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1.INTRODUCTION:

*The internet of things is the extension of internet connectivity into physical devices and everyday objects.

*IOT is simply the network of interconnected things/devices which are embedded with sensors, software ,network, connectivity and necessary electronics that enables them to collect and exchange data making them responsive.

*It makes devices and systems taking all the things in the world and connecting them to the internet.

*The internet of things (IOT) refers to the ever-growing network of physical object that feature an IP address for internet connectivity, and the communication that occurs between these objects and others internet- enabled devices and systems.

*It is also referred to as Machine-to-Machine (M2M), Skynet or internet of everything.

*These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices.

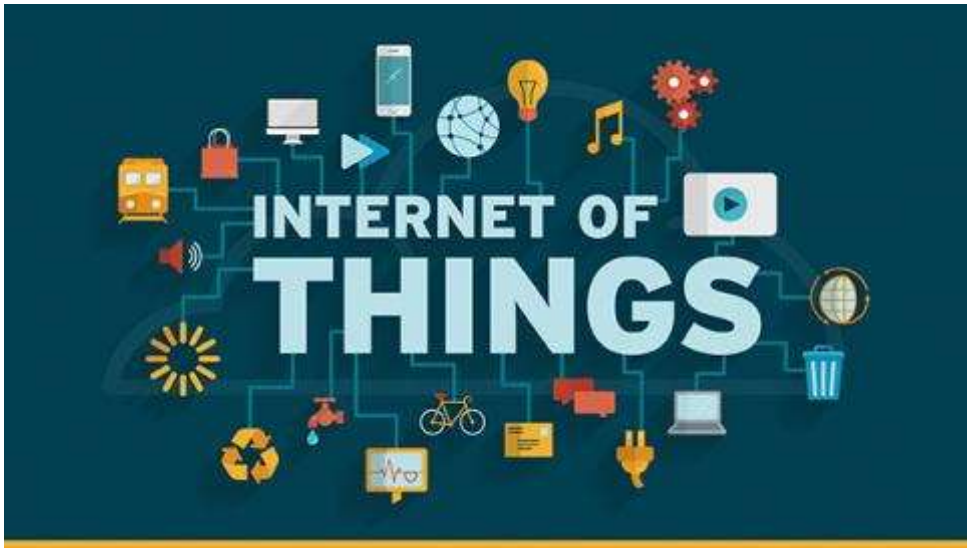


FIG 1.INTERNET OF THINGS

2.HISTORY:

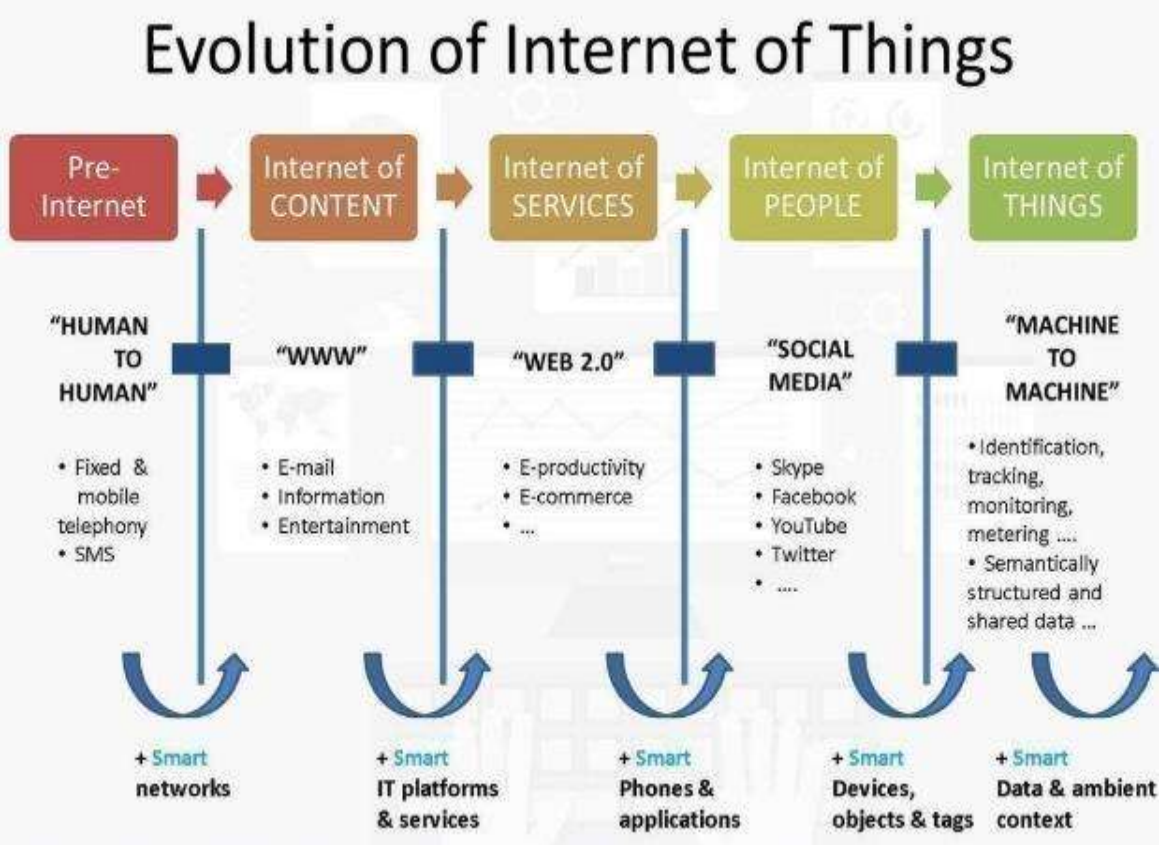


FIG 2. EVOLUTION OF IOT

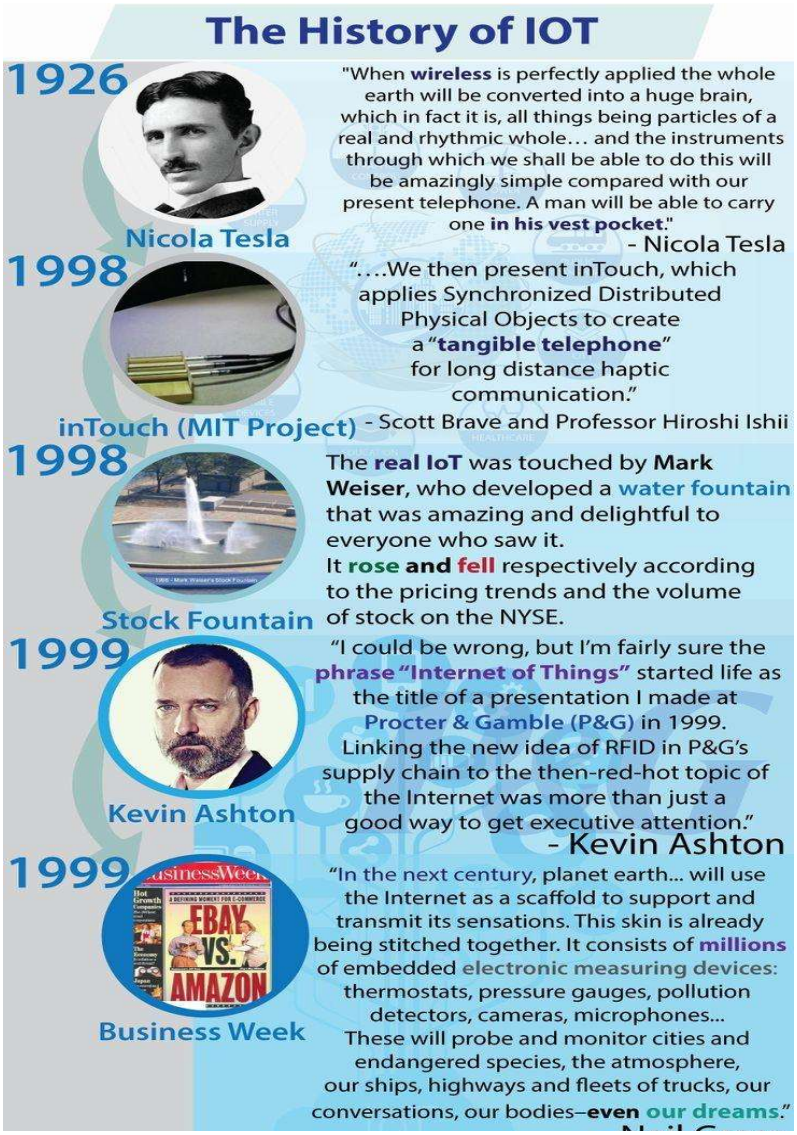


FIG 2.1 THE HISTORY OF IOT

3.LAYER OF INTERNET OF THINGS:

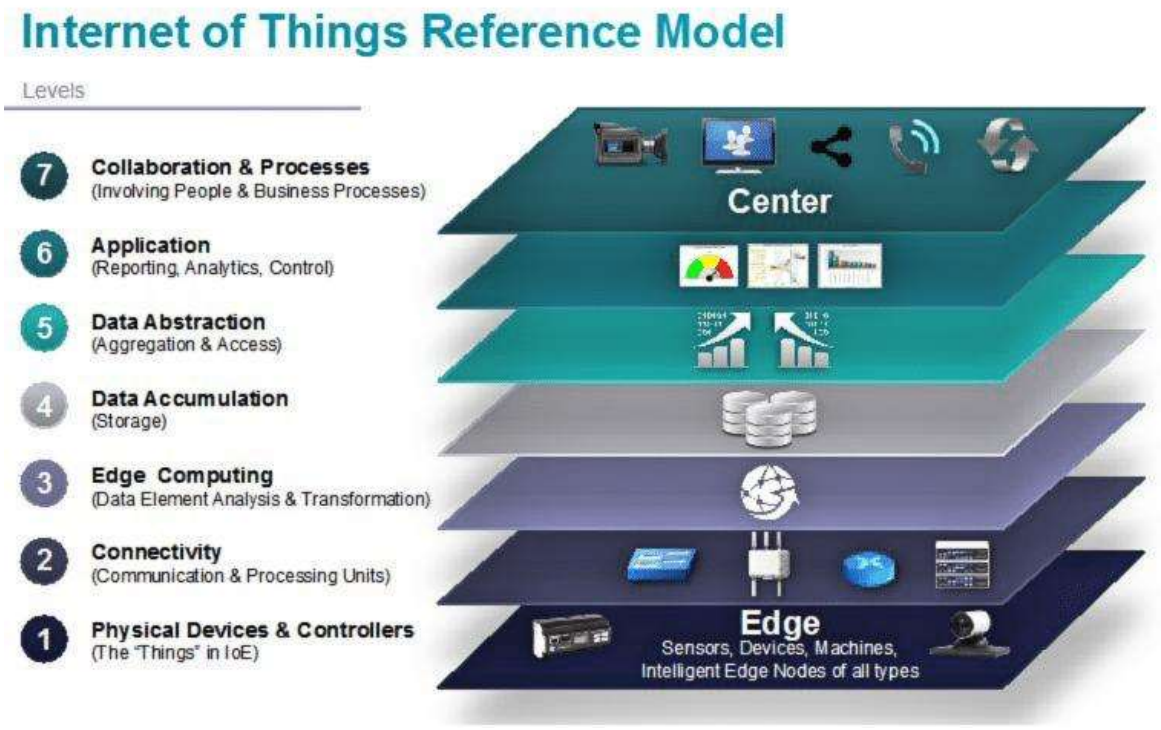


FIG 3. REFERENCE MODEL OF IOT

4.ARCHITECTURE OF IOT:

*The working of IOT is different for different IOT echo system (architecture). However, the key concept of there working are similar.

*The entire working process of IOT starts with the device themselves, such as smartphones , digital watches, electronic appliances, which securely communicate with the IOT platform.

*The platforms collect and analyze the data from all multiple devices and platforms and transfer the most valuable data with applications to devices.

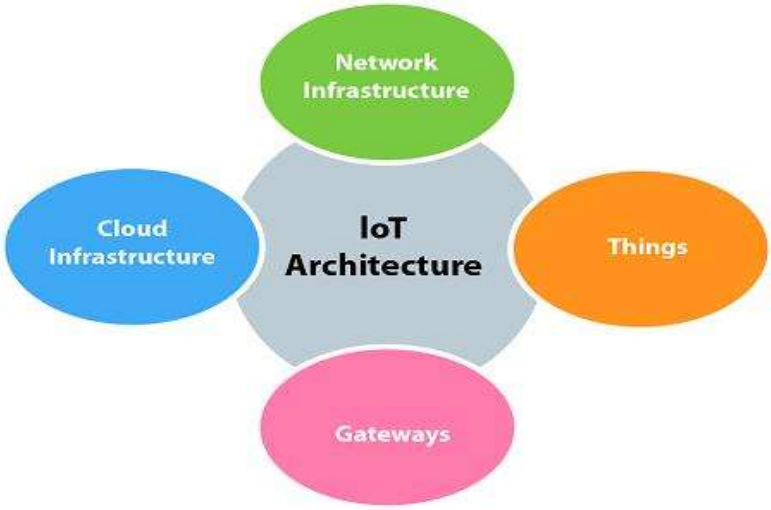


FIG 4. ARCHITECTURE OF IOT

5.APPLICATION OF IOT:

5.1 Agriculture

5.2 Smart home

5.3 Smart cities

5.4 Health care

5.5 Connected cars

5.6 Machine 2 machine

5.1 AGRICULTURE:

*Field management – strategically placed IOT sensors will enable collection of crucial data such as field history, soil moisture , and vegetation map.

*Climate analysis& forecast – installing IOT – powered weather stations will allow monitoring climate conditions and help forecast weather.

*Equipment tracking - IOT sensors installed will enable location tracking and predictive maintenance of machine by identifying defects.

*Energy & water conservation- IOT sensors can help monitor water consumption and energy consumption. Also identify faulty pipes &leaking equipment to save water.

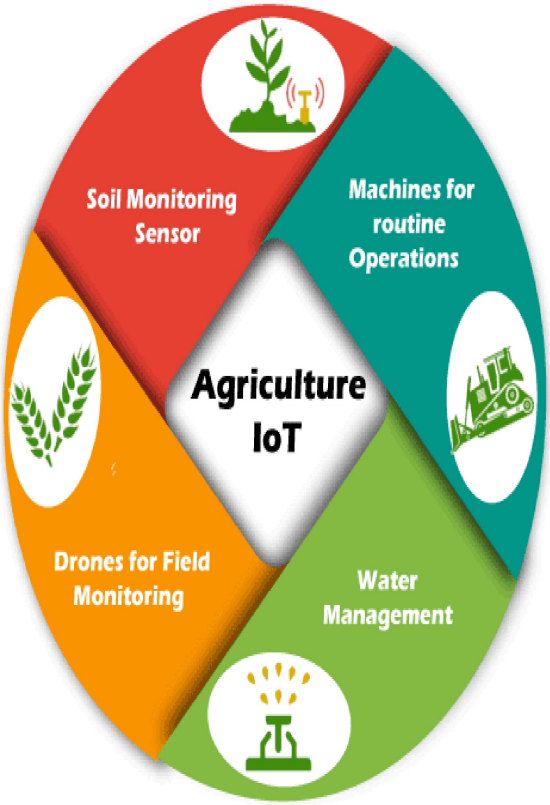


FIG5.1 AGRICULTURE OF IOT

5.2 SMART HOME:

*Device abstraction layer – the local interface that applications on the gateway use.

*Device driver interface – the interface to integrate HAN technologies.

*Remote interface – the interface between an operator cloud platform and the gateway.

*Cloud API – the interface provided to third parties from the operator cloud platform.

FIG5.2 SMART HOME

5.3 SMART CITIES:

*Resource management- collecting energy usage and water quality data to analyze and optimize consumption.

* Waste management – introducing smart recycling systems, improving sanitation.

*Eco friendly infrastructure- analyzing and reducing waste , mindful consumption natural resources,vehicle sharing system.

* Smart lighting- dimming street lights when no one around to save energy.

FIG 5.3 SMART CITY

5.4 HEALTH CARE:

*Telemedicine - remote appointment, remote diagnostics, remote monitoring, medication adherence.

*Hospital environmental condition monitoring- air quality, temperature , hazard sensing, lighting control.

*Connected ambulance - remote diagnostics, remote communication and data transfer.

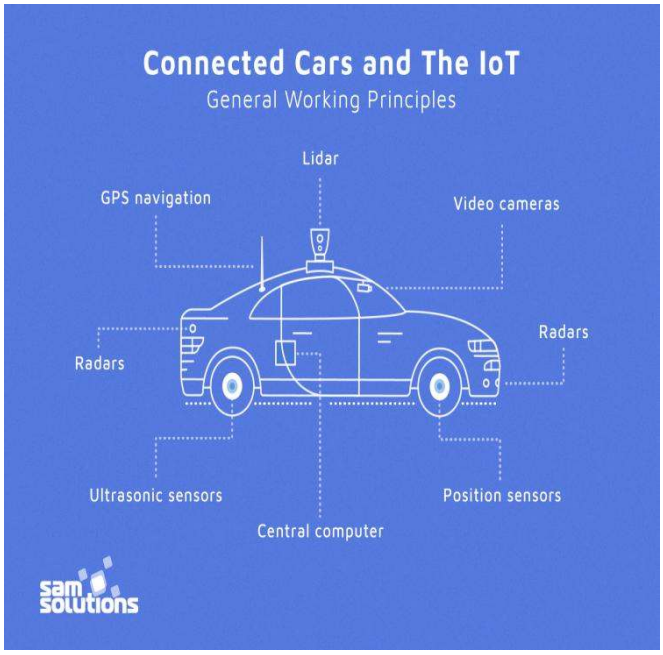
*Immersive media – media training simulation with VR, AR decision support testing.

FIG5.4 HEALTH CARE OF IOT

5.5 CONNECTED CARS:

*Thecars use several sensors and embedded system connected to the cloudand the internet to keep generating data and sending them to the cloud for informed deision –making through meachine learning.

*Through it will take a few more years for the technology to evolve completely and for countries to amend laws and policies, what we're witnessing right now is one of the best application of IOT.



Z FIG 5.5 CONNECTED CARS

5.6 MACHINE 2 MACHINE:

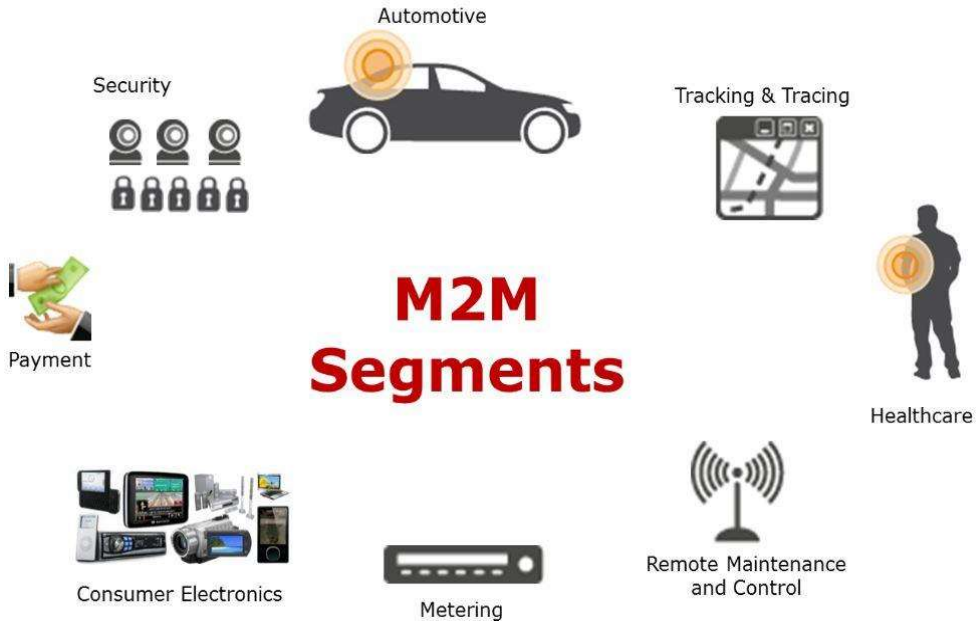


FIG 5.6 MACHINE 2 MACHINE

6. COMPONENT OF IOT:

*Devices& sensors

*Connectivity

*Data processing

*User interface

6.1 Sensors:

*A sensor is device that measures physical impact from its environment and converts it into that can be interpreted by a computer.

For example: speed, lights, sound and pressure.

6.2 Connectivity:

*Several communications protocols and technologies are used in IoT to connect to internet cloud. Depending upon range ,cost, power usage and the data rate etc. The right one used.

For example: Bluetooth, mobile phones and wi-fi

6.3 Data processing:

*In the processing stage, a computer transforms the raw data into information. The transformation carried out by using different data manipulation techniques.

For example: collecting feed of all electrical applications and extracting car number from video feed of speeding cars.

6.4 User interface:

*The information processed is made available to the end- user in some way, like giving alerts, notifications, monitoring , continuous feed or controlling the system remotely.

7.CLOUD IN IOT:

*Cloud is basically used for memory storage . Generally cloud computing is a virtualization technology.

*. Cloud computing is the combination of hardware and software resources to access the data through the cloud.

*It acts as a data storage element and configures the devices i.e., it stores bulk amount of data or information through online networking.

*Cloud doesn’t require separate software and we access data through web browser. For example, Google photos, Google drives, etc.

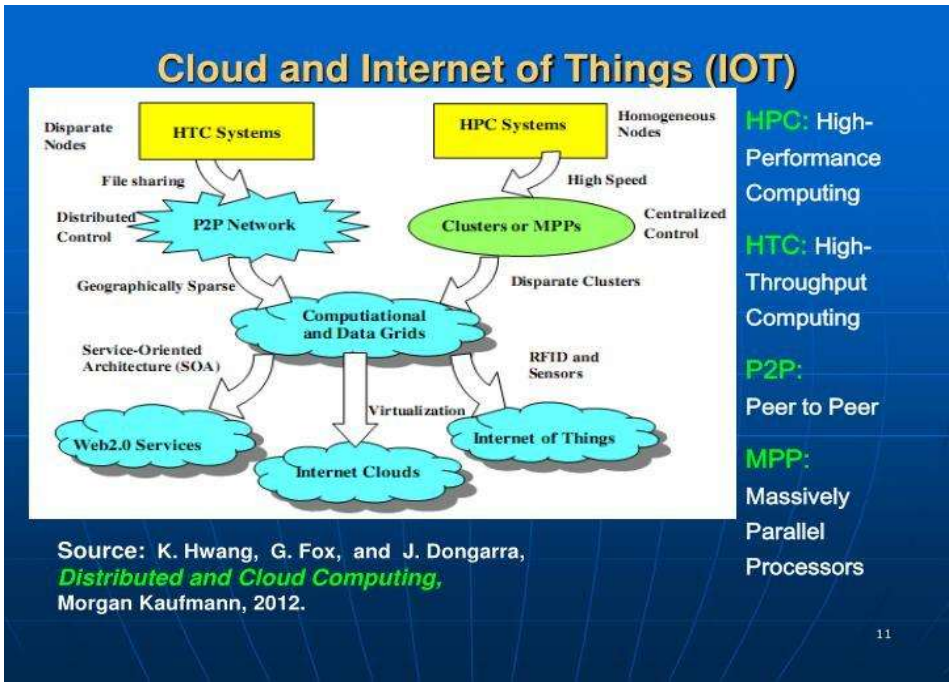


FIG 7.1 CLOUD IN IOT

7.1 CLOUD USED FOR IOT:

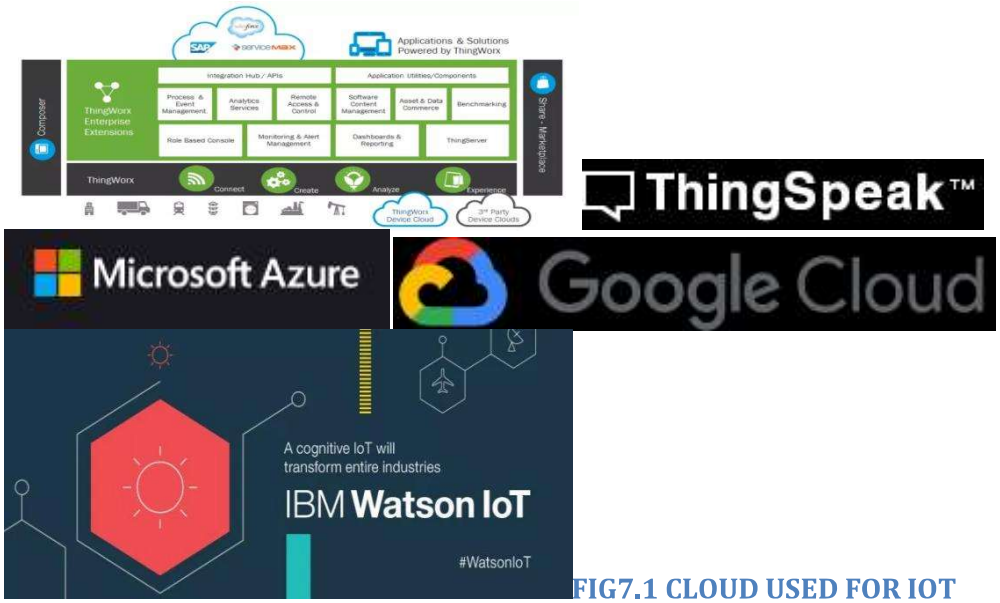


FIG7.1 CLOUD USED FOR IOT

8.TYPE OF CLOUD:

*public cloud

*Private cloud

*Community cloud

*Hybrid cloud

8.1 Public cloud:

* A public cloud is a type of computing in which a service provider makes resources available to the public via the internet.

*For example, google cloud , Microsoft azure, etc. But it provides less security as general public can access the cloud

8.2 Private cloud:

*Private cloud is also known as an internal cloud or corporate cloud. Private cloud provides computing services to a private internal network (within the organization) and selected users instead of the general public.

*For example, Oracle, Cisco, etc. It provides good security.

8.3 Community cloud:

*Community cloud is a cloud infrastructure that allows systems and services to be accessible by a group of several organizations to share the information.

*Example: Our government organization within India may share computing infrastructure in the cloud to manage data.

8.4 Hybrid cloud:

*Hybrid cloud refers to a mixed computing, storage, and services environment made up of on-premises infrastructure, private cloud services, and a public cloud.

*Here critical information is stored in private such as username & passwords while others stored in public cloud.

9. FEATURES OF IOT:

The most important features of IOT on which it works are connectivity, analyzing, integrating, active engagement, and many more. Some of them are listed below:

9.1 Connectivity: Connectivity refers to establish a proper connection between all the things of IOT to IOT platform it may be server or cloud. After connecting the IOT devices, it needs a high speed messaging between the devices and cloud to enable reliable, secure and bi-directional communication.

9.2 Analyzing: After connecting all the relevant things, it comes to real-time analyzing the data collected and use them to build effective business intelligence. If we have a good insight into data gathered from all these things, then we call our system has a smart system.

9.3 Integrating: IOT integrating the various models to improve the user experience as well.

9.4 Artificial Intelligence: IOT makes things smart and enhances life through the use of data. For example, if we have a coffee machine whose beans have going to end, then the coffee machine itself order the coffee beans of your choice from the retailer.

9.5 Sensing: The sensor devices used in IOT technologies detect and measure any change in the environment and report on their status. IOT technology brings passive networks to active networks. Without sensors, there could not hold an effective or true IOT environment.

9.6Active Engagement: ActiveIOT makes the connected technology, product, or services to active engagement between each other.

9.7Endpoint Management: It is important to be the endpoint management of all the IOT system otherwise, it makes the complete failure of the system. For example, if a coffee machine itself order the coffee beans when it goes to end but what happens when it orders the beans from a retailer and we are not present at home for a few days, it leads to the failure of the IOT system. So, there must be a need for endpoint management.

10.MICROPROCESSOR:

*A microprocessor is a computer processor where the data processing logic and control is included on a single integrated circuit, or a small number of integrated circuits.

*The microprocessor contains the arithmetic, logic, and control circuitry required to perform the functions of a computer's central processing unit.

* The integrated circuit is capable of interpreting and executing program instructions and performing arithmetic operations.

*The microprocessor is a multipurpose, clock-driven, register-based, digital integrated circuit that accepts binary data as input, processes it according to instructions stored in its memory, and provides results (also in binary form) as output.

*Microprocessors contain both combinational logic and sequential digital logic, and operate on numbers and symbols represented in the binary number system.

*The integration of a whole CPU onto a single or a few integrated circuits using Very-Large-Scale Integration (VLSI) greatly reduced the cost of processing power.

* Integrated circuit processors are produced in large numbers by highly automated metal-oxide-semiconductor (MOS) fabrication processes, resulting in a relatively low unit price.

FIG 10.1 MICROPROCESSOR

MICROCONTROLLER:

*A microcontroller (µC or uC) is a solitary chip microcomputer fabricated from VLSI fabrication. A micro controller is also known as embedded controller.

*Today various types of microcontrollers are available in market with different word lengths such as 4bit, 8bit, 64bit and 128bit microcontrollers.

*Microcontroller is a compressed micro computer manufactured to control the functions of embedded systems in office machines, robots, home appliances, motor vehicles, and a number of other gadgets.

*A microcontroller is comprises components like - memory, peripherals and most importantly a processor. Microcontrollers are basically employed in devices that need a degree of control to be ap plied by the user of th

FIG 10.2 MICROCONTROLLER

11. ARDUINO

11.1 WHAT IS ARDUINO?

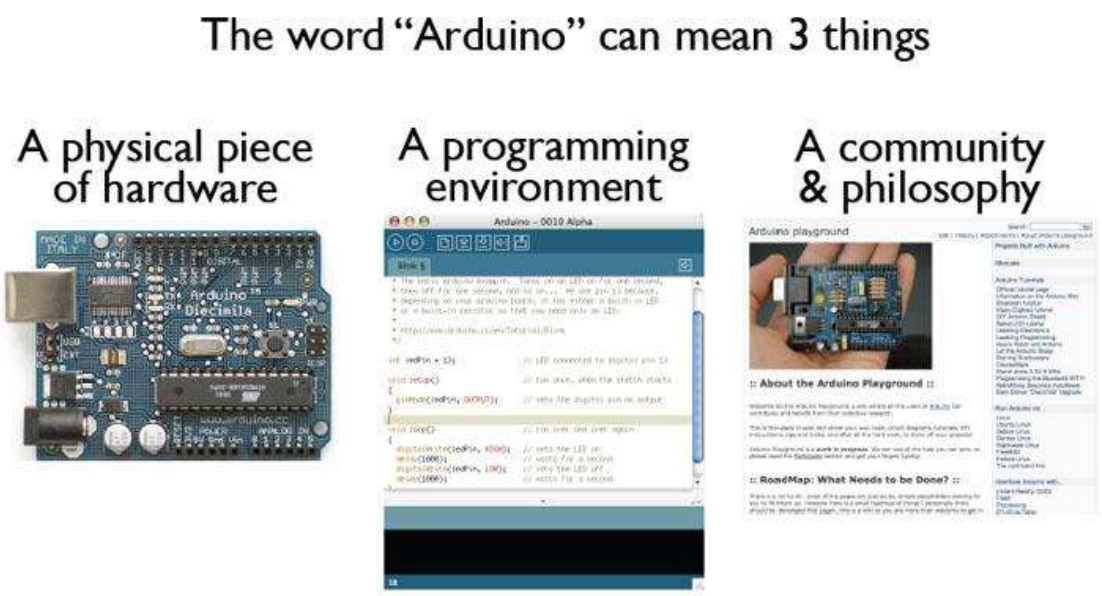


FIG 11.1 ARDUINO

11.2TYPE OF ARDUINO BOARD:

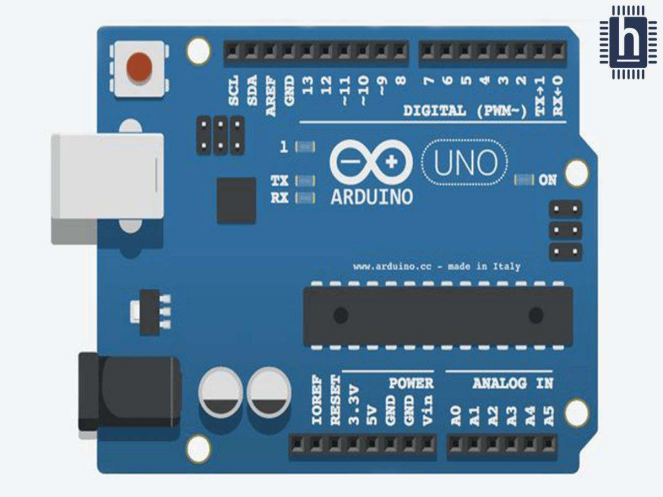
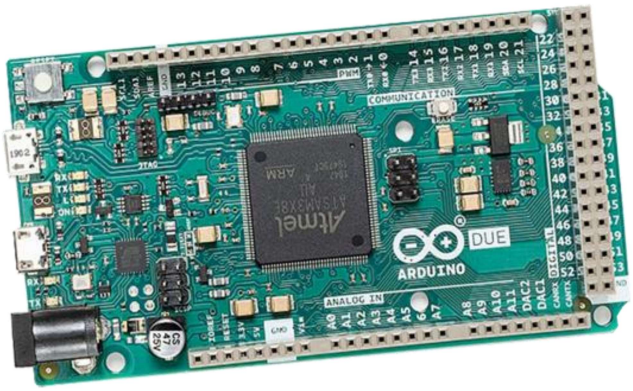


FIG 11.2.1 ARDUINO UNO



11.2.2 ARDUINO DUE

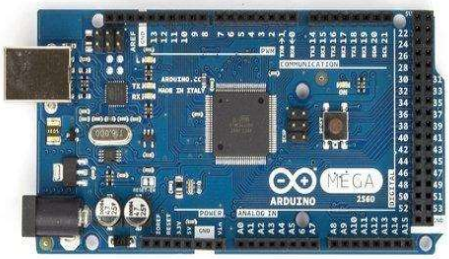


FIG 11.2.3 ARUDINO MEGA

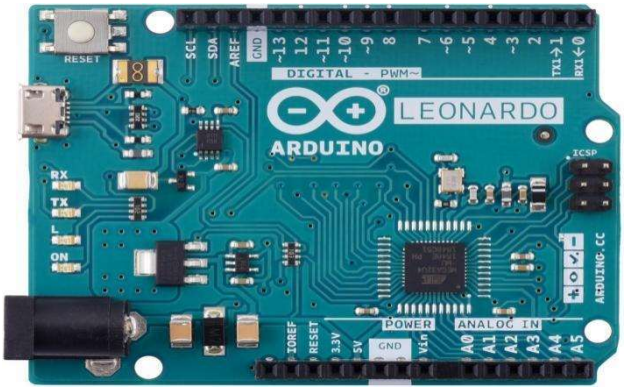
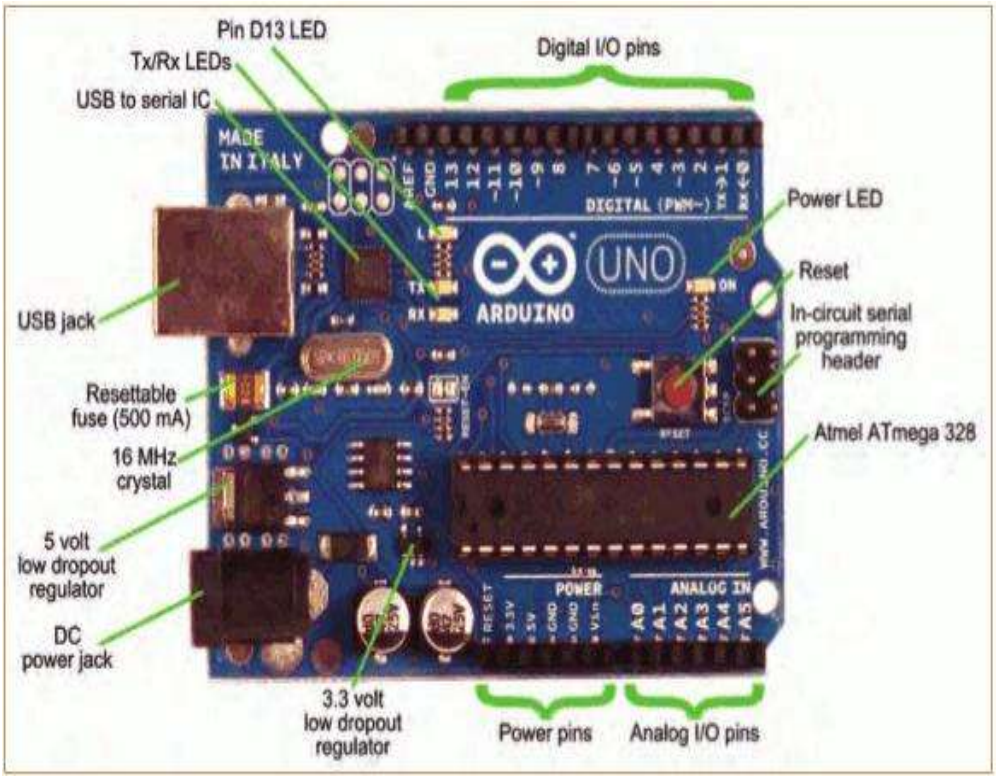


FIG 11.2.4 ARUDINO LEONARDO

11.3 THE ARDUINO DEVELOPMENT BOARD



11.4 PARAMETER

Parameter	Value
CBU type	8-bit AVR
Maximum CBU speed	20 MHz
performance	20MIPS at20 MHz
Flash memory	32 KB
SRAM	2 KB
EEPROM	1 KB
Package pin count	28 OR 32
Capacitive touch sensing channels	16
Maximum I/O pins	23
External interrupts	2
USB interface	NO

11.4 PIN DIAGRAM OF ARDUINO

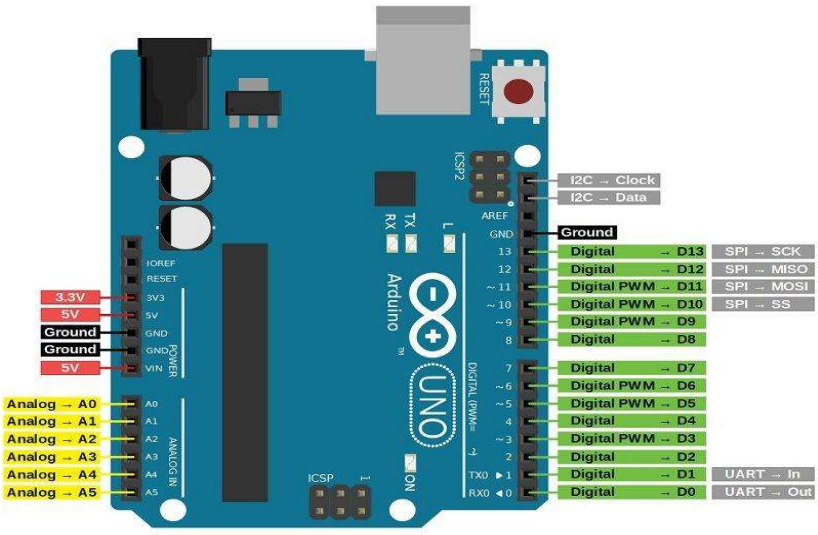


FIG 11.4 PIN DIAGRAM

Vin: This is the input voltage pin of the arduino board used to provide input supply from an external power source.

5V: This pin of the arduino board is used as a regulated power supply voltage and it is used to give supply to the board as well as onboard components.

3.3V: This pin of the board is used to provide a supply of 3.3V which is generated from a voltage regulator on the board

GND: This pin of the board is used to ground the arduino board.

Reset: This pin of the board is used to reset the microcontroller. It is used to Resets the microcontroller.

Analog Pins: The pins A0 to A5 are used as an analog input and it is in the range of 0-5V.

Digital Pins: The pins 0 to 13 are used as a digital input or output for the arduino board

Serial Pins: These pins are also known as a UART pin. It is used for communication between the arduino board and a computer or other devices. The transmitter pin number 1 and receiver pin number 0 is used to transmit and receive the data resp.

External Interrupt Pins: This pin of the Arduino board is used to produce the External interrupt and it is done by pin numbers 2 and 3.

PWM Pins: This pins of the board is used to convert the digital signal into an analog by varying the width of the Pulse. The pin numbers 3,5,6,9,10 and 11 are used as a PWM pin.

SPI Pins: This is the Serial Peripheral Interface pin, it is used to maintain SPI communication with the help of the SPI library. SPI pins include:

1. SS: Pin number 10 is used as a Slave Select
2. MOSI: Pin number 11 is used as a Master Out Slave In
3. MISO: Pin number 12 is used as a Master In Slave Out
4. SCK: Pin number 13 is used as a Serial Clock

LED Pin: The board has an inbuilt LED using digital pin-13. The LED glows only when the digital pin becomes high.

AREF Pin: This is an analog reference pin of the arduino board. It is used to provide a reference voltage from an external power supply.

11.5SOFTWARE DOWNLOAD:

*Arduino is a computation tool for sensing and controlling signals.

*It is more convenient and cost effective than using a personal computer pc.

*It's an open – source system in terms of hardware and software.

*You can download the integrated development environment(IDE)for your own OS form.

https://www.arduino.cc/en/software.

11.6 Tool bar details:

Verify:

Checks code for errors

Upload

Compiles and uploads code to the arduinoi/o board.

New

Creates a new sketch.

Open

Open sketch.

Save

Save sketch

Serial monitor

Display serial data being sent from the arduino boar

Arduino code basics:

Commands and other information are sent to LED's, motors and from sensors through **digital** and **analog** input & output pi

12. PROGRAM

12.1 LED BLINKING:

```
Void setup()

{

pinMode(13,OUTPUT);

}

Void loop()

{

digitalWrite(13,HIGH);

delay(1000);

digitalWrite(13,HIGH);

delay(1000);}
```

CONNECTION DIAGRAM:

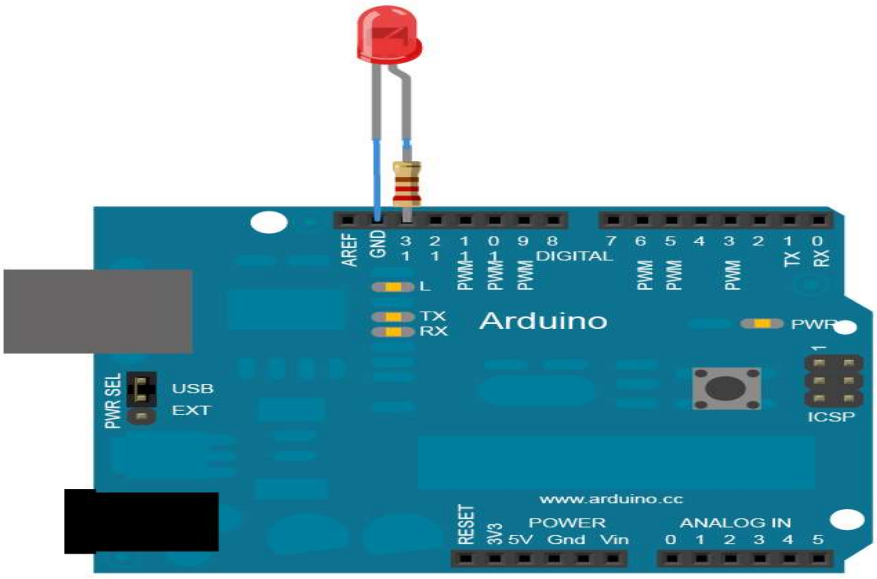


FIG12.1 CONNECTION DIAGRAM OF LED BLINKING

2. BUTTON LED:

```
Void setup()
{
pinMode(pin_no,INPUT);
pinMode(13,OUTPUT);
}
Void loop()
{
digitalRead(pin_no);
If { //statement
}
```

}

CONNECTION DIAGRAM:

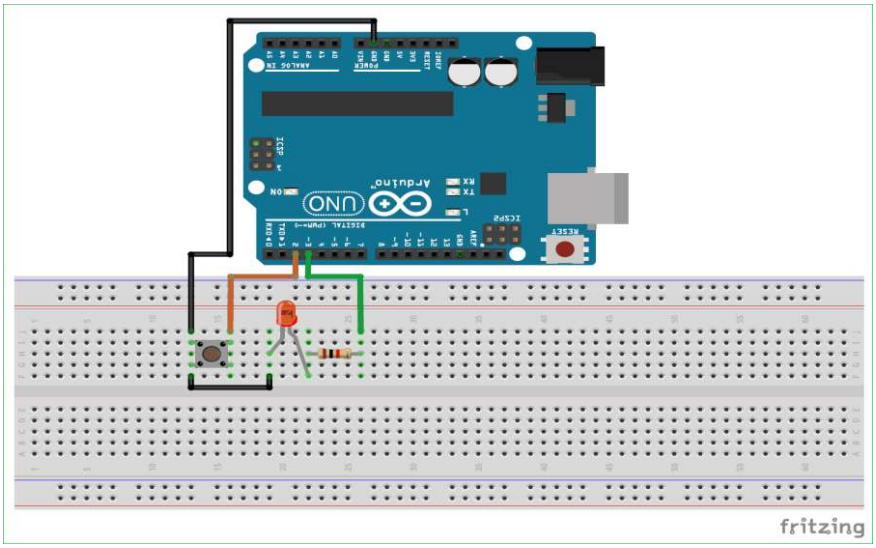


FIG12.2 CONNECTION DIAGRAM OF BUTTON LED

12.3 IR SENSORS:

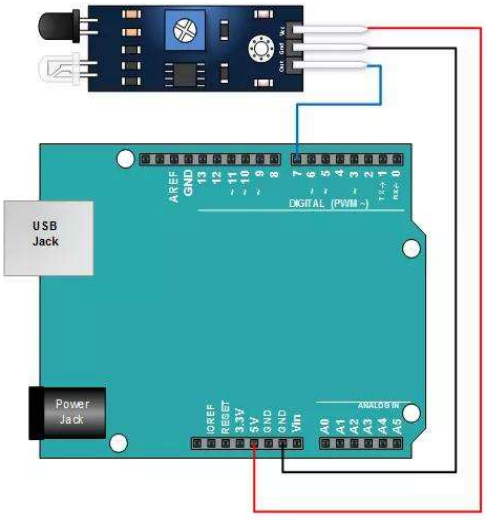


FIG12.3 CONNECTION DIAGRAM OF IR SENSORS

12.4ULTROSONIC SENSORS:

pinMode(pin_no,INPUT);

pinMode(pin_no,OUTPUT);

digitalWrite(pin_no,HIGH);

delay(_);

digitalWrite(pin_no,LOW);

delay(_);

Duration;

Distance;

CONNECTION DIAGRAM:

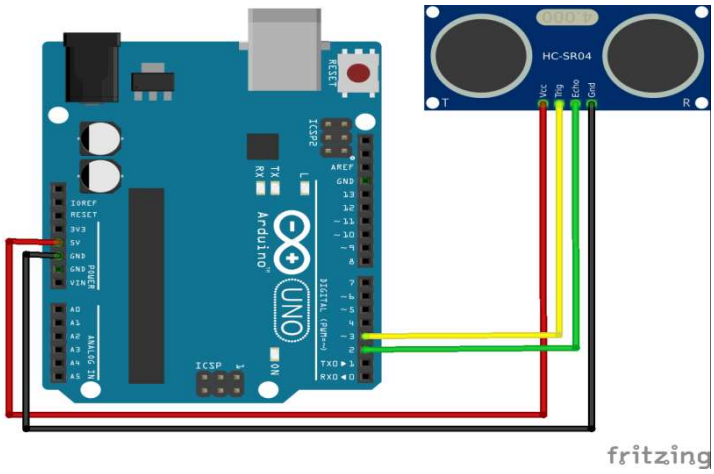


FIG12.4 CONNECTION DIAGRAM OF ULTRASONIC SENSORS

12.5 DHI 11

#include<dht.h>

#define pin D4;

Void setup

{

```
  //statement
}
Void loop
{
  //Statement
}
```

CONNECTION DIAGRAM:

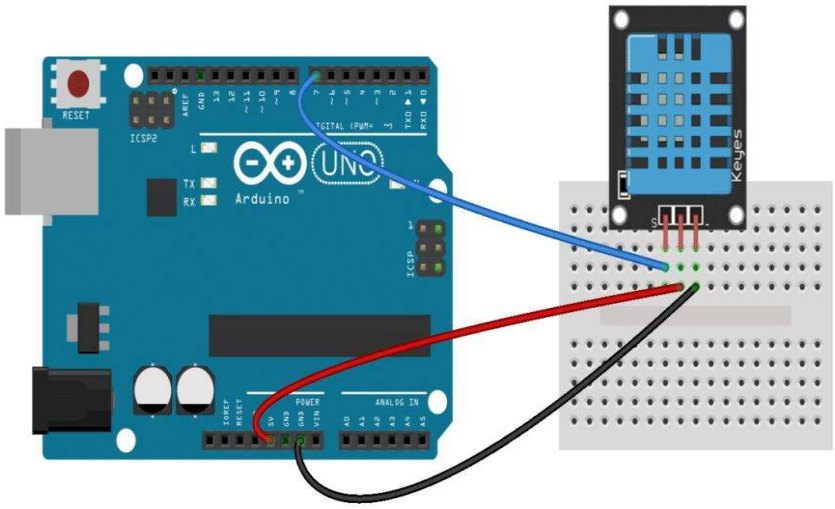


FIG12.5 CONNECTION DIAGRAM OF DHI 1

13. OUTPUT

13.1HELLO WORLD:

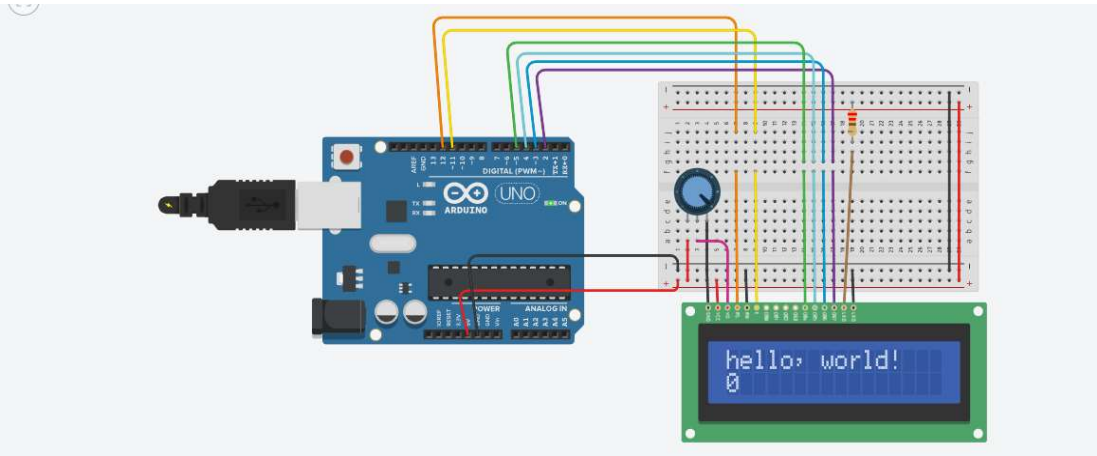


FIG 13.1 HELLO WORLD

/* LiquidCrystal Library - Hello World

Demonstrates the use a 16x2 LCD display. The LiquidCrystal

library works with all LCD displays that are compatible with the

Hitachi HD44780 driver. There are many of them out there, and you

can usually tell them by the 16-pin interface.

This sketch prints "Hello World!" to the LCD

and shows the time.

The circuit:

* LCD RS pin to digital pin 12

* LCD Enable pin to digital pin 11

* LCD D4 pin to digital pin 5

* LCD D5 pin to digital pin 4

```
 * LCD D6 pin to digital pin 3
 * LCD D7 pin to digital pin 2
 * LCD R/W pin to ground
 * LCD VSS pin to ground
 * LCD VCC pin to 5V
 * 10K   resistor:
 * ends  to +5V and ground
 * wiper  to LCD VO pin (pin 3)

 Library originally added 18 Apr 2008
 by David A. Mellis
 library modified 5 Jul 2009
 by Limor Fried (http://www.ladyada.net)
 example added 9 Jul 2009
 by Tom Igoe
 modified 22 Nov 2010
 by Tom Igoe

 This example code is in the public domain.
 http://www.arduino.cc/en/Tutorial/LiquidCrystal
 *// include the library code:
#include <LiquidCrystal.h>
// initialize the library with the numbers of the interface pins
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
void setup() {
  // set up the LCD's number of columns and rows:
```

```
  lcd.begin(16, 2);
 // Print a message to the LCD.
  lcd.print("hello, world!");
}
void loop() {
  // set the cursor to column 0, line 1
  // (note: line 1 is the second row, since counting begins with 0):
  lcd.setCursor(0, 1);
  // print the number of seconds since reset:
  lcd.print(millis() / 1000);
}
```

13.2 PUSH BUTTON:

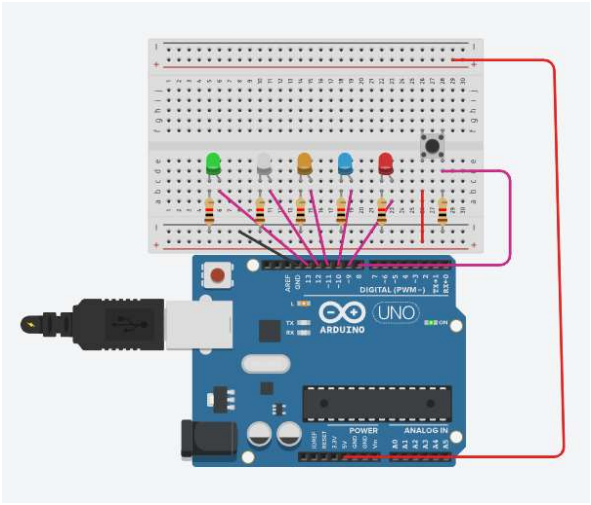


FIG 13.2 PUSH BUTTON

```
int pinButton = 8;
long t = 0;
```

```
int i = 0;
void setup(){
 Serial.begin(9600);
 pinMode(pinButton, INPUT);
 for(int e =9;e < 14; e++){
 pinMode(e, OUTPUT);
 }
}
void loop(){
 t++;
  if (t%20==0){
 digitalWrite(i+9,HIGH);
 i++;
 }
 if(digitalRead(pinButton)==HIGH){
 i=0;
 for(int e =9;e < 14; e++){digitalWrite(e,LOW);
 }
 }
 Serial.print(i);
 Serial.print("");
 Serial.print(digitalRead(pinButton));
 Serial.print("");
 Serial.println(t);
  delay(1);
}
```

13.3 FORCE SENSORS WITH6 LEDS

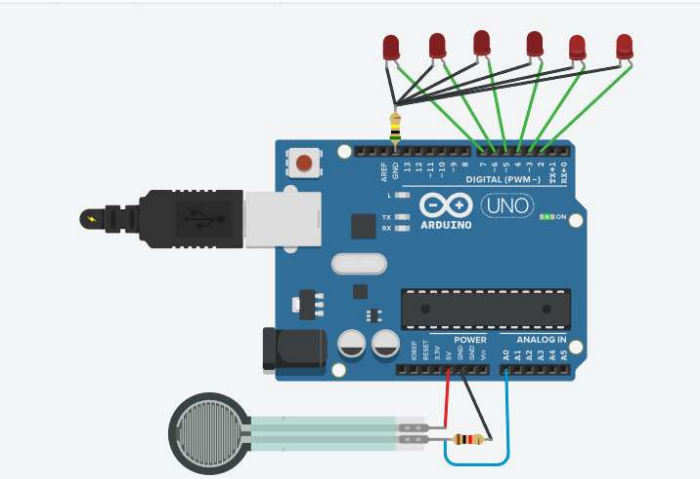


FIG 13.3 LEDS

```
#definefsrpin A0

#define led1 2

#define led2 3

#define led3 4

#define led4 5

#define led5 6

#define led6 7


int fsrreading;

void setup() {
```

```
Serial. begin(9600);

 pinMode(led1, OUTPUT);
  pinMode(led2, OUTPUT);
  pinMode(led3, OUTPUT);
  pinMode(led4, OUTPUT);
  pinMode(led5, OUTPUT);
  pinMode(led6, OUTPUT);
}
void loop() {

  fsrreading = analogRead(fsrpin);

  Serial.println(fsrreading);

  if (fsrreading > 200) {
    digitalWrite(led1, HIGH);
  }
  else digitalWrite(led1, LOW);
  if (fsrreading > 450) {
    digitalWrite(led2, HIGH);
  }
  else digitalWrite(led2, LOW);
```

```
if (fsrreading > 550) {
  digitalWrite(led3, HIGH);
}
else digitalWrite(led3, LOW);
if (fsrreading > 650) {
  digitalWrite(led4, HIGH);
}
else digitalWrite(led4, LOW);
if (fsrreading > 800) {
  digitalWrite(led5, HIGH);
}
else digitalWrite(led5, LOW);
if (fsrreading > 900) {
  digitalWrite(led6, HIGH);
}
else digitalWrite(led6, LOW);
}
```

14.1 ADVANTAGE OF IOT:

***Efficient resource utilization:** If we know the functionality and the way that how each device work we definitely increase the efficient resource utilization as well as monitor natural resources.

***Minimize human effort:** As the devices of IOT interact and communicate with each other and do lot of task for us, then they minimize the human effort.

***Save time:** As it reduces the human effort then it definitely saves out time. Time is the primary factor which can save through IOT platform.

***Improve security:** Now, if we have a system that all these things are interconnected then we can make the system more secure and efficient.

14.2 DIS ADVANTAGE OF IOT:

***Security:** As the IOT systems are interconnected and communicate over networks. The system offers little control despite any security measures, and it can be lead the various kinds of network attacks.

***Privacy:** Even without the active participation on the user, the IOT system provides substantial personal data in maximum detail.

***Complexity:** The designing, developing, and maintaining and enabling the large technology to IOT system is quite complicated.

15.CONCLUTION:

*In conclusion, internet of things is the concept in which the virtual world of information technology connected to the real world of things.

*The Internet of Things is happening now, and there is a need to address its challenges and maximize its benefits while reducing its risks.

*The Internet Society cares about IOT because it represents a growing aspect of how people and institutions are likely to interact with and incorporate the Internet and network connectivity into their personal, social, and economic lives.

*Solutions to maximizing the benefits of IOT while minimizing the risks will not be found by engaging in a polarized debate that pits the promises of IOT against its possible perils.

*Rather, it will take informed engagement, dialogue, and collaboration across a range of stakeholders to plot the most effective ways forward.