IOT BASED SMART FACTORY SYSTEM

ABSTRACT

- The Internet of Things (IoT) is playing a significant role in the transformation of traditional factories into smart factories in Industry 4.0 by using network of interconnected devices, sensors, and software to monitor and optimize the production process.
- Predictive maintenance using the IoT in smart factories can also be used to prevent machine failures, reduce downtime, and extend the lifespan of equipment.
- To monitor and optimize energy usage during part manufacturing, manufacturers can obtain real-time insights into energy consumption patterns by deploying IoT sensors in smart factories.
- Also, IoT can provide a more comprehensive view of the factory environment to enhance workplace safety by identifying potential hazards and alerting workers to potential dangers.

- Suppliers can use IoT-enabled tracking devices to monitor shipments and provide real-time updates on delivery times and locations in order to analyze and optimize the supply chain in smart factories.
- Moreover, IoT is a powerful technology which can optimize inventory management in smart factories to reduce costs, improve efficiency, and provide real-time visibility into inventory levels and movements.
- To analyze and enhance the impact of internet of thing in smart factories of industry 4.0, a review is presented.
- Applications of internet of things in smart factories such as predictive maintenance, asset tracking, inventory management, quality control, production process monitoring, energy efficiency and supply chain optimization are reviewed.
- Thus, by analyzing the application of IoT in smart factories of Industry 4.0, new ideas and advanced methodologies can be provided to improve quality control and optimize part production processes

INTRODUCTION

- One critical enabling technology for smart manufacturing is the Internet of Things (IoT), which is the formation of a global information network composed of large numbers of interconnected “Things.”
- Here, machines, equipment, products, and material handling manufacturing “Things” may include materials, sensors, actuators, controllers, robots, human operators, equipment to name but a few.
- The internet-based IoT infrastructure provides an unprecedented opportunity to link manufacturing “Things,” services, and applications to achieve effective digital integration of the entire manufacturing enterprise.
- This integration can be extended from enterprise resource planning (ERP) to supply chain management (SCM) to manufacturing execution system (MES) to process control systems (PCS).
- However, the rapid growth of large-scale IoT sensing leads to the creation/manifestation of big data that are stored locally or in data repositories distributed over the cloud

- The fourth industrial revolution, known as Industry , includes smart factories as a key element in order to enhance efficiency in part production.
- Industry is characterized by the incorporation of cutting-edge technologies into industrial processes to increase productivity, flexibility, and the Internet of Things (IoT), artificial intelligence(AI), and robotics .
- A smart factory is a highly automated manufacturing facility in industry that utilizes advanced technologies, such as artificial intelligence (AI), the Internet of Things (IoT), and robotics, to optimize its operations and improve its efficiency, productivity, and quality.
- Smart factories are facilities that use digital technologies to improve operational efficiency and productivity .
- Smart factories are highly automated and connected factories which are relied on advanced technologies such as IoT, artificial intelligence, and robotics to optimize production processes and enhance operational efficiency .
- In a smart factory of Industry , machines and equipment are interconnected and communicate with each other and with a central control system to enable real-time monitoring, analysis, and decision-making .
- This allows manufacturers to optimize their processes, decrease environmental pollution, and increase flexibility to respond quickly to changing market demands.
- The application of IoT in smart factories is recently developed in order to drive the digital transformation of manufacturing, and enable companies to operate more efficiently, cost-effectively, and sustainably .
- Smart factories are becoming increasingly popular, and IoT is a key technology in making these factories possible .

- A. The Evolution of the Internet :

- The Internet's reach and connectivity have touched every aspect of human endeavor.
- It is estimated that around 47% of the world population were internet users in 2015 .
- In the pre-internet stage, telecommunication advanced from the concept of the "speaking telegraph" by Innocenzo Manzetti in 1844 through the first New York to Chicago phone call by Alexander Bell in 1892 to the burgeoning mobile and smart phone technologies.
- In 1960, the US Department of Defense funded the ARPANET project to develop the first prototype of Internet – interconnected computer networks for fault-tolerant communications.
- From the 1960s to the 1990s, the world saw rapid developments of content materials in the internet such as emails, information, entertainment, web browsing, and HTML webpages.
- After the 1990s, the internet began to provide more services to individual users and business users such as online auctions, retailing, shopping, advertisements, search, and financial transactions.
- Since the 2000s, social networks have facilitated interconnectivity among billions of people, e.g., Linkedin, Facebook, and Twitter

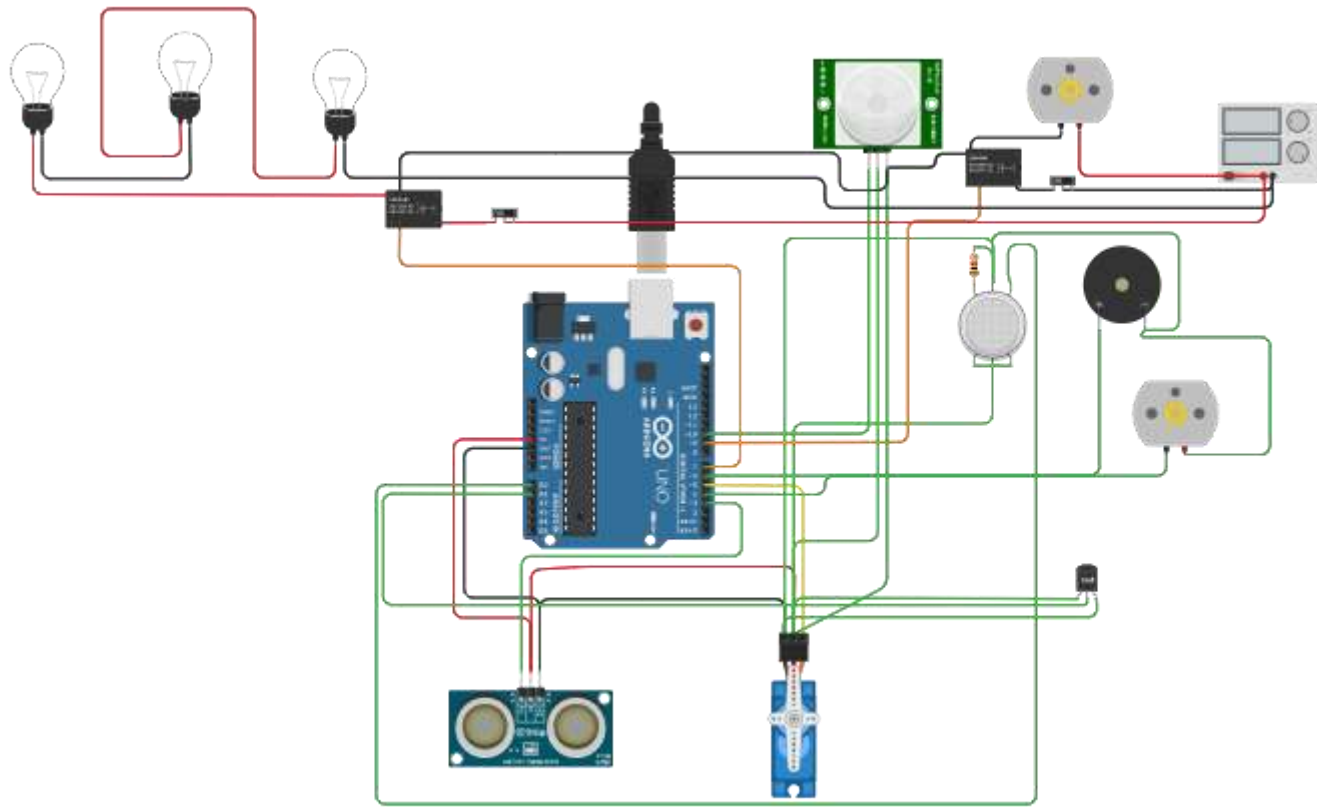
- B. IoT Sensing :

- The concept of IoT was first coined by Ashton at the MIT Auto-ID Center in 1999 .
- The term IoT means the formation of an “Internet” composed of large numbers of interconnected “Things.”
- Here, the “Internet” refers to a global inter-networking infrastructure that uses the TCP/IP protocol to connect and remotely control “Things”.
- High- The level communication based on the TCP/IP suite may be supported by a blend of low-level wired and wireless technologies such as Ethernet, Wi-Fi, Bluetooth, ZigBee, radio frequency identification (RFID), or barcodes.
- “Things” refer to any objects (either physical or virtual) that have unique identities and can sense, collect and/or exchange data about environmental and operational dynamics

- IoT Technologies:

- There are many enabling technologies (e.g., cloud computing, virtual reality, IPv6, ambient intelligence) contributing to the rapid development and implementation of IoT systems.
- This section presents the discussion of 3 key technologies – cloud computing, virtual reality, and big data analytics – that promise to improve IoT-enabled manufacturing services.

METHODOLOGY



- CODE:

```
#include <Servo.h> Servo servo_5;

const int pingUltra = 3;

const int smokePin = A0;

const int buzzer Sm = 4;

const int tempSen = A1;

const int fanExTemp = 6;

const int pirSensor = 10;

const int pirMotor = 9;

const int pirBulb = 7;
```

```
int smoke = 0;

int temp = 0;

int pir = 0;

void setup() {

Serial.begin(9600);

 servo 5.attach(5);

pinMode(smokePin, INPUT);

pinMode(buzzer Sm, OUTPUT);

 pinMode(tempSen, INPUT);
```

```
pinMode(fanExTemp, OUTPUT);

pinMode(pirSensor, INPUT);

pinmode(pirBulb, OUTPUT);
}
 void loop() {

long duration, entryDis;

pinMode(pingUltra, OUTPUT);

digitalWrite(pingUltra, LOW);

delayMicroseconds(2);

digitalWrite(pingültra, HIGH);

 delayMicroseconds(5);
```

```
digitalWrite(pingUltra, LOW);

pinMode(pingUltra, INPUT);

duration = pulseIn(pingUltra, HIGH);

entrydis = microsecondstoCentimeters(duration);

if (entryDis , 30) {

servo_5.write(180);

 delay(1000);

}
```

```
else{
servo_5.write(0);
}

smoke = analogread(smokePin);
if(smoke >= 120) {
digitalWrite(buzzerSm, HIGH);
delay(500);
}
else{
digitalWrite(buzzerSm, LOW);
}

Temp = ( -40 + 0.488155*(analogREad(tempSen) – 20);
If (temp >= 30) {
digitalWrite(fanExTemp, HIGH);
}
```

```
else {
digitalWrite(fanExTemp, LOW);

pir = digitalRead(pirSensor);
if (pir == HIGH)  {
digitalWrite(pirMotor, HIGH);
digitalWrite(pirBulb, HIGH);

}
else {
digitalWrite (pirMotor, LOW);
 digitalWrite (pirBulb, LOW);

}
```

```
serial.print(“Dis: “);
 Serial.println (entryDis);
//Serial.print(“ “);
Serial.print(“Smoke: “);
Serial.println(smoke);
//Serial.print(“ “0;
 Serial.print(“Temp: “);
Serial.println(temp);
//Serial.print(“ “);
Serial.print(“Dete: “);
 Serial.println(pir);
Serial.println(“            “);
Delay(1000);
}
long microsecondsToCentimeters(long microseconds) { return microseconds / 29  / 2;
}
```

Conclusion :-

- Smart factories are factories that use connected devices and real-time data to optimize production processes, improve efficiency, and minimize environmental pollution of part production.
- The IoT is a critical component in the development of smart factories in terms of productivity enhancement of part production.
- IoT has the potential to revolutionize the manufacturing industry by improving efficiency, reducing costs, and increasing productivity.
- IoT devices can automatically reorder items when inventory levels fall below a certain threshold, reducing the need for manual intervention and ensuring that inventory is always at optimal levels.
- By connecting machines, devices, and sensors, smart factories can improve efficiency, productivity, and safety, and reduce waste and downtime in part manufacturing process.

- IoT can provide end-to-end visibility of the supply chain, allowing factory managers to track inventory from the supplier to the factory and then to the end customer.
- The process can be used in order to optimize the supply chain, reduce lead times.
- Smart factories are just the beginning of what is possible with this technology.
- IoT sensors can be used to monitor environmental factors such as temperature, humidity, and air quality, ensuring that the factory environment is safe and comfortable for workers.
- Moreover, IoT sensors can be attached to inventory items and placed throughout the factory in order to track their location and movements.
- As a result, managers know exactly where the inventory is located at any given moment, reducing the risk of lost or misplaced items.

- IoT sensors can track inventory levels in real-time, helping manufacturers optimize their inventory levels and avoid stockouts.
- The process can reduce production delays and ensures that manufacturers always have the materials they need to meet customer demands.
- As a consequence, the inventory levels can be optimized in order to reduce the stockouts and overstocking conditions in part production process.
- IoT sensors can collect data on product usage and demand, enabling factory managers to predict when certain items will need to be restocked.
- IoT sensors can monitor the conditions of the inventory, such as temperature and humidity, to ensure that they are stored in optimal conditions.
- IoT devices can monitor product quality in real-time, detect defects, and trigger alerts if quality standards are not met during part production.
- As a result, factory managers can quickly take corrective action and prevent defective products from leaving the factory.
- IoT-enabled machines can also be used to automate production processes, reducing the need for manual intervention and increasing production efficiency.
- The IoT is transforming inventory management in smart factories by providing real-time data, automating processes, and improving visibility.
- By utilizing these technologies, factories can increase part manufacturing productivity, reduce waste materials, and improve inventory management procedures in process of part production.
- Overall, the IoT is poised to revolutionize the way smart factories operate.
- With IoT-enabled devices, factories can collect and analyze datain real-time, optimize operations, and improve efficiency.
- However, there are still many areas of IoT in smart factories that require further research. Here are some potential future research workdirections.

future research work directions

1. Security and privacy: As more devices are connected to the Internet, security and privacy become critical concerns. Research can explore new ways of securing IoT devices and networks to prevent cyber-attacks, data breaches, and other threats. Future research could focus on developing secure and privacy-preserving IoT architectures for smart factories .
2. Edge computing: Edge computing involves processing data closer to the source rather than sending it to the cloud. In smart factories, this can help reduce latency, improve response times, and enable real-time decision-making. Future research can focus on developing more efficient and effective edge computing algorithms and architectures.
3. Machine learning and artificial intelligence: Machine learning and artificial intelligence (AI) can help smart factories optimize production processes and improve efficiency. Future research could explore the use of machine learning and AI in smart factories, and how these technologies can be used to drive innovation and improve outcomes.
4. Interoperability: The lack of interoperability between IoT devices from different vendors is a significant challenge. Research can explore ways to improve interoperability through open standards, protocols, and APIs, which can help manufacturers integrate different devices and systems.
5. Energy efficiency: IoT devices require a constant supply of power, which can be a challenge in factories where power is limited or expensive. Future research can focus on developing more energy-efficient IoT devices, networks, and architectures to help reduce energy consumption and costs