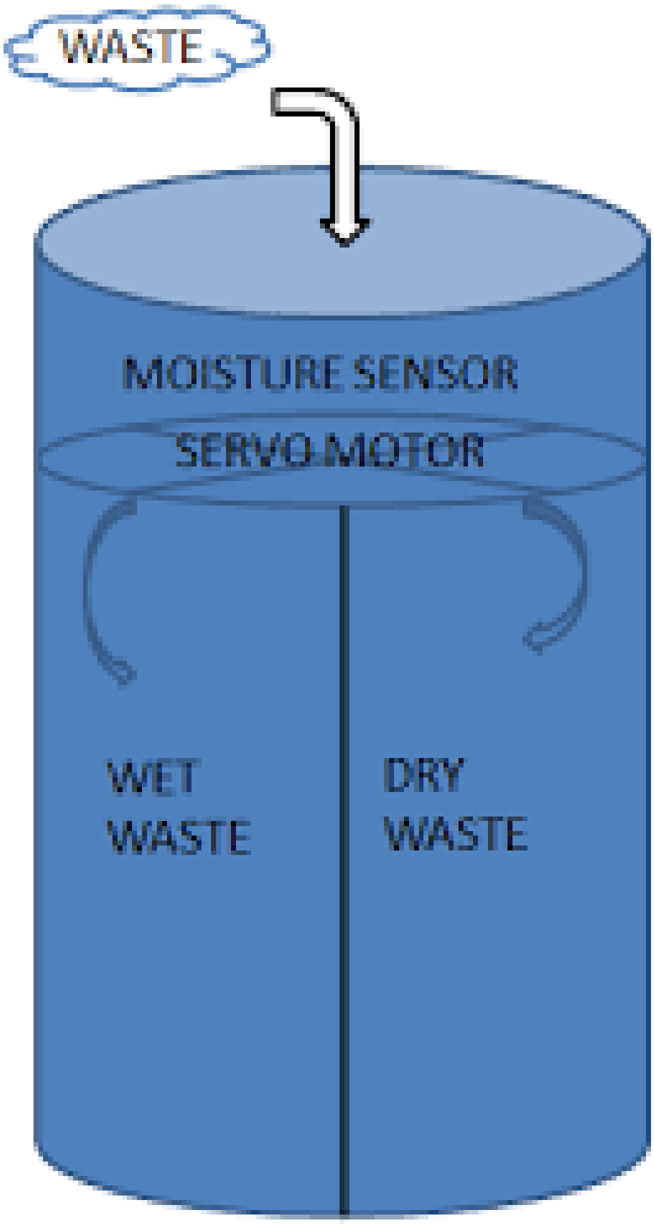
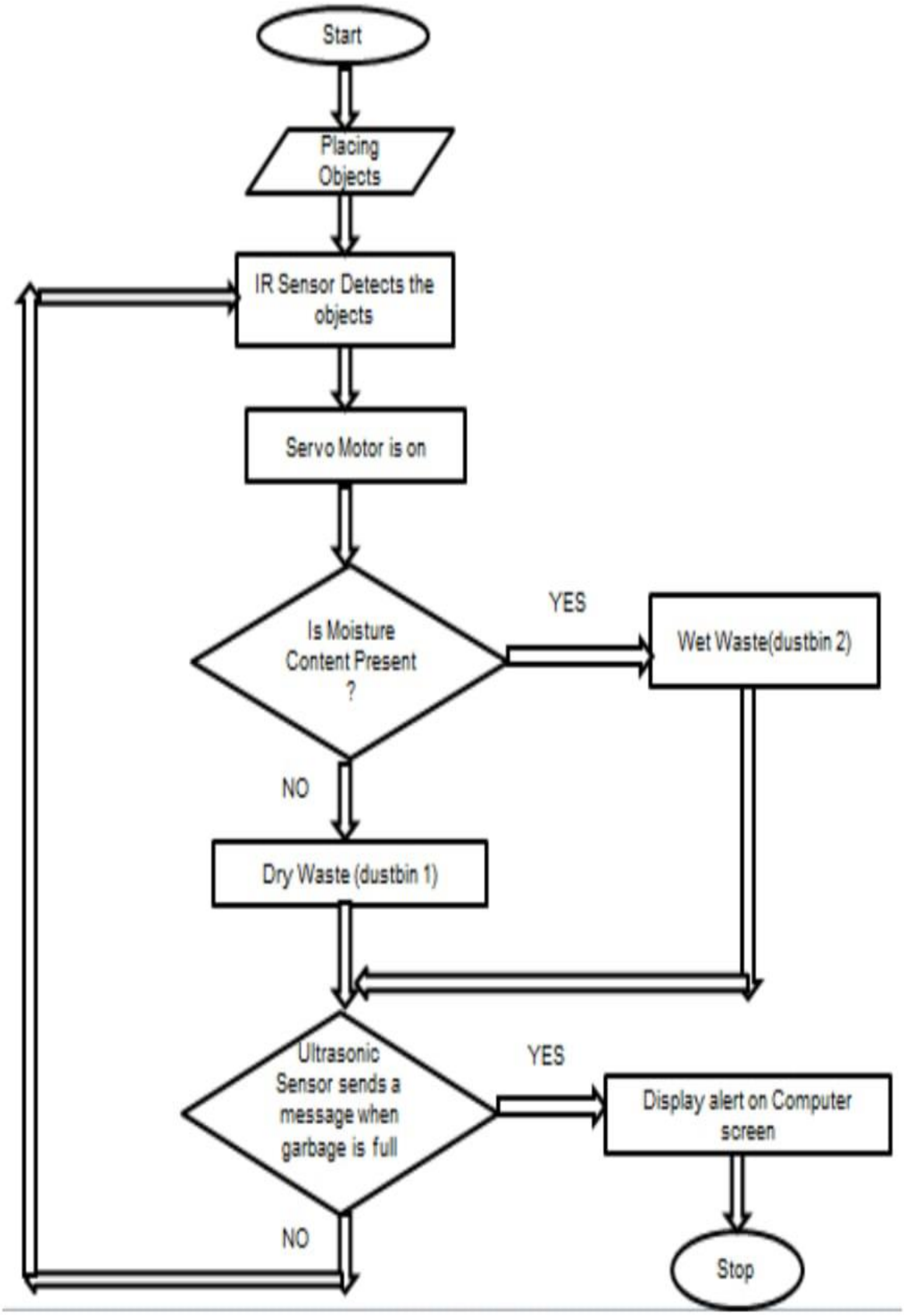


Fig. 2: Bin Design for automatic segregation

FLOW CHART



Start
Placing Objects
IR Sensor Detects the objects
Servo Motor is on
Is Moisture Content Present ?
YES
Wet Waste(dustbin 2)
NO
Dry Waste (dustbin 1)
Ultrasonic Sensor sends a message when garbage is full
YES
Display alert on Computer screen
NO
Stop

CHAPTER 2: HARDWARE DESCRIPTION

ARDUINO UNO

The **Arduino Uno** is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

The word "uno" means "one" in Italian and was chosen to mark the initial release of Arduino Software. The Uno board is the first in a series of USB-based Arduino boards; it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. The ATmega328 on the board comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.

General pin functions:

- **LED**: There is a built-in LED driven by digital pin 13. When the pin is high value, the LED is on, when the pin is low, it is off.
- **VIN**: The input voltage to the Arduino/Genuino board when it is using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

- **5V**: This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.
- **3V3**: A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND**: Ground pins.
- **IOREF**: This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source, or enable voltage translators on the outputs to work with the 5V or 3.3V.
- **Reset**: Typically used to add a reset button to shields that block the one on the board.

Special pin functions:

Each of the 14 digital pins and 6 analog pins on the Uno can be used as an input or output, under software control (using pinMode(), digitalWrite(), and digitalRead() functions). They operate at 5 volts. Each pin can provide or receive 20 mA as the recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50K ohm. A maximum of 40mA must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. The Uno has 6 analog inputs, labeled A0 through A5; each provides 10 bits of resolution (i.e. 1024 different values). By default, they measure from ground to 5 volts, though it is possible to change the upper end of the range using the AREF pin and the analogReference() function.

In addition, some pins have specialized functions:

- **Serial** / UART: pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL serial chip.
- **External interrupts**: pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- **PWM** (pulse-width modulation): pins 3, 5, 6, 9, 10, and 11. Can provide 8bit PWM output with the analogWrite() function.
- **SPI** (Serial Peripheral Interface): pins 10 (SS), 11 (MOSI), 12 (MISO), and 13 (SCK). These pins support SPI communication using the SPI library.
- **TWI** (two-wire interface) / I^2C: pin SDA (A4) and pin SCL (A5). Support TWI communication using the Wire library.
- **AREF** (analog reference): Reference voltage for the analog inputs.

ARDUINO NANO

The **Arduino Nano** is a small, complete, and breadboard-friendly board based on the ATmega328P released in 2008. It offers the same connectivity and specs of the Arduino Uno board in a smaller form factor.

The Arduino Nano is equipped with 30 male I/O headers, in a dip-30 like configuration, which can be programmed using the Arduino Software integrated development environment (IDE), which is common to all Arduino boards and running both online and offline. The board can be powered through a type-b micro-USB cable, or through a 9V battery.

The Arduino Nano has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provide UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An FTDI FT232RL on the board channels this serial communication over USB and the FTDI drivers (included with the Arduino software) provide a virtual com port to software on the computer. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the FTDI chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A SoftwareSerial library allows for serial communication on any of the Nano's digital pins. The ATmega328 also support I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus.

Rather than requiring a physical press of the reset button before an upload, the Arduino Nano is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the FT232RL is connected to the reset line of the ATmega328 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip.

This setup has other implications. When the Nano is connected to a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Nano. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened.

TECHNICAL SPECIFICATIONS:

- Microcontroller: Microchip ATmega328P
- Operating Voltage: 5 Volts
- Input Voltage: 6 to 20 Volts
- Digital I/O Pins: 14 (plus 6 can PWM output pins)
- Analog Input Pins: 8
- DC Current per I/O Pin: 40 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz
- Length: 45 mm
- Width: 18 mm
- Weight: 7 g

Moisture sensor;

Soil moisture sensors typically refer to sensors that estimate volumetric water content. Another class of sensors measure another property of moisture in soils called water potential; these sensors are usually referred to as soil water potential sensors and include tensiometers and gypsum blocks.

Technologies commonly used to indirectly measure volumetric water content (soil moisture) include:

- Frequency Domain Reflectometry (FDR): The dielectric constant of a certain volume element around the sensor is obtained by measuring the operating frequency of an oscillating circuit.
- Time Domain Transmission (TDT) and Time Domain Reflectometry (TDR): The dielectric constant of a certain volume element around the sensor is obtained by measuring the speed of propagation along a buried transmission line;[2] (see also: TDR moisture sensor)
- Neutron moisture gauges: The moderator properties of water for neutrons are utilized to estimate soil moisture content between a source and detector probe.
- Soil resistivity: Measuring how strongly the soil resists the flow of electricity between two electrodes can be used to determine the soil moisture content.
- Galvanic cell: The amount of water present can be determined based on the voltage the soil produces because water acts as an electrolyte and produces electricity. The technology behind this concept is the galvanic cell.[3]

Application

Agriculture

Measuring soil moisture is important for agricultural applications to help farmers manage their irrigation systems more efficiently. Knowing the exact soil moisture conditions on their fields, not only are farmers able to generally use less water to grow a crop, they are also able to increase yields and the quality of the crop by improved management of soil moisture during critical plant growth stages.[citation needed]

Landscape irrigation

In urban and suburban areas, landscapes and residential lawns are using soil moisture sensors to interface with an irrigation controller. Connecting a soil moisture sensor to a simple irrigation clock will convert it into a "smart" irrigation controller that prevents irrigation cycles when the soil is already wet, e.g. following a recent rainfall event.

Golf courses are using soil moisture sensors to increase the efficiency of their irrigation systems to prevent over-watering and leaching of fertilizers and other chemicals into the ground.

Research

Soil moisture sensors are used in numerous research applications, e.g. in agricultural science and horticulture including irrigation planning, climate research, or environmental science including solute transport studies and as auxiliary sensors for soil respiration measurements.[5]

Simple sensors for gardeners

Relatively cheap and simple devices that do not require a power source are available for checking whether plants have sufficient moisture to thrive. After inserting a probe into the soil for approximately 60 seconds, a meter indicates if the soil is too dry, moist or wet for plants.[

Liquid crystal display

A **liquid-crystal display** (**LCD**) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly,[1] instead using a backlight or reflector to produce images in color or monochrome.[2] LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden. For instance: preset words, digits, and seven-segment displays, as in a digital clock, are all good examples of devices with these displays. They use the same basic technology, except that arbitrary images are made from a matrix of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. For example, a character positive LCD with a backlight will have black lettering on a background that is the color of the backlight, and a character negative LCD will have a black background with the letters being of the same color as the backlight. Optical filters are added to white on blue LCDs to give them their characteristic appearance.

Application

LCDs are used in a wide range of applications, including LCD televisions, computer monitors, instrument panels, aircraft cockpit displays, and indoor and outdoor signage. Small LCD screens are common in LCD projectors and portable consumer devices such as digital cameras, watches, digital clocks, calculators, and mobile telephones, including smartphones. LCD screens are also used on consumer electronics products such as DVD players, video game devices and clocks. LCD screens have replaced heavy, bulky cathode-ray tube (CRT) displays in nearly all applications. LCD screens are available in a wider range of screen sizes than CRT and plasma displays, with LCD screens available in sizes ranging from tiny digital watches to very large television receivers. LCDs are slowly being replaced by OLEDs, which can be easily made into different shapes, and have a lower response time, wider color gamut, virtually infinite color contrast and viewing angles, lower weight for a given display size and a slimmer profile (because OLEDs use a single glass or plastic panel whereas LCDs use two glass panels; the thickness of the panels increases with size but the increase is more noticeable on LCDs) and potentially lower power consumption (as the display is only "on" where needed and there is no backlight). OLEDs, however, are more expensive for a given display size due to the very expensive electroluminescent materials or phosphors that they use. Also due to the use of phosphors, OLEDs suffer from screen burn-in and there is currently no way to recycle OLED displays, whereas LCD panels can be recycled, although the technology required to recycle LCDs is not yet widespread. Attempts to maintain the competitiveness of LCDs are quantum dot displays, marketed as SUHD, QLED or Triluminos, which are displays with blue LED backlighting and a Quantum-dot enhancement film (QDEF) that converts part of the blue light into red and green, offering similar performance to an OLED display at a lower price, but the quantum dot layer that gives these displays their characteristics can not yet be recycled.

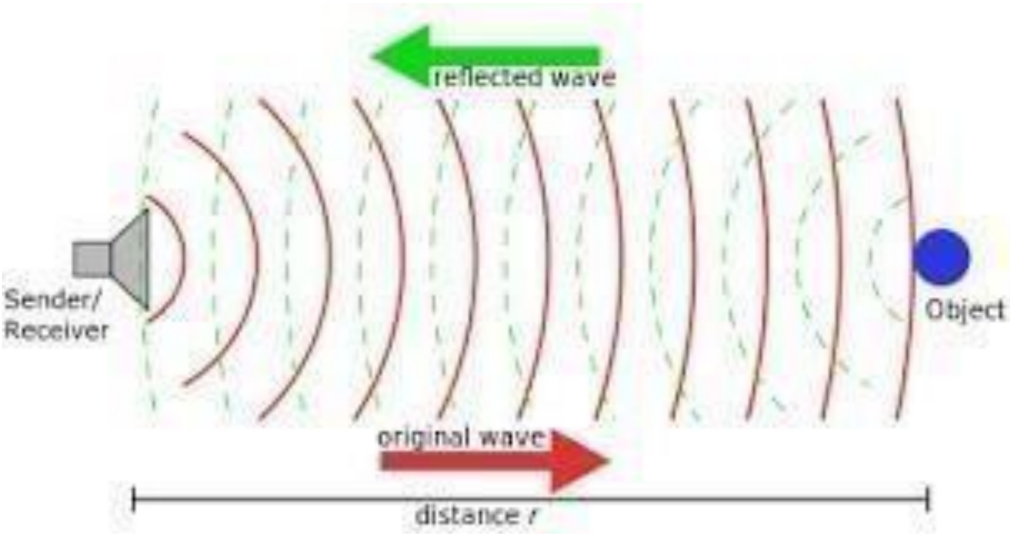
Ultrasonic Sensor :

Ultrasonic transducers and **ultrasonic sensors** are devices that generate or sense ultrasound energy. They can be divided into three broad categories: transmitters, receivers and transceivers. Transmitters convert electrical signals into ultrasound, receivers convert ultrasound into electrical signals, and transceivers can both transmit and receive ultrasound.

Ultrasound can be used for measuring wind speed and direction (anemometer), tank or channel fluid level, and speed through air or water. For measuring speed or direction, a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure tank or channel liquid level, and also sea level (tide gauge), the sensor measures the distance (ranging) to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultrasonography, burglar alarms, non-destructive testing and wireless charging.

Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18 kHz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed.

This technology, as well, can detect approaching objects and track their positions.



Ultrasonic transducers convert AC into ultrasound, as well as the reverse.
Ultrasonics, typically refers to piezoelectric transducers or capacitive transducers. Piezoelectric crystals change size and shape when a voltage is applied; AC voltage makes them oscillate at the same frequency and produce ultrasonic sound. Capacitive transducers use electrostatic fields between a conductive diaphragm and a backing plate.

The beam pattern of a transducer can be determined by the active transducer area and shape, the ultrasound wavelength, and the sound velocity of the propagation medium. The diagrams show the sound fields of an unfocused and a focusing ultrasonic transducer in water, plainly at differing energy levels.

Since piezoelectric materials generate a voltage when force is applied to them, they can also work as ultrasonic detectors. Some systems use separate transmitters and receivers, while others combine both functions into a single piezoelectric transceiver.

Ultrasound transmitters can also use non-piezoelectric principles. such as magnetostriction. Materials with this property change size slightly when exposed to a magnetic field, and make practical transducers.

A capacitor ("condenser") microphone has a thin diaphragm that responds to ultrasound waves. Changes in the electric field between the diaphragm and a closely spaced backing plate convert sound signals to electric currents, which can be amplified.

IR Sensor :

An **infrared** (**IR**) **sensor** is an electronic device that measures and detects **infrared** radiation in its surrounding environment. ... **IR** is invisible to the human eye, as its wavelength is longer than that of visible light (though it is still on the same electromagnetic spectrum).

A **passive infrared sensor** (**PIR sensor**) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. PIR sensors are commonly used in security alarms and automatic lighting applications.

PIR sensors detect general movement, but do not give information on who or what moved. For that purpose, an imaging IR sensor is required.

PIR sensors are commonly called simply "PIR", or sometimes "PID", for "passive infrared detector". The term *passive* refers to the fact that PIR devices do not radiate energy for detection purposes. They work entirely by detecting infrared radiation (radiant heat) emitted by or reflected from objects.

Operating Principles :

All objects with a temperature above absolute zero emit heat energy in the form of electromagnetic radiation. Usually this radiation isn't visible to the human eye because it radiates at infrared wavelengths, but it can be detected by electronic devices designed for such a purpose.

The use of infrared sensors to accurately measure the chemical composition of materials or gases in military applications is well known. Now, however, given their rapidly declining price tag, these IR sensors are gaining traction in Internet of

Things M2M applications, including medical diagnostics, imaging and industrial process controls, fire detection and remote gas leak detection, pollution monitoring, and realtime combustion control.

There are three major wavelength/frequency categories for the IR spectrum: near-, mid-, and far-IR. Near-IR involves fiber optic, IR sensors in the 700 nm – 1400 nm (0-7 µm – 1.4 µm) range. Mid-IR includes heat-sensing devices in the 1400 nm –
3000 nm (1.4 µm – 3 µm) range, and far, or thermal imaging IR, involves 3000 nm – 1 mm (3 µm – 1000 µm); all markets are seeing an uptick in sales and product development.
According to a recent market research report by ReportsnReports,[1] mid-IR sensor markets totaled $789 million in 2012 and are forecast to reach $7 billion by 2019. The impetus for growth includes price-performance increases and unit cost decreases from a high of $3,000 per unit to $300, in some cases, all the way down to approximately $8 per unit. Size has also migrated from bench sizes to portable units.

IR applications

Infrared sensors are used to sense characteristics in its surroundings by emitting and/or detecting infrared radiation and are capable of measuring the heat being emitted by an object and detecting motion.

Some of the most important tools for maintaining a clean, safe, and healthy environment are sensors, sensor systems, and sensor networks that detect the presence and quantify the amount of specific chemical trace gases. Once the source is located, monitoring also provided by sensors supports mitigation and compliance.

This is also true for industrial process and automotive monitoring and health, especially in breath analysis. Today’s standard expensive and time-consuming medical tests will give way to breathalyzers able to diagnose medical conditions on the spot. Medical care will become more proactive and remote care more accurate for today’s aging population.

Infrared vision has several applications. It can visualize heat leaks in houses, help doctors monitor blood flow, identify environmental chemicals in the environment, allow art historians to see under layers of paint, and integrate it with contact lenses or wearable electronics.

Servo Motor :

A **servomotor** is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

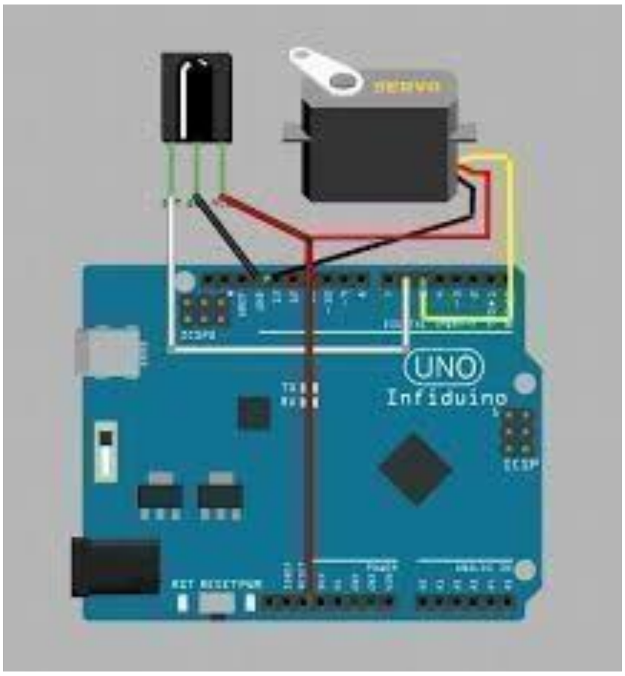
Servomotors are not a specific class of motor, although the term *servomotor* is often used to refer to a motor suitable for use in a closed-loop control system.

Servomotors are used in applications such as robotics, CNC machinery or automated manufacturing.

A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft.

The motor is paired with some type of position encoder to provide position and speed feedback. In the simplest case, only the position is measured. The measured position of the output is compared to the command position, the external input to the controller. If the output position differs from that required, an error signal is generated which then causes the motor to rotate in either direction, as needed to bring the output shaft to the appropriate position. As the positions approach, the error signal reduces to zero and the motor stops.

The very simplest servomotors use position-only sensing via a potentiometer and bang-bang control of their motor; the motor always rotates at full speed (or is stopped). This type of servomotor is not widely used in industrial motion control, but it forms the basis of the simple and cheap servos used for radiocontrolled models.



More sophisticated servomotors use optical rotary encoders to measure the speed of the output shaft[2] and a variable-speed drive to control the motor speed. Both of these enhancements, usually in combination with a PID control algorithm, allow the servomotor to be brought to its commanded position more quickly and more precisely, with less overshooting.

The servo motor is most commonly used for high technology devices in the industrial applications like automation technology. It is a self contained electrical device, that rotates parts of machine with high efficiency and great precision. Moreover the output shaft of this motor can be moved to a particular angle. Servo motors are mainly used in home electronics, toys, cars, airplanes and many more devices.

Servo motor works on the PWM (Pulse Width Modulation) principle, which means its angle of rotation is controlled by the duration of pulse applied to its control PIN. Basically servo motor is made up of DC motor which is controlled by a variable resistor (potentiometer) and some gears.

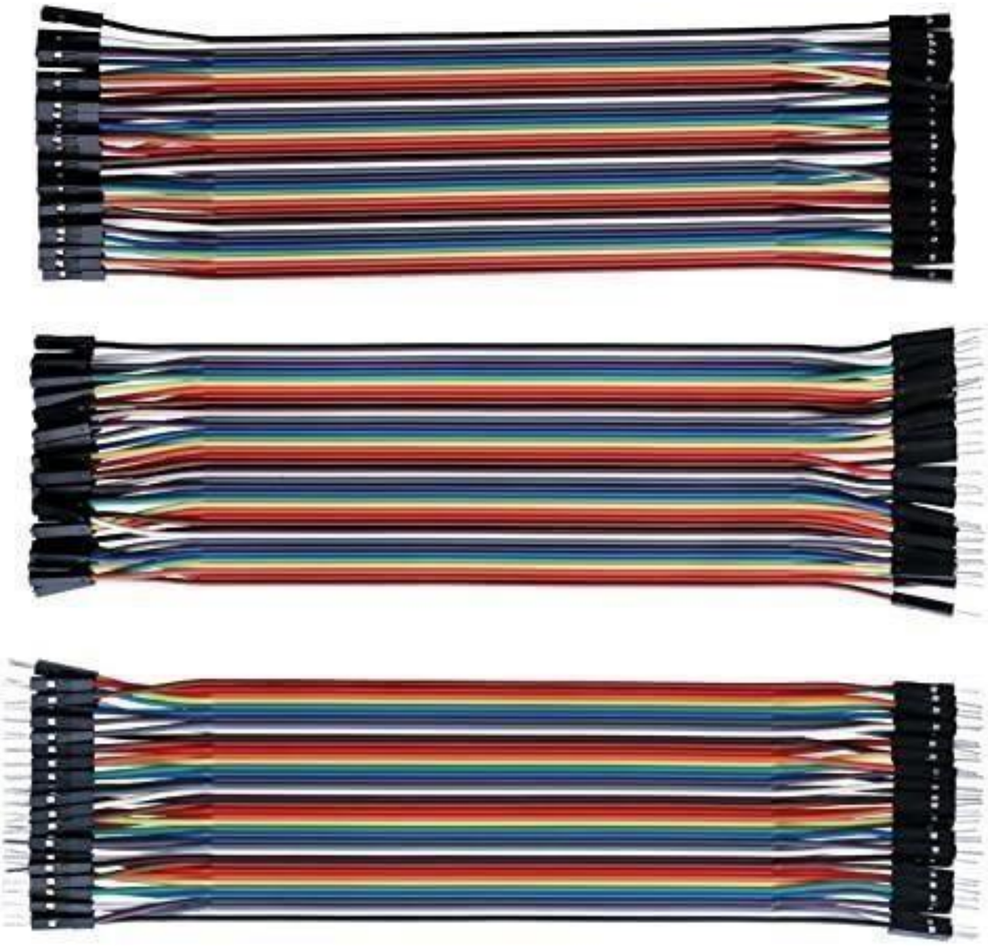
Applications :

1. Robotics : At every joint of the robot, we connect a servomotor. Thus giving the robot arm its precise angle.

2. Conveyor belts : servo motors move , stop , and start conveyor belts carrying product along to various stages , for example , in product packaging/ bottling, and labelling .

3. Camera auto focus : A highly precise servo motor build into the camera corrects a camera lens to sharpen out of focus images.

Jumper Wires :



A **jump wire** (also known as jumper, jumper wire, jumper cable, DuPont wire or cable) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

SHOWA **jumper wire** (NSL: New Showa Lead) is a lead-free tin-plated annealed copper **wire**. Tin plating is tin: 99.2%, copper: 0.8%. In general, it is said that hot plating is difficult to control the plating thickness compared with electroplating, but we control the plating thickness by the original processing method.

Connecting Wires :

A **wire** is a single usually cylindrical, flexible strand or rod of metal. Wires are used to bear mechanical loads or electricity and telecommunications signals. Wire is commonly formed by drawing the metal through a hole in a die or draw plate. Wire gauges come in various standard sizes, as expressed in terms of a gauge number. The term 'wire' is also used more loosely to refer to a bundle of such strands, as in "multistranded wire", which is more correctly termed a wire rope in mechanics, or a cable in electricity.

Wire comes in solid core, stranded, or braided forms. Although usually circular in cross-section, wire can be made in square, hexagonal, flattened rectangular, or other cross-sections, either for decorative purposes, or for technical purposes such as high- efficiency voice coils in loudspeakers. Edge-wound coil springs, such as the Slinky toy, are made of special flattened wire.

Not all metals and metallic alloys possess the physical properties necessary to make useful wire. The metals must in the first place be ductile and strong in tension, the quality on which the utility of wire principally depends. The principal metals suitable for wire, possessing almost equal ductility, are platinum, silver, iron, copper, aluminium, and gold; and it is only from these and certain of their alloys with other metals, principally brass and bronze, that wire is prepared.

CHAPTER 3: SOFTWARE

Arduino IDE :

The **Arduino Integrated Development Environment (IDE)** is a crossplatform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards.

The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program *avrdude* to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. By default, avrdude is used as the uploading tool to flash the user code onto official Arduino boards. Arduino IDE is a derivative of the Processing IDE, however as of version 2.0, the Processing IDE will be replaced with the Visual Studio Code-based Eclipse Theia IDE framework.

Arduino interface with multiple devices:

Arduino senses the environment by receiving inputs from add-on devices such as sensors, and can control the world around it by adjusting lights, motors, and other actuators. In this class you will learn how and when to use the different types of sensors and how to connect them to the Arduino. Since the external world uses continuous or analog signals and the hardware is digital you will learn how these signals are converted back-and-forth and how this must be considered as you program your device. You'll also learn about the use of Arduino-specific shields and the shields software libraries to interface with the real world. Please note that this course does not include discussion forums.

CHAPTER 4: PROGRAMS

```
// ------------------------------------------------------------ //
// Using Arduino IDE 1.8.7
// Using HC-SR04 Module
// ------------------------------------------------------------ //
#include <LiquidCrystal.h>

// initialize the library by associating any needed LCD
interface pin
// with the arduino pin number it is connected to
#define echoPin 6  // attach pin D6 Arduino to pin Echo
of HC-SR04
#define trigPin 7 //attach pin D7 Arduino to pin Trig of
HC-SR04
#define trigPin2 10//attach pin D10 Arduino to pin Trig
of HC-SR04 2
#define echoPin2 8//attach pin D8 Arduino to pin Trig of
HC-SR04 2

int sensorPin = A0;
int sensorValue;
int limit = 1000;
```

```
// defines variables
int moisture_detected = 0;
long duration; // variable for the duration of sound wave
travel
int distance; // variable for the distance measurement
const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
#include <Servo.h>
Servo myservo;

void setup() {
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an
OUTPUT
  pinMode(echoPin, INPUT); // Sets the echoPin as an
INPUT
    pinMode(trigPin2, OUTPUT); // Sets the trigPin as an
OUTPUT
  pinMode(echoPin2, INPUT); // Sets the echoPin as an
INPUT
  Serial.begin(9600); // // Serial Communication is
starting with 9600 of baudrate speed
```

```
  Serial.println("Ultrasonic Sensor HC-SR04 Test"); //
print some text in Serial Monitor
  Serial.println("with Arduino UNO R3");
  // set up the LCD's number of columns and rows:
  lcd.begin(16, 2);
  // Print a message to the LCD.



  //lcd.clear();
  myservo.attach(9);
  myservo.write(90);


  pinMode(13, OUTPUT);
}


int measure_distance(int trig, int echo)
{
    // Clears the trigPin condition
  digitalWrite(trig, LOW);
  delayMicroseconds(2);
  // Sets the trigPin HIGH (ACTIVE) for 10 microseconds
```

```
  digitalWrite(trig, HIGH);
  delayMicroseconds(10);
  digitalWrite(trig, LOW);
  // Reads the echoPin, returns the sound wave travel
time in microseconds
  duration = pulseIn(echo, HIGH);
  // Calculating the distance
  int dist = duration * 0.034 / 2; // Speed of sound wave
divided by 2 (go and back)
  return dist;
}

void loop() {
  lcd.setCursor(0, 0);
lcd.print("WASTE SEGREGATOR");



  sensorValue = analogRead(sensorPin);
  Serial.println("Analog Value : ");
  Serial.println(sensorValue);
```

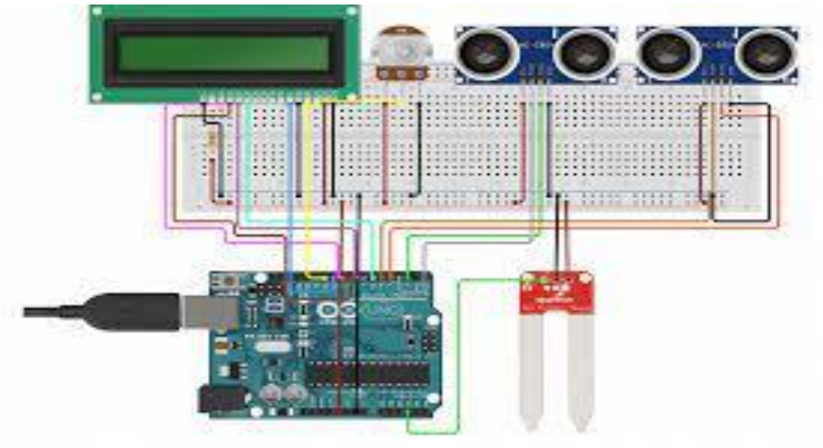
```
if (sensorValue < limit) {
  digitalWrite(13, HIGH);
  moisture_detected = 1;
}
else {
  digitalWrite(13, LOW);
  moisture_detected = 0;
}

distance = measure_distance(trigPin, echoPin);
Serial.print(distance);
Serial.println(" cm");
//print first distance
int distance2 = measure_distance(trigPin2, echoPin2);
// Displays the distance on the Serial Monitor
Serial.print("Distance2: ");
Serial.print(distance2);
Serial.println(" cm");
lcd.setCursor(0, 1);
if (distance2 < 8)
{ lcd.print(" - Dustbin Full- ");//Dustbin Full indication
```

```
 delay(1000);
 Serial.print("dustbin full");
  //lcd.print("Distance:");
  //lcd.print(distance);
 }

  //lcd.print("cm       ");
 //lcd.print("Distance:");
 //lcd.print(distance);

 //lcd.print("cm       ");
 delay(1000);

lcd.setCursor(0, 1);
 if (distance < 15)//object detected...open and close
 {
  if (moisture_detected)
  {
   lcd.print(" - WET DETECTED - ");
   myservo.write(30);
   Serial.println("30");
```

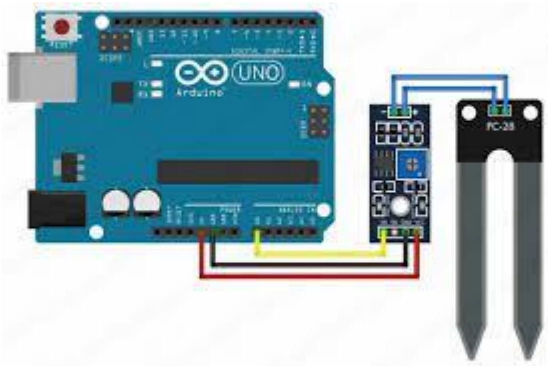
```
    }
    else
    {
     lcd.print(" - DRY DETECTED - ");
     myservo.write(150);
     Serial.println("150");
    }
    delay(1000);
    myservo.write(90);
    Serial.println("90");
    delay(2000);
  }
  else
  {
    lcd.print("  -  No Input -  ");
  }
}
```

CHAPTER 5: CIRCUIT DESIGNING

CIRCUIT DIAGRAM OF AUTOMATIC WASTE SEGREGATOTOR



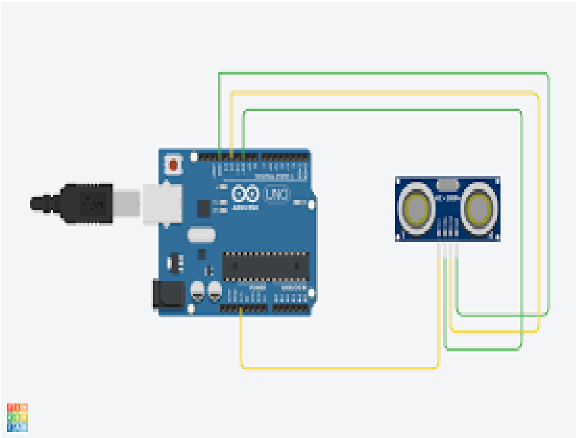
INTERFACING MOISTURE SENSOR



1. Connect the vcc of moisture sensor tob rhe vcc of Arduino
2. Connect the ground of moisture sensor to the ground of Arduino
3. Connect the Ao pin of ,oidture sensor to A0 pin of Arduino
4. Connect the P) pin of moisture sensor to the D13 pin of arduino

INTERFACING ULTRASONIC SENSOR 1

CONNECTIONS



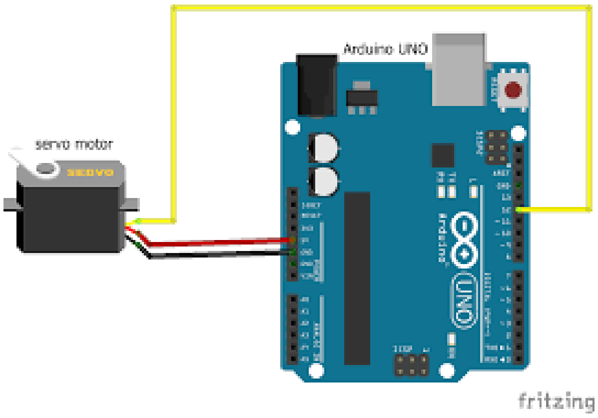
1. Connect Ultrasonic Sensor 's ECHO PIN to D6 PIN of Arduino.
2. Connect Ultrasonic Sensor 's TRIGER PIN to D7 PIN of the Arduino.
3. Connect Ultrasonic Sensor 's VCC PIN to 5Volts PIN of the Arduino.
4. Connect Ultrasonic Sensor 's GROUND PIN TO GROUNG PIN of the Arduino.

INTERFACING ULTRASONIC SENSOR 2

1. Connect Ultrasonic Sensor 's ECHO PIN to D8 PIN of Arduino.
2. Connect Ultrasonic Sensor 's TRIGER PIN to D10 PIN of the Arduino.
3. Connect Ultrasonic Sensor 's VCC PIN to 5Volts PIN of the Arduino.

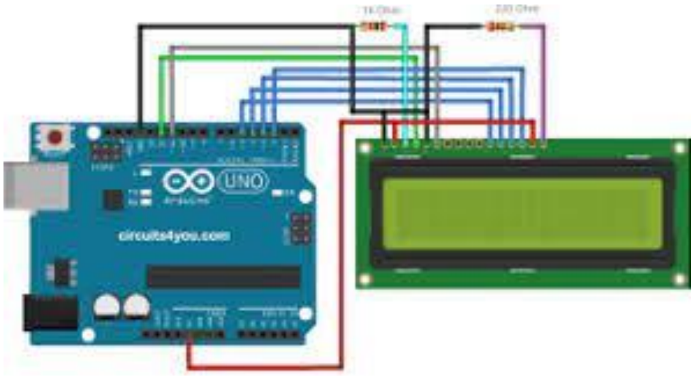
4. Connect Ultrasonic Sensor 's GROUND PIN TO GROUNG PIN of the Arduino.

INTERFACING SERVO MOTOR



1. the red pin (5volts).
2. The orange pin to D9
3. The brown pin (ground).
4. Connect the pins according to the diagram.

INTERFACING LCD



1. Connect the RX PIN of LCD to the D12 of motor driver shield.
2. Connect the EN pin to the D11 of the motor driver shield.
3. Connect VCC pin to the 5vlots pin of the motor driver shield.
4. Connect ground pin to the ground pin of the motor driver shield.
5. Connect the d4 pin of lcd to D5 pin of arduino
6. Connect the D5 pin to D4 pin of arduino
7. Connect D6 pin of lcd to D3 of arduino
8. connect D7 pin of lcd to D2 pin of arduino

POWER SUPPLY

1. We are using 9V lithium batteries for power the supply.

REFERENCES

The sites we used during our preparation of Documentation of project are as follows:

1. https://circuitdigest.com
2. https://en.wikipedia.org
3. https://www.arduino.com
4. https://www.google.com

Chapter 6

CONCLUSION

FUTURESCOPE

The future of Waste management starts and proceeds with technological adjustments. Like every other industry, to proceed, the waste management industry needs to become digitized and data-driven to advance its work field. The future is smart and competitive! Especially for businesses, they are required to be one step ahead of their competitors. When** smart waste management solutions **are applied over time, the data is collected. These data in hand sensors can be used to identify fill patterns, optimize driver routes and schedules, and reduce operational costs. These sensors' cost is steadily decreasing, making smart bins more feasible to implement and more attractive to companies or city leaders.

ADVANTAGES

- Proper waste removal helps improve air and water quality as well as reduces greenhouse gas emissions.
- It helps in minimising the extraction of resources along with reducing pollution and energy consumption which is associated with manufacturing new materials.
- One of the most significant benefits of waste management is the protection of the environment and the health of the population.
- By smartly managing your waste, you also help conserve natural resources including minerals, water and wood. So this is the effect of reducing, reusing and recycling.

Why Arduino?

There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Netmedia's BX-24, Phidgets, MIT's Handyboard, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems.

Inexpensive - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than Cross-platform - The Arduino software runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.

Simple, clear programming environment - The Arduino programming environment is easy-to use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it’s conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with the look and feel of Arduino.