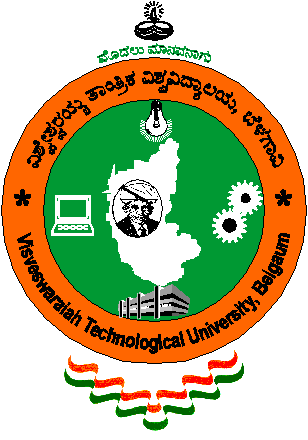
**INTERNSHIP - I**

******(Inter / Intra Institutional Internship)**

**An**

**Internship Report Submitted To**

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY**

**Belagavi, Karnataka**

*For The Award of Degree*

***Bachelor of Engineering***

By

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**2022-2023**

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**BELAGAVI**



**DEPARTMENT OF ELECTRONICS AND COMMUNICATON ENGINEERING**

**Certificate**

**Certified that Miss. Soniya Khatavkar,** anundergraduate student bearing **USN 2JI22EC416** has satisfactorily completed the **Internship – I** on **“AIPS – ARDUINO PROGRAMMING, INTRODUCTION TO IOT USING RASPBERRY PI, 3D-PRINTING AND SPREADSHEETS”,** submitted to **Visvesvaraya Technological University, Belagavi** in partial fulfillment for the award of **Bachelors** in **Electronics and Communication Engineering.**

**Guide Internship Co-ordinator**

**HOD Principal & Director**

**Visvesvaraya Technological University, Belagavi**

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**CERTIFICATE**

**Certified that the Internship - I**

**“AIPS – ARDUINO PROGRAMMING, INTRODUCTION TO IOT USING RASPBERRY PI, 3D-PRINTING AND SPREADSHEETS”**

is a bonafide work carried out by

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*In partial fulfillment for the award of* **BACHELORS IN ELECTRONICS AND COMMUNICATION ENGINEERING** *of the* ***Visvesvaraya Technological University, Belagavi.*** *The report has been approved as it satisfies the academic requirements in respect of Internship Work prescribed for the said degree.*

**Name of the Examiners Signature with date**

**Internship Certificate**

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(**Only for reference)**

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**CHAPTER: 1**

INTRODUCTION

## 1.1 Introduction:

This brief introduction delves into the world of Arduino programming, IoT using Raspberry Pi, 3D printing, and the power of spreadsheets. Arduino programming allows enthusiasts and professionals alike to create interactive electronic projects, while IoT with Raspberry Pi enables seamless connectivity and control of devices and systems. 3D printing revolutionizes manufacturing, allowing for the creation of physical objects from digital designs. Additionally, leveraging the capabilities of spreadsheets provides a versatile tool for data management, analysis, and automation. Collectively, these technologies offer diverse opportunities for innovation, prototyping, and problem-solving across various domains.

# **1.2: Internship study:**

# Module 1: Arduino Programming

Module 2: Introduction to IOT using Raspberry Pi

Module 3: 3D Printing

Module 4: Spread Sheets for Beginners and UHV

## 1.3: Aims and Objectives:

To provide hands-on experience, professional growth, and preparation for future careers. And also Provide training and experiential learning opportunities for the development of skills in counseling.

**1.4: Report Outline:**

* This report consists of seven chapters
* Chapter 1: Introduction
* Chapter 2: Literature Review
* Chapter 3: Arduino Programming
* Chapter 4: Introduction to IOT using Raspberry Pi
* Chapter 5: 3D - Printing
* Chapter 6: Microsoft Office
* Chapter 7: Conclusion & Future Scope

**CHAPTER 2:**

LITERATURE REVIEW

**2.1: Arduino programing:**

Audio programming refers to the process of writing and uploading code to an audio microcontroller board. Arduino is an open-source electronics platform that provides a flexible and accessible way to create interactive projects. It consists of both Hardware, such as the Arduino board and software, including the Arduino Integrated Development Environment (IDE) used for programming.

Arduino programming is based on the Arduino programming language, which is simplified version of C/ C++. It uses a set of libraries and functions specifically designed to interact with the Arduino board’s hardware and peripherals. The programming language enables users to control inputs and outputs, read sensors, communicate with other device, and perform various tasks.

# **2.2: Introduction to IOT using Raspberry Pi:**

The Internet of Things (IoT) refers to the network of interconnected devices and objects that can communicate and exchange data with each other over the internet. It has revolutionized the way we interact with technology, enabling the integration of physical devices and digital systems to create smart and automated solutions.

Raspberry Pi, a credit-card-sized single-board computer, is a popular and versatile platform for building IoT projects. It combines affordability, a rich set of features, and a large community of developers, making it an excellent choice for beginners and professionals alike.

The combination of Raspberry Pi and IoT opens up countless possibilities for creating innovative and connected solutions. From home automation and environmental monitoring to robotics and industrial automation, the ability to integrate physical devices with digital systems brings efficiency, convenience, and new opportunities across various domains. IoT using Raspberry Pi offers exciting possibilities for creating innovative and connected solutions. With its powerful features, community support, and flexibility, Raspberry Pi empowers individuals and organizations to explore and leverage the potential of IoT to solve real-world problems and create a more interconnected world.

## 2.3: 3D-printing:

3D printing, also known as additive manufacturing, is a revolutionary technology that allows the creation of three-dimensional objects by adding material layer by layer based on a digital design. It has transformed various industries and opened up new possibilities for design, prototyping, and manufacturing.

3D printing starts with a digital 3D model created using computer-aided design (CAD) software or obtained from a 3D scanner. The model is then sliced into thin horizontal layers using specialized software. The 3D printer reads these slices and builds the object by depositing or solidifying material layer by layer, following the design instructions.

## 2.4: Microsoft Office:

Microsoft Office is a suite of productivity software applications developed by Microsoft Corporation. It is one of the most widely used software suites globally and provides a range of tools and programs that assist individuals, businesses, and organizations in creating, managing, and sharing various types of digital content.

Microsoft Office has become an essential toolset for individuals, businesses, and organizations worldwide. Its comprehensive range of applications and features empowers users to create professional documents, analyse data, deliver impactful presentations, and effectively manage information. With continuous updates and improvements, Microsoft Office remains at the forefront of productivity software, supporting users in various fields and industries.

## 2.5: Concluding Remarks:

This chapter has the literature review of topic. The next chapters will conclude the topics.

**CHAPTER: 3**

ARDUINOPROGRAMMING



## 3.1: Introduction:

Arduino is an open-source hardware and software platform that allows you to create and program electronic projects. It was developed in Italy in the early 2000s and has gained popularity worldwide due to its simplicity, versatility, and affordability. Arduino boards are equipped with microcontrollers that can be easily programmed using the Arduino programming language, a simplified version of C/C++.

The main idea behind Arduino is to provide a user-friendly interface for both beginners and experienced users to build interactive projects without requiring an in-depth knowledge of electronics or programming. Arduino boards come in various shapes and sizes, but they all share common characteristics, such as Digital and Analog input/output pins, power pins, and communication interfaces like USB or Bluetooth.

One of the key advantages of Arduino is its extensive library of pre-built software functions, called "sketches," which can be readily used and customized to control various hardware components. These components can include sensors, actuators, displays, motors, and more. By connecting these components to the Arduino board and writing code, you can create projects ranging from simple LED blinking to complex robotics and home automation systems.

* **Topic 1**: Embedded system Introduction, Microcontroller, Input and output devices. Arduino Uno Board. Open-source Hardware and software.
* **Topic 2**: Tinker cad online simulator, LED with Battery, Bread Board, adding more LEDs. Slider Switch, Push Button, Potentiometer circuits. Arduino Uno Simulation using Tinker cad.
* **Topic 3**: Serial Communication Interface: Serial. Begin (), Serial. Print (), Serial. Print ln () functions. Message display on Serial.

**3.1.1 Embedded System:**

An embedded system is a computer system designed to perform specific functions within a larger system or device. It is characterized by its dedicated purpose, real-time operation, and integration into a physical environment. Embedded systems are found in various applications, ranging from consumer electronics and automotive systems to industrial control systems and medical devices.

The primary objective of an embedded system is to execute specific tasks efficiently and reliably, often with constraints such as limited processing power, memory, and power consumption. Unlike general-purpose computers, embedded systems are designed to perform a specific set of functions and typically operate in real-time, meaning they must respond to events and produce results within strict timing constraints.

Embedded systems consist of three main components: hardware, software, and the physical interface. The hardware component includes microcontrollers or microprocessors, memory units, input/output interfaces, sensors, actuators, and other peripheral devices. These components are selected and designed to meet the system's requirements, taking into account factors such as cost, power consumption, size, and performance.

The software component of an embedded system includes the programs and algorithms that control its operation. This software can be divided into two categories: system software and application software. System software includes the operating system, device drivers, and other low-level software that provide an interface between the hardware and application software. Application software is responsible for implementing the specific functionality of the embedded system, such as controlling motors, processing sensor data, or running user interfaces.

The physical interface of an embedded system allows it to interact with the external world. This interface may involve various input devices like buttons, switches, sensors, or output devices like displays, actuators, or communication interfaces. The physical interface is crucial for embedded systems as it enables them to sense and respond to the surrounding environment.

**3.1.2: Microcontroller:**

A microcontroller is a compact integrated circuit (IC) that contains a processor core, memory, and input/output peripherals. It is designed to perform specific tasks and control various devices and systems. Microcontrollers are widely used in numerous applications, ranging from simple consumer electronics to complex industrial automation systems.

Microcontrollers offer several advantages over general-purpose processors in certain applications. They are typically low-cost, consume less power, and are designed for real-time and embedded systems, where reliability and responsiveness are crucial. The specialized nature of microcontrollers allows for tailored solutions in specific domains.

To use a microcontroller, you typically write code using a programming language like C or assembly language. This code instructs the microcontroller on how to perform specific tasks and control the connected devices. Once the code is written, it is compiled and uploaded to the microcontroller's memory, where it is executed.

**3.1.3: Input and Output Devices:**

In embedded systems, input and output devices are used to interact with the system and exchange information with the external environment. These devices are often connected to microcontrollers or microprocessors to perform specific tasks. Here are some common input and output devices used in embedded systems:

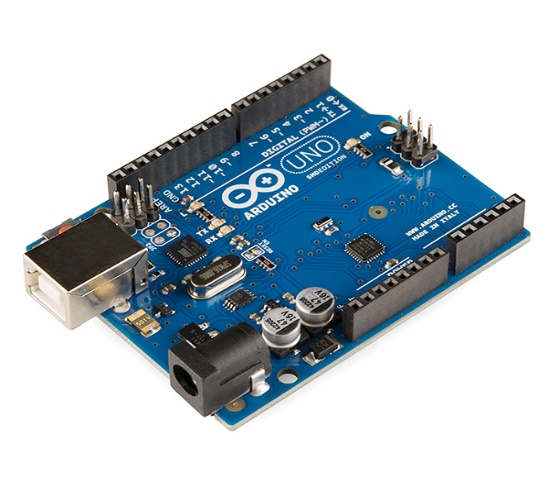
**Input Devices:**

1. **Switches and Buttons**: Simple mechanical switches or push buttons used to provide digital input signals to the embedded system.
2. **Keypads**: Arrays of buttons or keys used to input alphanumeric characters or commands.
3. **Sensors**: Various sensors, such as temperature sensors, humidity sensors, accelerometers, gyroscopes, and proximity sensors, are used to measure and provide Analog or digital input data to the embedded system.
4. **Rotary Encoders**: Used to detect rotational movement or position changes and provide corresponding input signals.
5. **Touchscreens**: Enable users to provide input by touching the screen, often combined with LCD or OLED displays.

**Output Devices:**

1. **LEDs (Light-Emitting Diodes)**: Used to provide visual output by emitting light in different colours and patterns.
2. **LCD (Liquid Crystal Display)**: Used to display alphanumeric characters, symbols, and graphics in embedded systems.
3. **Seven-Segment Displays**: Commonly used for numeric and limited character output, such as displaying numbers or simple messages.
4. **Buzzer or Speaker**: Used to produce audible output such as beeps, alarms, or tones.
5. **Motor and Actuators**: Motors, servos, and other actuators are used to control physical movements and perform mechanical tasks in response to system commands.
6. **Relays**: Electromechanical relays or solid-state relays are used to control the switching of higher voltage or current devices in response to digital signals.

**3.1.4: Arduino Uno Board:**



The Arduino Uno is a popular microcontroller development board based on the ATmega328P microcontroller. It has 14 digital input/output pins, 6 analog inputs, and supports serial communication. The board can be powered via USB or an external power supply and is compatible with various Arduino shields for expanding its capabilities. The Uno is programmed using the Arduino programming language and IDE. It is widely used for prototyping and DIY projects due to its simplicity, and strong community support.

The Arduino Uno board finds applications in various projects and domains. Here are some common applications:

* **Prototyping and DIY Projects.**
* **Home Automation.**
* **Internet of Things (IoT).**
* **Robotics**
* **Data Logging and Monitoring.**
* **Education.**
* **Interactive Art and Installations.**
* **Environmental Monitoring.**
* **Wearable Technology.**
* **Scientific Experiments.**

## 3.1.5: INTRODUCTION TO BREADBOARD:

## Breadboard Images – Browse 9,934 Stock Photos, Vectors, and Video | Adobe Stock

A breadboard, also known as a prototyping board or solderless breadboard, is a fundamental tool used in electronics for building and testing circuits without the need for soldering. It provides a convenient platform for quickly assembling and modifying electronic circuits, making it an essential tool for prototyping, experimentation, and learning electronics.

The breadboard consists of a plastic base with a grid of holes or sockets arranged in a series of rows and columns. These holes or sockets are interconnected in specific patterns to facilitate circuit building. The most common type of breadboard follows a "strip" pattern, where each row of holes is electrically connected internally, while the columns are isolated from each other.

Using a breadboard is relatively simple:

1. Insert the electronic components (such as resistors, capacitors, and ICs) into the breadboard by placing their leads or pins into the appropriate holes. The rows and columns are usually labelled with alphanumeric coordinates for easy reference.
2. Connect the components and create the desired circuit by inserting jumper wires into the relevant holes. These wires bridge the gaps between the components, creating the necessary electrical connections.
3. Utilize the power rails and bus strips to provide power and ground connections to the circuit. Connect the power source (such as batteries or a power supply) to the respective power rails to power the circuit.

**3.2: Tinker cad Online Simulator:**

Tinker cad is an online simulation and design tool that provides users with a user-friendly interface to create, simulate, and prototype electronic circuits and 3D models. With its intuitive drag-and-drop functionality and comprehensive component library, Tinker cad allows users of all skill levels to quickly build and test circuits without the need for physical components.

One of the standout features of Tinker cad is its interactive simulation capability. Users can simulate the behaviour of their circuits in real-time, applying voltage, interacting with switches and sensors, and monitoring voltage levels and current flow. This enables users to validate their circuit designs, troubleshoot issues, and refine their projects before physically implementing them.

Tinker cad offers a wide range of components and parts in its library, including resistors, capacitors, LEDs, motors, microcontrollers, and sensors. Users can easily select and add these components to their circuits, allowing for the creation of complex and diverse projects. Additionally, Tinker cad supports visual programming using code blocks, enabling users to create logic and control the behaviour of their circuits. This feature is particularly helpful for beginners who are new to coding and electronics. Tinker cad is a web-based application that does not require any software installation.

## 3.3 Arduino Uno Programming and Simulation:

Arduino Uno programming involves writing code in the Arduino IDE, which is based on the C/C++ language. The code is uploaded to the Arduino Uno board, which executes it to control connected components or perform specific tasks. The Arduino IDE provides features like code verification, uploading, and monitoring the serial output for debugging purposes.

For simulation, there are software tools like Tinker cad, Virtual Breadboard, and Proteus that offer virtual Arduino environments. These tools allow you to design circuits, write and upload code, and simulate the behaviour of the Arduino Uno board without physical hardware. This enables you to test and validate your code before implementing it in real-world applications, making the development process more efficient and error-free.

**3.3.1 Program to blink a LED and a Buzzer simultaneously** **and continuously:**

void setup() {

pinMode(13, OUTPUT);

pinMode(5, OUTPUT);

}

// the loop function runs over and over again forever

void loop() {

digitalWrite(13, HIGH); // turn the LED on (HIGH is the voltage level)

digitalWrite(5,LOW);

delay(1000); // wait for a second

digitalWrite(13, LOW); // turn the LED off by making the voltage LOW

digitalWrite(5,HIGH);

delay(1000); // wait for a second

}

**3.3.2 ON & OFF all LEDs in sequence:**

Void setup() {

pinMode(7, OUTPUT);// LED1

pinMode(8, OUTPUT);// LED2

pinMode(9, OUTPUT);// LED3

}

void loop() {

digitalWrite(7, HIGH); digitalWrite(8, LOW); digitalWrite(9, LOW); delay(1000);

digitalWrite(7, HIGH); digitalWrite(8, HIGH); digitalWrite(9, LOW); delay(1000); digitalWrite(7, HIGH); digitalWrite(8, HIGH); digitalWrite(9, HIGH); delay(1000); digitalWrite(7, LOW); digitalWrite(8, HIGH); digitalWrite(9, HIGH); delay(1000); digitalWrite(7, LOW); digitalWrite(8, LOW); digitalWrite(9, HIGH); delay(1000); digitalWrite(7, LOW); digitalWrite(8, LOW); digitalWrite(9, LOW); delay(1000);

}

**3.3.3 Traffic Light controller one side with 3 LEDs:**

void setup() {

// configure the output pins

pinMode(2,OUTPUT);

pinMode(3,OUTPUT);

pinMode(4,OUTPUT);

pinMode(5,OUTPUT);

pinMode(6,OUTPUT);

pinMode(7,OUTPUT);

pinMode(8,OUTPUT);

pinMode(9,OUTPUT);

pinMode(10,OUTPUT);

void loop()

digitalWrite(2,1); //enables the 1st set of signals

digitalWrite(7,1);

digitatWrite(10,1);

digitalWrite(4,0);

digitalWrite(6,0):

digitalWrite(3,0);

digitalWrite(8,0);

digitalWrite(9,0);

digitalWrite(5,0);

delay(5000);

digitalWrite(3,1); //enables the yellow lights

digitalWrite(6,1);

digitalWrite(2,0);

digitalWrite(7.0);

delay(1000);

digitalWrite(10,1)

digitalWrite(4,1); //enables the 2nd set of signals

digitalWrite(5,1):

digitalWrite(2,0);

digitalWrite(6,0);

digitalWrite(7.0)

digitalWrite(3,0);

digitalWrite(8,0);

digitalWrite(9,0);

delay(5000);

digitalWrite(9,1); //enables the yellow lights

digitalWrite(6,1);

digitalWrite(10,0);

digitalWrite(5,0);

digitalWrite(4,0);

delay(1000);

digitalWrite(8,1); //enables the 3rd set of signals

digitalWrite(4,1);

digitalWrite(7,1);

digitalWrite(2,0);

digitalWrite(3,0);

digitalWrite(5,0);

digitalWrite(6,0);

digitalWrite(9,0):

digitalWrite(10,0);

delay(5000);

digitalWrite(9,1); //enables the yellow lights

digitalWrite(3,1);

digitalWrite(7,0);

digitalWrite(8,0);

digitalWrite(4,0);

delay(1000);

## 3.4 Serial Communication Interface

void setup() {

Serial.begin(9600);

}

void loop(){

Serial.print(“Hello World”); delay(1000);

}

void setup() {

Serial.begin(9600);

}

void loop() {

Serial.println(“Hello World”);

delay(1000);

## 3.5 Potentiometer Interface as Analog Input and LED Blinking:

## PROGRAM FOR LED BLINKING USING POTENTIOMETER

## int SensorValue=0;

## void setup() {

## Serial.begin(9600);

## pinMode( 13, OUTPUT);

## }

## void loop() {

## SensorValue = analogRead(A0);

## Serial.print(SensorValue);

## digitalWrite(13,HIGH);

## delay(SensorValue);

## digitalWrite(13,LOW);

## delay(SensorValue);

## }

**3.6 Arduino Uno Interface with LDR (light dependent resistor/photo resistor):**

**INTRODUCTION TO LIGHT DEPENDENT RESISTOR**

LDR, which stands for Light Dependent Resistor, is a passive electronic component that exhibits changes in its electrical resistance based on the intensity of light falling on its surface. It is also commonly referred to as a photoresistor or photocell. LDRs are widely used in various applications where light detection or measurement is required.

The structure of an LDR typically consists of a semiconductor material, such as cadmium sulfide (CdS), that undergoes changes in conductivity when exposed to light. When light falls on the LDR, the photons absorbed by the semiconductor material cause the electrons to move from the valence band to the conduction band, resulting in a decrease in resistance.

The resistance of an LDR can range from several kilohms in bright light conditions to several megohms or higher in darkness. This property makes LDRs highly useful for detecting and measuring light levels in a wide range of applications. They are particularly popular in automatic light control systems, photography equipment, burglar alarm systems.

**Analog input code Read value in serial monitor**

void setup(){

Serial.begin(9600);

}

void loop(){

int sensorValue = analogRead(A0); Serial.println(sensorValue); delay(1);

}

void loop(){

SensorValue=analogRead(A0); Serial.print(SensorValue); digitalWrite(13,HIGH); delay(SensorValue);

digitalWrite(13,LOW);

delay(SensorValue);

}

int input=A0;

int LED=10;

int sensorvalue=0;

void setup(){

Serial.begin(9600);

pinMode (LED, OUTPUT);

}

void loop() {

sensorvalue=analogRead(input); Serial.println("Sensor value ="); Serial.println(sensorvalue);

if(sensorvalue > 512)

{

digitalWrite(LED,HIGH);

}

else

{

Digital write(LED LOW);

}

delay(50);

}

**INTRODUCTION TO ULTRASONIC SENSOR:**

An ultrasonic sensor is a device that uses ultrasonic sound waves to detect and measure distance to objects. It is a type of non-contact proximity sensor that emits high-frequency sound waves and analyses the echoes reflected from nearby objects.

The sensor consists of two main components: a transducer and a receiver. The transducer emits ultrasonic waves, usually in the range of 20 kHz to 200 kHz, which are inaudible to humans. These waves travel through the air and when they encounter an object, they bounce back as echoes. The receiver then detects these echoes and measures the time it takes for the waves to return. Overall, ultrasonic sensors offer reliable and versatile solutions for detecting and measuring distances, making them popular in various industries and applications.

**3.7 Arduino with Ultrasonic Sensor**:

/\*Ultrasonic Sensor HC-SR04 and Arduino Tutorial\*/

// defines pins numbers

const int trigPin = 9;

const int echoPin = 10;

// defines variables

long duration;

int distance;

void setup() {

pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output

pinMode(echoPin, INPUT); // Sets the echoPin as an Input

Serial.begin(9600); // Starts the serial communication

}

void loop(){

// Clears the trigPin

digitalWrite(trigPin, LOW);

delayMicroseconds(2);

// Sets the trigPin on HIGH state for 10 micro seconds

digitalWrite(trigPin, HIGH);

delayMicroseconds(10);

digitalWrite(trigPin, LOW);

// Reads the echoPin, returns the sound wave travel time in microseconds

duration = pulseIn(echoPin, HIGH);

// Calculating the distance

distance= duration\*0.034/2;

// Prints the distance on the Serial Monitor

Serial.print("Distance: ");

Serial.println(distance);

delay(1000);

}

**3.8 Arduino Uno Interface with LCD Display:**

An LCD (Liquid Crystal Display) is a flat panel display technology that uses liquid crystals to display images or text. LCD displays are commonly used in electronic devices such as televisions, computer monitors, smartphones, and, in this case, with Arduino microcontrollers.

There are different types of LCD displays, but one commonly used with Arduino is the character LCD display. Character LCD displays come in various sizes, such as 16x2 or 20x4, indicating the number of characters they can display per line and the number of lines.

Character LCD displays are controlled using parallel or serial communication protocols. The parallel communication method requires several pins on the Arduino, while the serial communication method requires fewer pins but requires an I2C or SPI interface.

To interface an Arduino with an LCD display, you typically need to connect power (VCC and GND), data (data pins or I2C/SPI interface), and control signals (such as enable, register select, and read/write pins). Additionally, some LCD displays have backlight control pins.

**3.8.1 Display “Hello World!” on LCD:**

Void setup() {

Serial.begin(9600);

Serial.println(“\*\*\*\*\*\*\*\*\*\*\*\*\*\*Hello JCE!\*\*\*\*\*\*\*\*\*\*\*\*\*\*”);

Serial.println(“\*\*\*\*Welcome to Arduino Programming\*\*\*\*”);

}

void loop(){

}

### **3.8.2 Custom Character Display on LCD:**

#include <LiquidCrystal.h>

const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2;

LiquidCrystal lcd ( rs,en,d4,d5,d6,d7);

byte custom[8] = {

B00001,

B00010,

B00100,

B01000,

B10000,

B01000,

B00100,

B00010};

void setup() {

lcd.begin(16,2);

lcd.clear();

lcd.createChar(1,custom);

lcd.setCursor(0,0);

lcd.print("CUSTOM!");

delay(3000);

}

void loop() {

for(int i=0;i<=15;i++)

{

lcd.setCursor(i,1);

lcd.write(1);

delay(1000);

}

}

### **3.8.3 Program for scrolling Numbers:**

#include <LiquidCrystal.h>

const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2;

LiquidCrystal lcd (rs, en, d4, d5, d6, d7);

void setup() {

lcd.begin(16, 2);

}

void loop() {

lcd.setCursor(0, 0);

// print from 0 to 9:

for (int thisChar = 0; thisChar < 10; thisChar++) {

lcd.print(thisChar);

delay(500);

{

lcd.setCursor(16, 1);

// set the display to automatically scroll:

lcd.autoscroll();

print from 0 to 9:

for (int thisChar = 0; thisChar < 10; thisChar++) {

lcd.print(thisChar);

delay(500);

}

// turn off automatic scrolling

lcd.noAutoscroll();

// clear screen for the next loop:

lcd.clear();

}

**3.8.4 Program for scrolling Characters:**

#include <LiquidCrystal.h>

const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2; LiquidCrystal lcd (  rs,en,d4,d5,d6,d7); byte custom[8] ={

B00001,

B00010,

B00100,

B01000,

B10000,

B01000,

B00100, B00010};

void setup() {

lcd.begin(16,2);

lcd.clear();

lcd.createChar(1,custom);

lcd.setCursor(0,0);

lcd.print("CUSTOM!");

delay(3000);

}

void loop() {

for(int i=0;i<=15;i++)

 {

lcd.setCursor(i,1);

lcd.write(1);

delay(1000);

}

**3.8.5 Program for displaying character on LCD sent from serial monitor:**

#include <LiquidCrystal.h>//Library for LCD

LiquidCrystal lcd(12, 11, 5, 4, 3, 2);//LCD pins at which it is attached to the Arudino

void setup()//method used to run the code for once

{

lcd.begin(16, 2);//LCD order

lcd.print("                  ");//prints on LCD

// lcd.setCursor(0,1);//Setting the cursor on LCD

//lcd.print("");//prints on LCD

delay(500);//delay of 1 second

}

void loop() //used to run the code repeatedly

{

for(int PositionCount=0; PositionCount<13; PositionCount++)

{

lcd.scrollDisplayRight(); //builtin command to scroll right the text

delay(150);//delay of 150 msec

}

for(int PositionCount=0; PositionCount<13; PositionCount++)//loop for scrolling the text

{

lcd.scrollDisplayLeft();//builtin command to scroll the text left again

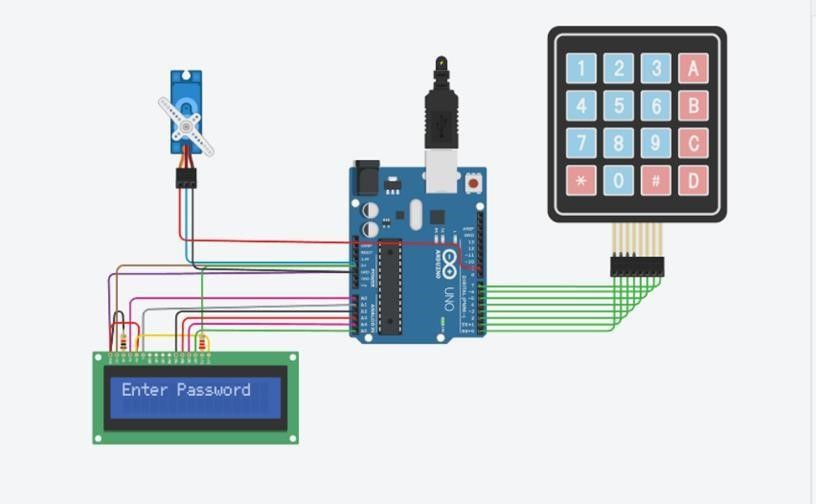
delay(150);//delay of 150 msec

}

}

**Mini project on thinker cad using Arduino board:**

**digital door lock opener using Arduino:**



## 

A digital door lock opener using Arduino combines various components to create a functional system. At the core of this system is the Arduino microcontroller, which acts as the central processing unit. It receives inputs from a keypad or an RFID (Radio Frequency Identification) reader, allowing users to enter a password or use an RFID card for access.

The Arduino code implements a validation mechanism to compare the user's input with authorized codes or credentials. If the input matches an authorized code, the Arduino sends signals to control the lock mechanism, which can be a servo motor or a solenoid. The lock mechanism physically controls the door, unlocking it to grant access or locking it to deny access.

Optionally, an LCD display can be integrated into the system to provide feedback and display relevant information to the user. This can include prompts for input, error messages, or status updates on the locking/unlocking process.

**Here are the main theoretical concepts involved:**

1. **Arduino Microcontroller:** The Arduino serves as the brain of the system. It is responsible for processing inputs, making decisions, and controlling the lock mechanism based on predefined conditions.
2. **Keypad or RFID Reader:** The input device allows users to enter a password or use an RFID card to gain access. The keypad can be a matrix of buttons, while the RFID reader communicates with RFID tags or cards.
3. **Password/RFID Validation:** The Arduino code implements a validation mechanism to compare the user's input (password or RFID tag) against authorized codes or credentials. If the input matches an authorized code, access is granted; otherwise, access is denied.
4. **Servo Motor or Solenoid Lock:** The lock mechanism physically controls the door, either by rotating a servo motor or activating a solenoid. The Arduino sends signals to the lock mechanism to unlock or lock the door based on the validation result.

**The working of a locker using Arduino involves the following steps:**

1. User provides authentication credentials through an input interface such as a keypad, RFID reader, or biometric scanner.
2. Arduino validates the credentials against authorized data stored in its memory.
3. If the credentials are valid, Arduino sends signals to the lock control mechanism to unlock the locker.
4. Optionally, feedback on the locker's status can be provided through an LCD display or LEDs.
5. Security measures should be implemented to protect the system and data, such as encryption and secure communication protocols.

**3.9 Module Outcome:**

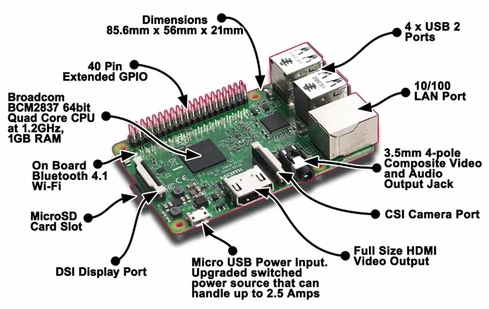
From this module The Students will be able To Design and Program the Arduino

Circuits & The Monitor.

**CHAPTER 4:**

Introduction to IOT using Raspberry pi

## 4.1: Introduction to Raspberry pi:

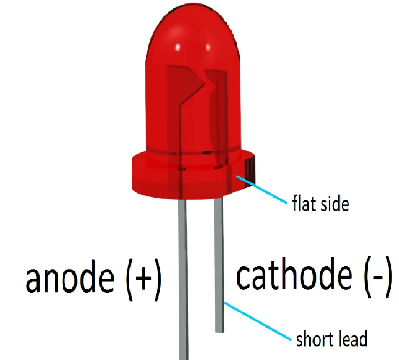


The Raspberry Pi is a compact and affordable single-board computer that has become a game-changer in the world of technology. Its small size, low cost, and impressive capabilities have made it a favourite among hobbyists, educators, and professionals alike.

## The Raspberry Pi is a small and affordable single-board computer that has gained popularity for its versatility and educational value. It offers a range of models with different specifications, runs on various operating systems like Raspberry Pi OS, and supports multiple programming languages. With its GPIO pins, it allows users to connect and control external electronic components. The Raspberry Pi has a thriving community that shares resources, tutorials, and project ideas, making it accessible for beginners and experienced users alike. It has found applications in diverse fields such as home automation, media centres, robotics, and more. Overall, the Raspberry Pi is a powerful tool that promotes learning, creativity, and innovation in programming and electronics.

**4.2: IOT Components:**

**4.2.1: LED:**

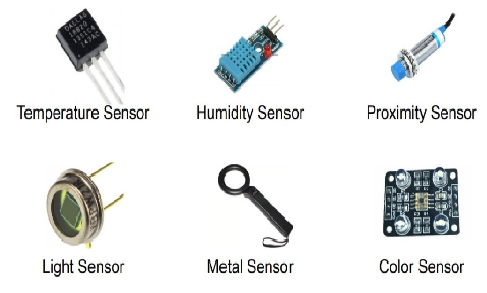
An LED, or Light-Emitting Diode, is a semiconductor device that emits light when an electric current passes through it. It is a solid-state technology that has revolutionized lighting due to its numerous advantages. LEDs are highly energy-efficient, converting a higher percentage of electrical energy into light compared to traditional incandescent bulbs.

**4.2.2: Resistors:**

A resistor is a passive electronic component that opposes or restricts the flow of electric current in a circuit. It is designed to introduce a specific amount of resistance to the flow of electrons, which in turn affects the voltage and current levels within the circuit.

**4.2.3: Jumper Wires:**

The primary purpose of jumper wires is to create temporary or permanent connections between various components, such as microcontrollers, sensors, actuators, and other electronic devices. They eliminate the need for soldering and provide flexibility for quick modifications or experimentation in circuits.

**4.2.4: Sensors:**

Sensors are devices that detect physical changes and convert them into electrical signals. They are used to measure parameters like temperature, pressure, light, and motion. Sensors play a crucial role in electronics, automation, and various applications by providing information for decision-making and control.

**4.2.5 Gas Sensors (MQ – 2):**

Gas sensors, specifically the MQ-2 gas sensor, are electronic devices used to detect and measure the presence of various gases in the surrounding environment. The MQ-2 sensor is commonly used for detecting gases such as methane, propane, butane, alcohol, smoke, and other flammable gases.

The MQ-2 gas sensor operates on the principle of metal oxide semiconductors. It consists of a sensing element that contains a metal oxide material. When the target gas comes into contact with the sensing element, it undergoes a chemical reaction that causes a change in the resistance of the sensor. This change in resistance is then measured and converted into an electrical signal, indicating the presence and concentration of the gas.

### **4.2.6 Button Switches:**

Button switches, also known as tactile switches or push buttons, are ubiquitous electronic components that serve as user input devices. They consist of a housing, contacts, and a button or actuator. When the button is pressed, it activates the internal mechanism, causing the contacts to momentarily connect and complete an electrical circuit. When the button is released, the contacts separate, breaking the circuit.

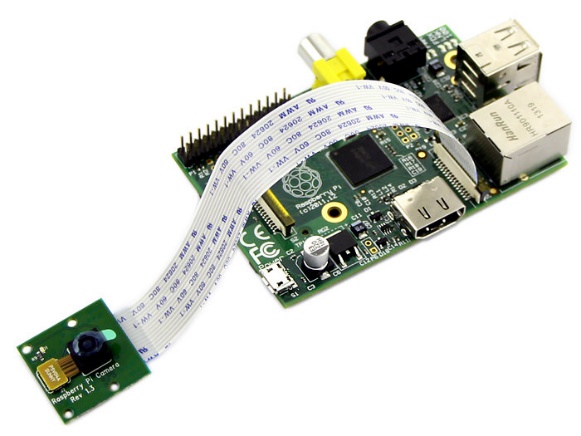
Button switches are designed to provide a tactile feedback or click sensation when pressed, giving users a physical confirmation of the switch activation. This feedback is often accompanied by an audible click sound. The tactile response makes button switches useful for applications that require precise user input or control, such as keyboards, gaming controllers, industrial control panels, and various electronic devices.

**4.2.7 Buzzers:**

Buzzers are electronic devices that produce audible sound or tones when an electric current is applied to them. They are commonly used for audio alerts, notifications, alarms, and signalling purposes.

Buzzers consist of a piezoelectric element or an electromagnetic coil and a diaphragm. When an electric current is passed through the buzzer, the piezoelectric element vibrates or the coil generates a magnetic field, causing the diaphragm to move back and forth rapidly. This movement creates sound waves, producing an audible tone or buzz.

### **4.2.8 Pi Camera Module Interface with Raspberry Pi using Python 68:**



The Pi Camera Module is an accessory specifically designed for the Raspberry Pi single-board computer. It is a small, high-quality camera that can be easily connected to the Raspberry Pi, enabling users to capture photos and videos directly from their projects.

The Pi Camera Module is compact and lightweight, making it ideal for embedding in various applications, such as robotics, security systems, home automation, and more. It connects to the Raspberry Pi through a ribbon cable, providing a convenient and straightforward interface.

The camera module offers high-resolution imaging capabilities, with different versions available that support varying resolutions and features. For instance, the original Pi Camera Module (v1) had a fixed focus lens and offered a resolution of 5 megapixels, while the later Pi Camera Module v2 provided an 8-megapixel resolution and added features like adjustable focus.

**4.3: Introduction to Python:**



Python is a popular and versatile programming language known for its simplicity and readability. It is widely used for web development, data analysis, artificial intelligence, scripting, and more. Python has a large and active community that contributes to its extensive library of packages and resources. It is cross-platform compatible and offers seamless integration with other languages. Python's ease of learning and powerful capabilities makes it a top choice for both beginners and experienced developers. Its broad range of applications and thriving ecosystem make it a valuable tool in the world of programming.

### **4.4 Program to Flash an LED at a given on time and off time cycle, Where the two times are taken from a file.**

#define redLed 5

#define bluLed 6

long previousMillis[2]; //[x] = number of leds

void setup() {

pinMode(redLed, OUTPUT);

pinMode(bluLed, OUTPUT);

}

void loop()

{

//OnOffBlink(which led?, tOn, tOff, One of the previousMillis);

OnOffBlink(redLed, 300, 500, 0); //array must be different

OnOffBlink(bluLed, 300, 300, 1); //for each led

}

void OnOffBlink(int led, int tOn, int tOff, int array)

{

static int timer=tOn;

if ((millis() - previousMillis[array]) >= timer)

{

if (digitalRead(led) == HIGH) {

timer = tOff;

}

else

{

timer = tOn;

}

digitalWrite(led, !digitalRead(led));

previousMillis[array] = millis();

}

}

**4.5 Program to Get Input from Two Switches and Switch on:**

**Corresponding LED**

**s**import RPi.GPIO as GPIO #Import GPIO library

import time #Import time library

GPIO.setmode(GPIO.BOARD) #Set GPIO pin numbering

GPIO.setup(12, GPIO.IN, pull\_up\_down=GPIO.PUD\_UP) #Enable input and pull up resistors while True:

input\_state = GPIO.input(12) #Read and store value of input to a variable

if input\_state == False: #Check whether pin is grounded print('Button

Pressed') #Print 'Button Pressed' time.sleep(0.3) #Delay of 0.3

**4.6 Program to Access an Image through a Pi Web Cam:**

from picamera import PiCamera import time camera = PiCamera() time.sleep(2) camera.resolution = (1280, 720) camera.vflip = True camera.contrast = 10 file\_name = "/home/pi/Pictures/video\_" + str(time.time()) + ".h264" print("Startrecording...")

camera.start\_recording(file\_name)

camera.wait\_recording(5) camera.stop\_recording()

print("Done.")

**4.7 Program to Get an Alarm from a Remote Area (Through LAN)**

**If Smoke is detected**

import socket

import Adafruit\_MCP3008 import Adafruit\_GPIO.SPI as SPI import time

HOST = ‘192.168.234.121’

PORT = 3000

SPI\_DEVICE = 0 SPI\_PORT = 0 mcp = Adafruit\_MCP3008.MCP3008(spi=SPI.SpiDev(SPI\_PORT,SPI\_DEVICE)) try: with socket.socket(socket.AF\_INET,socket.SOCK\_STREAM) as s: s.bind((HOST,PORT)) s.listen()

conn,addr = s.accept() with conn:

print(‘connected by’,addr) while True: value = mcp.read\_adc(0)

print(“Gas value”,value, “units”) if (value>80): data = “Alert”.encode( ‘utf-8’ ) conn.sendall(data) Client:

import socket import RPi.GPIO as GPIO import time Buzzer = 35

HOST = ‘192.168.234.121’ PORT = 3000

GPIO.setmode(GPIO.BOARD)

GPIO.setup(36,GPIO.OUT) GPIO.setup(False) try: with socket.socket (socket.AF\_INET,socket.SOCK\_STREAM) as s: s.connect((HOST,PORT)) while True:

data = s.recv(1024).decode(‘utf-8’) if (str(data) == ‘Alert’) : print(“Alert!gas leakage detected”) GPIO.output(35,True) time.sleep(3) GPIO.output(36,False) time.sleep(3) except KeyboardInterrupt: s. close() GPIO.cleanup()

**4.8**: **Module Outcome:**

* Raspberry Pi proves to be a smart, economic and efficient platform for implementing The home automation.
* The system is Flexible and programmable and has wide range applications and Supports wide Varity of peripherals and accessories
* The system can be accessed from any internet based device including handheld

Devices such as mobile phones.

**CHAPTER 5:**

3-D PRINTING

3D printing, also known as additive manufacturing, is a revolutionary technology that enables the creation of three-dimensional objects by building them layer by layer. Instead of traditional subtractive manufacturing processes that involve cutting, drilling, or molding, 3D printing adds material to create objects.

The process starts with a digital model of the object, which is sliced into thin layers. These layers serve as instructions for the 3D printer, which deposits or solidifies material, typically plastic or resin, layer by layer until the complete object is formed.

3D printing offers several advantages. It allows for the production of complex and intricate designs that would be challenging or impossible with traditional methods. It enables rapid prototyping, reducing time and costs in the product development cycle. Customization and personalization are key benefits, as objects can be tailored to individual needs or specific requirements.

**5.1: TECHNOLOGIES:**

Each technology has its strengths, limitations, and suitable applications, and the choice of technology depends on factors such as desired print quality, material compatibility, cost, and intended use of the printed objects. Here are some of the key technologies in 3D printing:

* **Selective Laser Sintering (SLS):** SLS employs a high-power laser to selectively fuse powdered materials, such as nylon or metal, layer by layer. The laser heats the powdered material, causing it to fuse and solidify. Unfused powder supports the structure during printing, eliminating the need for additional support structures.
* **Digital Light Processing (DLP):** DLP is similar to SLA, but instead of using a laser, it uses a digital light projector to cure a liquid resin. The entire layer is exposed to light simultaneously, allowing for faster print times compared to SLA.
* **Binder Jetting:** Binder Jetting involves the deposition of a liquid binder onto thin layers of powdered material, such as sand or metal. The binder binds the particles together, layer by layer, forming the object. After printing, additional post-processing, such as sintering, may be required for improved strength and durability.
* **Material Jetting:** Material Jetting works by jetting or depositing droplets of liquid photopolymer or wax materials onto the build platform. These droplets solidify through UV light exposure or cooling, forming the object layer by layer. Material Jetting can produce multi-material and multi-color prints simultaneously.
* **Direct Metal Laser Sintering (DMLS)/Selective Laser Melting (SLM):** DMLS/SLM uses a high-power laser to selectively melt and fuse metal powders together, creating fully dense metal parts. The laser melts the metal powder particles, which solidify upon cooling. DMLS/SLM is primarily used for producing metal components with complex geometries.

**5.2: Applications:**

3D printing has a wide range of applications across various industries. Here are some notable applications of 3D printing:

* **Prototyping and Product Development:** 3D printing allows rapid prototyping, enabling designers and engineers to quickly iterate and test their designs before mass production. It speeds up the product development cycle and reduces costs.
* **Healthcare and Medical Applications:** 3D printing has revolutionized healthcare by enabling the production of patient-specific medical devices, prosthetics, and implants. It allows for personalized and tailored solutions, improving patient outcomes. It is also used for creating anatomical models for surgical planning and education.
* **Aerospace and Automotive:** 3D printing is used in aerospace and automotive industries for rapid prototyping, manufacturing lightweight components, and producing complex geometries. It helps reduce weight and improve fuel efficiency.
* **Architecture and Construction:** 3D printing is utilized in architecture and construction for creating intricate models, prototypes, and even full-scale structures. It enables faster and more cost-effective construction methods.
* **Education and Research:** 3D printing has educational applications by providing hands-on learning experiences. It allows students to bring their designs to life and enhances understanding of concepts in various fields. It is also used in scientific research for creating custom lab equipment, models, and prototypes.

These are just a few examples of the wide-ranging applications of 3D printing.

**5.3: Modeling Software:**

### **SOLID EDGE**

Solid Edge is a professional 3D computer-aided design (CAD) software developed by Siemens Digital Industries Software. It offers a comprehensive suite of tools for designing, simulating, and manufacturing mechanical and electrical systems. With its user-friendly interface and robust functionality, Solid Edge is widely used across industries such as mechanical engineering, automotive, aerospace, and consumer products.

Key features of Solid Edge include powerful 3D modeling capabilities, allowing users to create complex parts and assemblies using parametric, direct, and synchronous modeling techniques. It offers specialized tools for sheet metal design, simulation and analysis for structural and thermal performance, drafting and documentation for detailed drawings, and electrical design capabilities for creating electrical schematics and harness designs. Here are some features on solid edge:

* Advanced 3D modeling techniques for precise part and assembly creation.
* Specialized tools for sheet metal design and automatic unfolding.
* Assembly design and management capabilities, including motion simulation and interference detection.
* Simulation and analysis tools for structural, thermal, and fluid flow performance evaluation.
* Comprehensive drafting tools for detailed 2D drawings with annotations and dimensions.
* Electrical design capabilities for creating schematics, wiring diagrams, and harness designs.
* Support for additive manufacturing, including design optimization and support structure generation.
* Built-in data management for collaboration, version control, and integration with Siemens' Teamcenter.
* Seamless integration with CAM software for CNC machining and manufacturing processes.

**5.4 Module Outcome:**

3D printing can be a great teaching tool to enhance students' understanding of complex concepts and processes, which should presumably improve learning performance, problem solving and critical thinking skills, communication and collaboration skills, and attitudes, engagement, and motivation.

## CHAPTER 6:

## MICROSOFT OFFICE

Microsoft Office is a suite of productivity applications developed by Microsoft. It includes widely used programs such as Word for word processing, Excel for spreadsheets, PowerPoint for presentations, Outlook for email and personal information management, and OneNote for note-taking. Additional applications like Access for database management, Publisher for desktop publishing, and Teams for communication and collaboration are also part of the suite.

Microsoft Office is designed to enhance productivity and streamline tasks in various professional and personal settings. It provides tools for creating, editing, and formatting documents, managing data and calculations, designing presentations and publications, organizing emails and schedules, and facilitating collaboration among team members.

The suite is known for its user-friendly interface, extensive functionality, and compatibility across different platforms and devices. Microsoft Office has become a standard in many industries and educational institutions, empowering users to create professional-quality content, analyse data, communicate effectively, and streamline workflows.

**6.1: Microsoft Word:**

Microsoft Word is a word processing program that is part of the Microsoft Office suite. It is one of the most widely used applications for creating, editing, and formatting documents.

Microsoft Word provides a user-friendly and feature-rich environment for creating and editing text-based documents. It offers a wide range of tools and functions to help users format text, add images and tables, and customize the layout of their documents. Word supports various file formats, allowing seamless compatibility with other word processing software.

With Microsoft Word, users can create professional-looking documents for various purposes, such as reports, letters, resumes, and manuscripts. It offers features like spell checking, grammar correction, and thesaurus to enhance the quality and accuracy of written content. Users can also collaborate with others in real-time, making it easy to review and edit documents as a team

**6.2: Microsoft Excel:**

Microsoft Excel is a powerful spreadsheet program that allows users to organize, analyse, and manipulate data effectively. It offers a range of features and functions that make it a versatile tool for various tasks.

It enables users to input data, organize it in rows and columns, and perform calculations using built-in mathematical formulas. Excel supports a vast number of functions, ranging from basic arithmetic operations to advanced statistical and financial calculations.

One of Excel's key features is its ability to handle large amounts of data. Users can easily sort, filter, and format data to create meaningful insights. Excel also supports the creation of charts and graphs, making it easier to visualize data trends and patterns.

Excel's functionality extends beyond basic calculations. It offers tools for data analysis, including pivot tables, which allow users to summarize and analyse large datasets quickly. Users can also create custom macros and automate repetitive tasks to improve efficiency.

**6.3: Microsoft Power point:**

Microsoft PowerPoint is a presentation software developed by Microsoft as part of the Microsoft Office suite. It is widely used to create visually appealing and engaging presentations for various purposes. It allows users to combine text, images, videos, and other multimedia elements to convey information effectively. With PowerPoint, users can craft visually stunning slideshows that capture the attention of their audience.

PowerPoint provides a variety of slide templates and themes to choose from, making it easy to create consistent and visually appealing presentations. Users can add text, format it with different fonts, colours, and styles, and arrange it on slides to create a logical flow of information.

The software offers tools for inserting and editing images, charts, tables, and SmartArt graphics to enhance the visual impact of presentations. Users can also incorporate audio and video files, transitions, animations, and slide timings to create engaging and interactive presentations. PowerPoint enables users to deliver presentations in various formats, including on-screen slideshows, printed handouts, or even as self-running presentations. It provides features for rehearsing timings, adding speaker notes, and controlling the presentation flow during live delivery.

Collaboration is made easy with PowerPoint's cloud-based features. Multiple users can work on the same presentation simultaneously, and changes are synced in real-time. PowerPoint also integrates with other Office applications, allowing seamless insertion of content from Word or Excel, and easy sharing and collaboration with colleagues.

Microsoft PowerPoint is widely used in business, education, and other professional settings for presentations, training sessions, sales pitches, and more. Its intuitive interface, extensive customization options, and multimedia capabilities make it a go-to tool for creating impactful and visually appealing slideshows.

**6.4 Module Outcome:**

Microsoft Office offers enhanced productivity, streamlined communication and collaboration, effective data management and analysis, professional document creation, efficient presentations, and access to a comprehensive suite of applications that support various tasks and requirements.

## CHAPTER 7:

## CONCLUSION AND FUTURE SCOPE

**7.1 Conclusion:**

It provided valuable real-world work experience, practical skills development, industry exposure, networking opportunities, and a pathway to future career success. They offer a chance to apply knowledge, gain insights into specific industries, and make informed career decisions. The given modules having a very good scope in industry, will be helpful to get to know about the technical and practical knowledge about technology.

**7.2: Future Scope:**

**Arduino:** Arduino has a bright future with growing interest in electronics and IoT. It offers endless possibilities for innovation and automation in various industries, making it a valuable skillset for aspiring engineers and inventors.

**Raspberry Pi:** Raspberry Pi's versatility and affordability make it well-positioned for future applications in home automation, robotics, IoT, and educational projects. Its continuous development and expanding community ensure an exciting future for this powerful single-board computer.

**3D Printing:** The future of 3D printing looks promising as it revolutionizes manufacturing and customization. Advancements in materials, speed, and accessibility will lead to wider adoption in industries like healthcare, aerospace, and consumer products, shaping the future of production.

**Microsoft Office:** Microsoft Office remains an essential suite for productivity and communication. Its continuous updates and integration with cloud services ensure it will adapt to evolving work environments, enabling efficient document creation, data analysis, collaboration, and professional communication.