# PRO-MAG


**MADRAS INSTITUTE OF TECHNOLOGY**
**DEPARTMENT OF PRODUCTION TECHNOLOGY**
**THE ASSOCIATION OF PRODUCTION ENGINEERS**
**BATCH: 2017-2018**

# PARALLEL MANIPULATORS IN ROBOTICS

A parallel manipulator is a mechanical system that uses several computer-controlled serial chains to support a single platform, or end-effector. Perhaps, the best known parallel manipulator is formed from six linear actuators that support a movable base for devices such as flight simulators. This device is called a Stewart platform or the Gough-Stewart platform in recognition of the engineers who first designed and used them.

**Design features:**

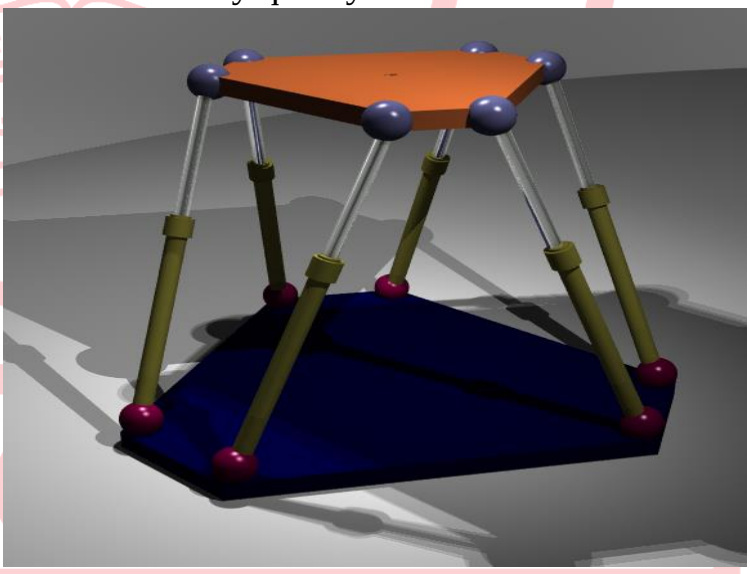
A parallel manipulator is designed so that each chain is usually short, simple and can thus be rigid against unwanted movement, compared to a serial manipulator. Errors in one chain's positioning are averaged actuator must still move within its own degree of freedom, as for a serial robot; however in the parallel robot the off-axis flexibility of a joint is also constrained by the effect of the other chains. It is this closed-loop stiffness that makes the overall parallel manipulator stiff relative to its components, unlike the serial chain that becomes progressively less rigid with more components.

**Concomitant motion:**

Manipulators with less than six degrees of freedom cannot have all motion in ϵR^6. So, its space is decomposed to two important sub-spaces called motion and constraint subspaces. In the motion space, the actual DoF of the mechanism may contain dependent motion. Dependent motions are called parasitic or concomitant motion of the output plate. Hence, concomitant motions refer to some dependent motions that accompany with other independent motions of the task space which may introduce some undesired motion components which lead to lower manipulation accuracy/quality and more difficulties in calibration.

**Applications:**

- Flight simulators
- Automobile simulators
- In work processes
- Photonics/Optical fiber alignment



**Parallel Manipulator**

**NAME:B. ASHWATH SRIRAM**

**REG NO: 2018507007**

# RECENT ADVANCEMENT IN MANUFACTURING
# ARTIFICIAL INTELLIGENCE IN MANUFACTURING

Today artificial intelligence is one of the components in Industry 4.0. Artificial Intelligence is used in the following field

1. **Quality and Inspection**
2. **Customer Service**
3. **Robotics**

## 1. Quality and Inspection:

Some flaws in the components cannot be found out by naked for detecting those flaws we can use the Convolutional Neural network, which is a technique in Artificial intelligence in which we can train the system with images of the flaw so it can detect the flaw on the production line. Landing.ai, a company founded by Andrew Ng, offers an automated visual inspection tool to find even microscopic flaws in products. The system recognizes defects, marks them, and sends alerts.

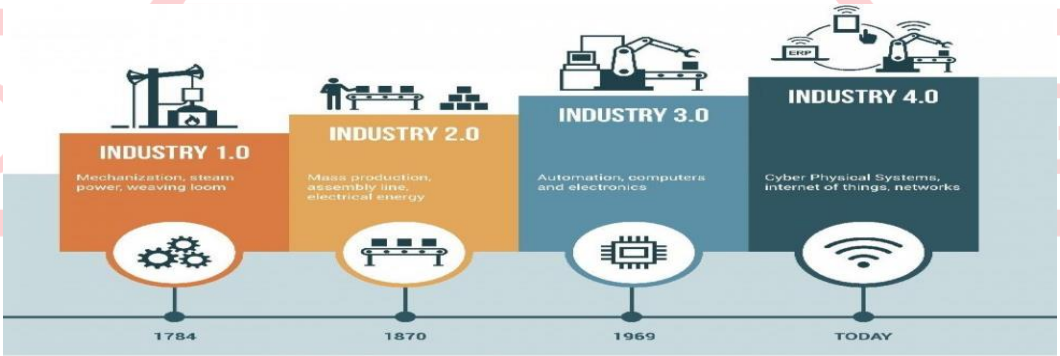
## 2. Customer Service:

In manufacturing, however, the significance of client support is often neglected – which is a mistake as lost customers can mean millions of dollars in lost sales. AI solutions can analyze the behaviors of customers to identify patterns and predict future outcomes. Observing actual customers' behaviors allows companies to better answer their needs. In 2018, Nokia had released the latest version of its Cognitive Analytics for Customer Insight software that can consistently deliver a superior real-time and personalized customer experience.

## 3. Robotics:

Nowadays most of the company uses the robot to take care of the work. The conventional robot requires a specific program for taking care of the task but the AI-powered robot does not require any programming because it can interpret 3D Models. In 2017, Siemens had developed a two-armed robot, which can manufacture components without programming it.

Today most of the company are working on incorporating AI in their company within 5-10 years it will be the game-changer of the modern industrial era.




**Evolution of Artificial Intelligence**

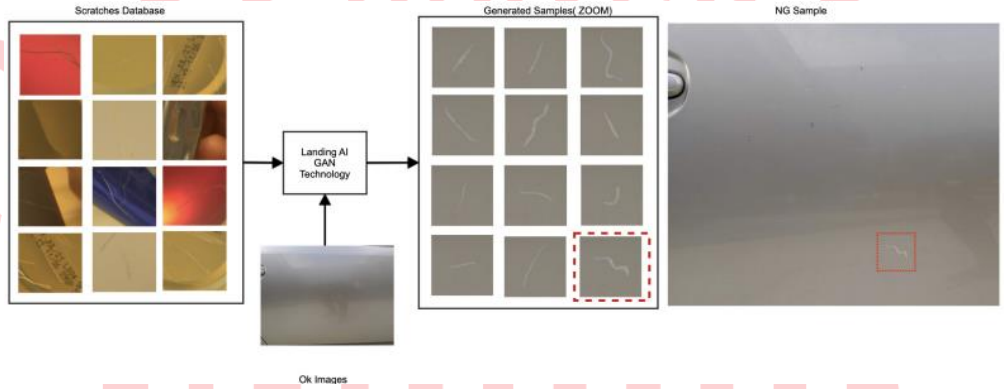
**NAME: ASHWIN A L**

**REG NO: 2018507008**

# ARTIFICIAL INTELLIGENCE IN QUALITY CONTROL

Now the world is moving in the direction of digital transformation, the need for anticipating the need for the market in the future and developing the system, which can fulfil the needs, is needed. The present way of inspecting every component by the naked eye is now inevitable.

Instead of the typical human inspector checklist, AI algorithms can check 25 or more items all at once. To understand the real value of this process, we first need a deeper understanding of classic manufacturing processes. In this article, we are going to look in detail about role, benefits and challenges of AI in Quality Control.




**Artificial Intelligence in Quality Control**

## Challenges of AI in Quality Control

The above image is one of the examples of AI-based Quality Assurance. This system was developed by Landing. The system is created in such a way if a manufacturer wants to detect a certain defect he wants to train the model with the image of that defect and the image of the non-defect component. After creating the model he should export the model and load it on a controller with a Camera to detect the defects in the components.

This system can easily detect the defect which is not seen by our naked eye. Since working at night is tedious for the employees, due to fatigue they might not be able to detect the defect in those cases this will be a good feedback system for them.



**NAME: ASHWIN A L**

**REG NO: 2018507008**

# HEATING VENTILATION AND AIR CONDITIONING (HVAC)

Heating, ventilation, and air conditioning (HVAC) is the technology of indoor and vehicular environmental comfort. Its goal is to provide thermal comfort and acceptable indoor air quality. HVAC system design is a sub discipline of mechanical engineering, based on the principles of thermodynamics, fluid mechanics and heat transfer.

## HVAC information for homeowners

Heating, ventilation, and air-conditioning systems, a mouthful more commonly referred to as HVAC (H-vack) systems, keep our homes cool in summer and warm in winter. The three components of types HVAC system include air conditioning, ventilation, and heating.

## Energy Efficiency

Since the 1980s, manufacturers of HVAC equipment have been making an effort to make the systems they manufacture more efficient. This was originally driven by rising energy costs, and has more recently been driven by increased awareness of environmental issues. Additionally, improvements to the HVAC system efficiency can also help increase occupant health and productivity.

## HVAC INDUSTRY ANS STANDARDS

The HVAC industry is a worldwide enterprise, with roles including operation and maintenance, system design and construction, equipment manufacturing and sales, and in education and research. The HVAC industry was historically regulated by the manufacturers of HVAC equipment, but regulating and standards organization like HARDI, ASHRAE, SMACNA, ACCA, Uniform Mechanical Code, International Mechanical Code, and AMCA have been established to support the industry and encourage high standards and achievement.

The starting point in carrying out an estimate both for cooling and heating depends on the exterior climate and interior specified conditions. However, before taking up the heat load calculation, it is necessary to find fresh air requirements for each area in detail, as pressurization is an important consideration.



**NAME: KAMALESH S H**

**REG NO: 2018507015**

# SWARM ROBOTICS

Swarm robotics has its origins in swarm intelligence and, in fact, could be defined as "embodied swarm intelligence". Initially, the main focus of swarm robotics research was to study and validate biological research. In recent years, the focus of swarm robotics has been shifting: from a bio-inspired field of robotics, swarm robotics is increasingly becoming an engineering field whose focus is on the development of tools and methods to solve real problems. Swarm robotics is the use of numerous, autonomous robotics to accomplish a task. Robot swarms coordinate the behaviours of a large number of relatively simple robots in a decentralized manner. Swarm robotics plays an important role in the development of collective artificial intelligence.

Current uses for robot swarms include:

- Search and rescue
- Supply Chain Management
- Precision agriculture
- Military reconnaissance

The researchers use the *bee's algorithms* to replicate that same behavior with robots.
**To wrap up:** Swarm robotics has also been used to investigate, via controlled experiments, the conditions under which some complex social behaviors might result out of an evolutionary process. For example, robot swarms have been used to study the evolution of communication and collective decision making.

**Swarm Robots**

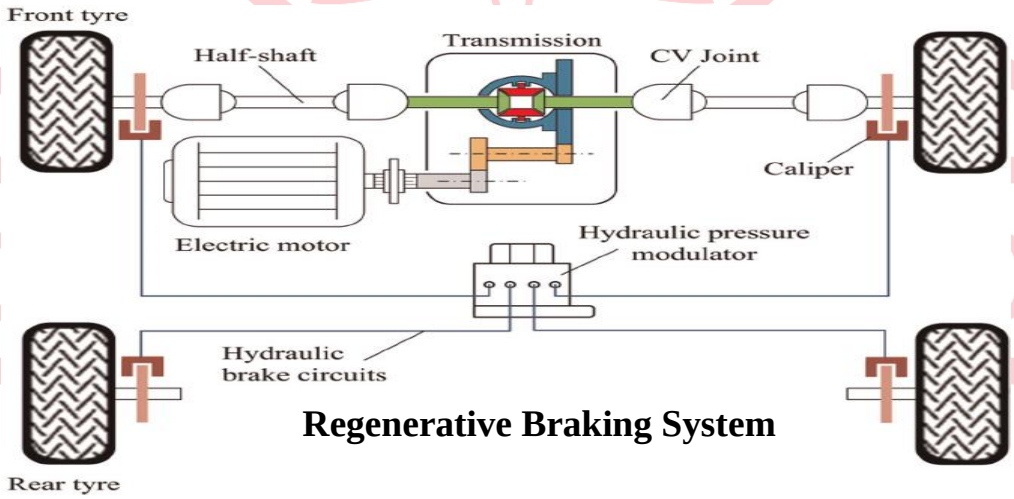
**NAME: KEERTHIVATSAN S**

**REG NO: 2018507018**

# REGENERATIVE BRAKING IN ELECTRIC CARS

Regenerative braking technology is widely used in electric vehicles especially electric cars. Electric cars uses induction motor for its operation instead of using IC engines which are used in normal cars. The speed of the wheel drive can be controlled by varying frequency of power supply supplied to induction motor. The power supply is produced from battery. The induction works on the condition that the rotor speed must be less than RMF. The inverter is used to convert DC to AC power supply and it also control the frequency and amplitude of power supply. The main advantage of electric car is it is easy to control efficiently using one pedal. The main reason behind this is regenerative breaking. In electric cars huge kinetic energy of the car is stored in the form of electricity instead of wasting in the form of heat.The conversion of kinetic energy into electric energy used to charge of the battery. For this conversion,the induction motor acts as generator.

For the conversion of induction motor into generator the rotor speed should be greater than RMF .The inverter is used to control the input power frequency and keeps rotor speed less than RMF . The rotation of wheel drive rotates the motor and it produces the electricity and it is stored in stator coils, the generated electricity will be converted using invertor converts and sends to battery for storage. The electromagnetic force acts on the rotor during this process this will slow down the car without applying brake. In this way the electric car can be efficiently driven including the charging of battery using one pedal itself. The brake is applied only during complete stop of the vehicle. The electric cars are has many advantages compared to IC engine cars. But still it has some serious advantages like high cost,charging time etc. But the electric cars can control the pollution in the larger aspect which is good for the environment. The present situation in our capital Delhi is in worse condition. The awareness and development is needed in electric vehicles. Tesla is example where they done a huge development in Battery storage, fast charging and super charger. This kind of automation should be implemented in every country so the environment will be safe.




**Regenerative Braking System**

**NAME: MAGESH M**

**REG NO: 2018507023**

# SUSTAINABLE PRODUCT DESIGN- TENSEGRITY

TENSEGRITY (light-weighting strategy) is a term coined by Buckminster Fuller to describe the strategy of using tension for structural integrity. Sometimes turning compressive stress into tensile stress can help **you to reduce material use.** It's ideal when working with materials that have strength in tension, which is similar to their strength in compression.

**Strength in Tension:**

Any design that resists compression forces is also resisting buckling. Compression can buckle your product long before the strength of the materials fails, especially in long or skinny parts. By contrast, a part under tension will fail at the yield strength of the material. So, you can make the elements in tension thinner without compromising structural integrity. You'll see **tension helping to lightweight** a bicycle wheel in two ways. The spokes that connect the hub and the rim are in tension, and can be much thinner and lighter than if they were in compression. The inflated rubber tire is also in tension and maintains its shape due to its internal air pressure.

**Tensegrity Model**



**NAME: MAGESH S**

**REG NO: 2018507024**

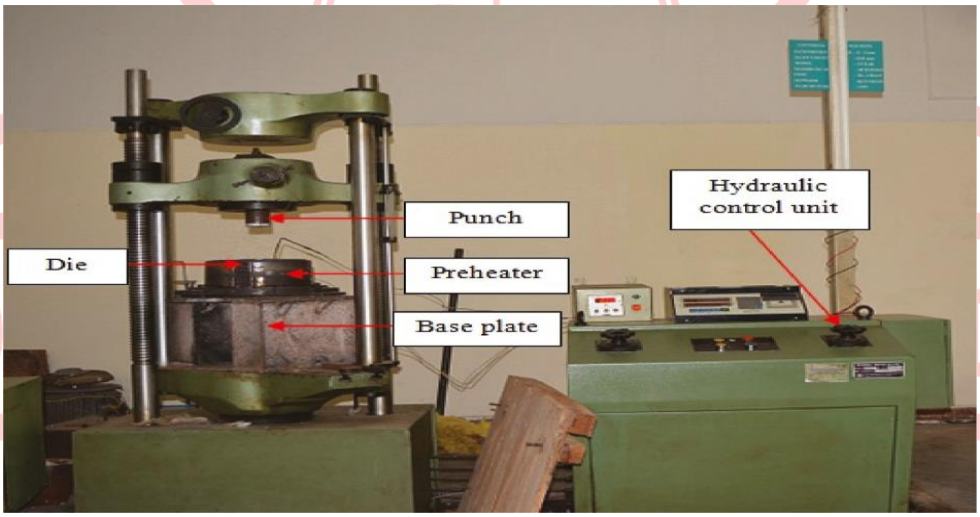
# SQUEEZE CASTING

The squeeze casting is also known as “liquid metal forging”. Squeeze casting is considered as a special casting process because, this process in takes two principles such as “casting” and “forging”. Hence this is a “hybrid process of casting and forging”. The squeeze casting consists of molten metal, a die and a punch or tool. First the metal is taken and heated above the melting point as a result we get a molten metal. The molten metal is then poured into the die. Allowances of the molten metal and die are taken into consideration.

- At the initial stage, die is at the open position, the molten metal is poured into the die.
- We now let the molten metal to settle into the die.
- After pouring, the punch or tool is used to squeeze the molten metal.
- The factors like pressure, time, rate at which it moves (punch) are taken into consideration.
- The die closes, that is the punch or the tool may enter into the die and squeeze the molten metal.
- As a result, the excess molten metal may come out of the die, if we pour excess molten metal than required level.
- Then the punch is removed from the die.
- Now we may get the final product.

Due to this type of casting, it is not easy to get blow holes or defect. As a result, we may tend to arrive the uniform homogeneity and fibrous grain structure. The part or product formed by squeeze casting is,

- Defect free
- Increased mechanical properties
- Long life
- No failure
- Any critical part can be casted.




**Experimental Setup of Squeeze Casting**

**NAME : NAVIN KARTHIK E**

**REG NO: 2018507028**

# INDUSTRIAL INTERNET OF THINGS (IIOT)

It is a way to digital transformation in manufacturing. Industrial IOT employs a network of sensors to collect critical production data and uses cloud software to turn this data into valuable insights about the efficiency of the manufacturing operations.

**IIOT adoption in Manufacturing:**

The main adoption drivers for the Industrial IOT solutions include:

- Cost reduction
- Shorter time-to-market
- Mass customization
- Improved safety

**Three dimensions of IIOT's impact:**

IOT technologies are transforming the way production systems are built and run, driving improvements across three main dimensions of the digital transformation:

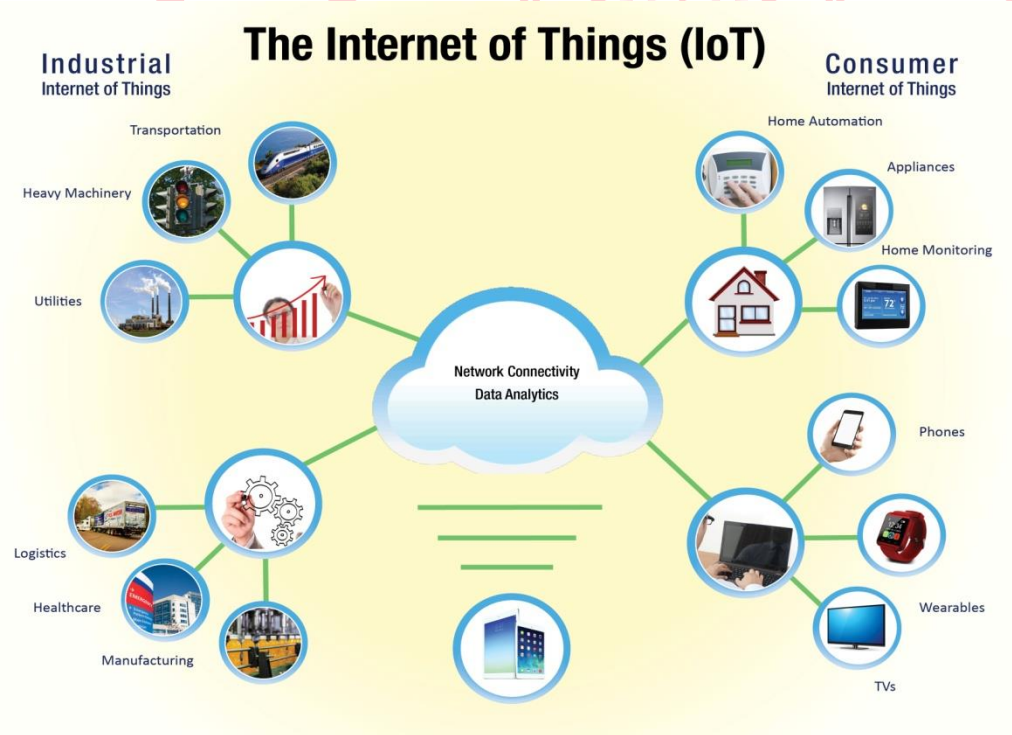
- Dimension 1. Visibility into shop floor and field operations
- Dimension 2. Visibility into the manufacturing supply chain
- Dimension 3. Visibility into remote and outsourced operations.

**The challenges of IIOT adoption:**

- Large investment needs and uncertainty about the ROI
- Data security issues.
- Lack of qualified employees.
- The integration with operational technologies and legacy systems

**To wrap it up:**

Though implementing Industrial IOT is a tedious job but it maximizes the productivity by reducing the cost and eliminating the waste. So most of the companies are striving towards Industrial IOT.




**Industrial IOT**

**vs**

**Consumer IOT**

**NAME: SAKTHIVEL R**

**REG NO: 2018507043**

# PLASTER MOULD CASTING

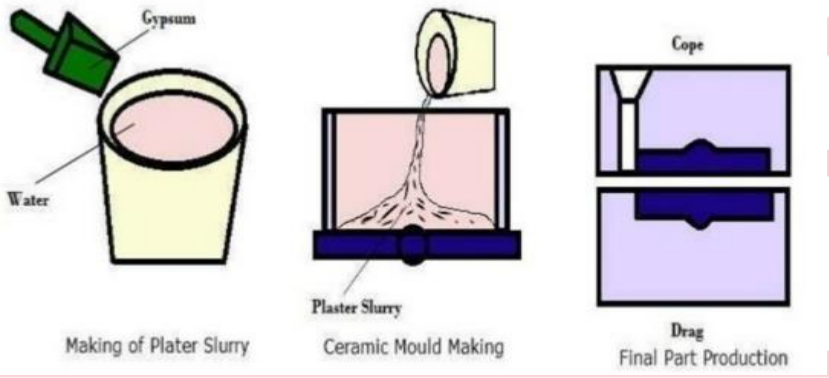
Plaster mould casting is a “metalworking casting” process similar to sand casting except the moulding material is ‘Plaster of Paris’ instead of sand. Like sand casting is an expendable mould process, however it can be used with non-ferrous materials. The Plaster is not pure Plaster of Paris, but rather has additives to improve green strength, dry strength, permeability, and castability. Talc or magnesium oxide are added to prevent cracking and reduce setting time, lime and cement limit expansion during braking , glass fibers increase strength, sand can be used as filter. The ratio of ingredients is 70-80% gypsum and 20-30% additives. The pattern is usually made from metal, however rubber molds may be used for complex geometry; these molds are called Rubber plaster molds.

The steps involved in this casting is as follows:

- Plaster is mixed and the pattern is sprayed with a thin film of parting compound to prevent the Plaster from sticking to the pattern.
- Plaster is then poured over the pattern and the unit shaken so that the Plaster fills any small features.
- The Plaster sets, usually in about 15 minutes, and the pattern is removed.
- The mould is then baked, between 120°C(248°F) and 260°C(500°F), to remove any excess water.
- The dried mould is then assembled , preheated, and the metal poured.
- After the metal has solidified, Plaster is broken from the cast part.

The Plaster has a low thermal conductivity and heat capacity, the metal cools more slowly than in a sand mould, which allows the metal to fill in thin cross section. As a result the Plaster Mould Casting is suitable for complex shape components and it is very economical for that components. The part or product made in Plaster Mould Casting has,

- Excellent surface finish
- Good dimensional accuracy




**Plaster Mould Casting**

**NAME: SHYAMGANES P**

**REG NO: 2018507047**