

# SMART ROBOTICS: PART 1 MECHATRONICS

SEPTEMBER 2018 TECH BRIEF FOR ADVANCED  
MANUFACTURING TALENT NETWORK

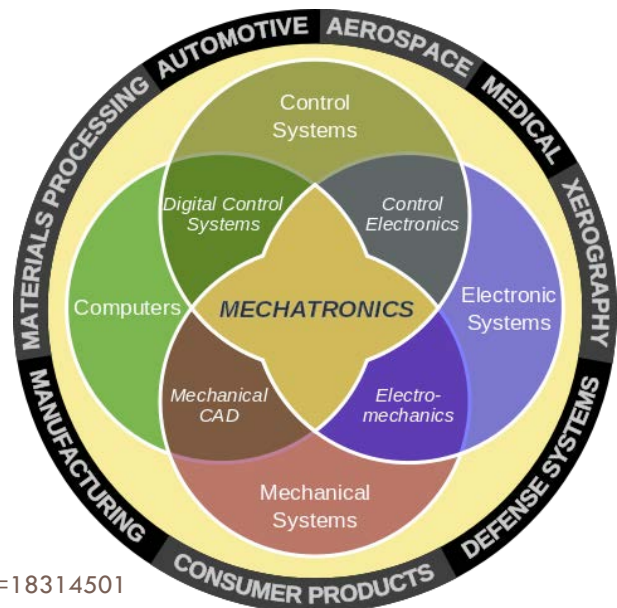


Figure 1: <https://commons.wikimedia.org/w/index.php?curid=18314501>

## Part One of a Two-Part Series

From a cinematic perspective, we have dozens of robots to help us intuitively understand mechatronics – the intersection of mechanics and electronics. Screen icons set the expectation for robot behavior

- There are mission-focused robots like R2-D2 (Star Wars, 1977) and The Terminator (1984)
- There are cartoonish villains like Eva in Wall-E (2008) or the Omnidroid in The Incredibles (2004)
- Some robots are easily swayed by purpose as in The Iron Giant (1999) and Robot and Frank (2012)

From a purely technical perspective though, **robots are classified** by the way they move – not how they act or fit into a narrative arc. Robotics [standard ISO 8373](#) identifies six types of bot:

1. Articulated robot: A robot with an arm that has at least three rotary joints.
2. Cartesian robot: A robot with an arm that has three prismatic joints and axes.
3. Cylindrical robot: A robot with axes that form a cylindrical coordinate system.
4. Parallel robot: A robot that has an arm with a concurrent prismatic or rotary joint.
5. Selective compliance assembly robot arm (SCARA): A feature that offers a high degree of flexibility.
6. Spherical robot: A robot with an axis that forms a polar coordinate system.

## Labor Force Takeaway

For mechatronics, skills developed through work experience and mentoring are highly valued, which means that credentials on the [IVC list](#) must be especially well accepted.

Machine learning, the next step after mechatronics in developing robotics, is another story – “book learning” is very important. One low-bar program to consider is [Microsoft Certified Solutions Associate](#) especially these three affordable credentials:

[Data Science](#), [Principles of Machine Learning](#), and [Applied Machine Learning](#)

The Technology Advisory Network recommends providing more information about how/where [Packaging Machinery Manufacturing Institute's credentials](#) are to be delivered.

Part 2 of this series, sensor technology and machine learning will be published in October.

# Mechatronics – Ancestor of Internet of Things

There will be many origin stories for the Internet of Things (IoT). Given that we live in New Jersey, we may posit that the truest origin story begins here with the telegraph, the telephone, read-only memory, the transistor, charge couple devices and rudimentary software. Add NJ innovations to basic machines and one gets mechatronics, a multidisciplinary field of engineering, synonymous with robotics and electromechanical engineering.

Mechatronics is codified in the database of Federally registered apprenticeship programs:

- MECHATRONICS TECHNICIAN      2014    49-2094.00      8000 work hours
- MECHATRONICS TECHNICIAN      2014CB 49-2094.00      **CB = competency based**
- ASSEMBLER, ELECTROMECHANICAL 0875    17-3024.00      8000 work hours
- ELECTROMECHANICAL TECHNICIAN 0167    17-3024.00      6000 work hours
- INDUSTRIAL CONTROL MECHANIC   0167R   17-3024.00      5840 work hours

**Apprenticeship programs currently registered at the Federal level run 3 - 4 years.  
Only one is competency-based; i.e. based on tested skills.**

Today's mechatronics technician is undoubtedly spending much of their day with robots of one form or another. They may be programming the machine or overseeing its quality.

Settings for robotics include manufacturing, military, site security and rehabilitation facilities. This is a non-inclusive list. Still let's consider these four settings to be archetypal of what mechatronics equipment is asked to do in today's world. In both manufacturing and military settings robots are working so closely with their human counterparts that they are referred to as co-bots. Sensors supply data, but very often the final decision making is done by humans. In both cases, the robots are taking over tedious tasks, but also protecting humans from harm.

With site security, robots are heavily armed with sensors backed up with software algorithms for facial recognition and movement identification. The machines can make decisions up to a very high level. Ditto diagnostic devices in hospitals: machines for imagining (i.e. MRI), diagnostics (urine analyzers) and advanced therapies administered by "mobile C-arms." Siemens Healthineers' Flanders facility and GE Health Care in Princeton are continually advertising for professionals at all levels – including field service positions which are largely mechatronics-based.

Machines don't have to be sophisticated to generate jobs. Hospitals will hire mechatronics technicians full-time just to repair infusion pumps such as the one shown here.

After the mechatronics understanding of robots, the next step is machine learning. As robots move into commodity product territory, the skills involved with optimizing machine learning and changing processes to leverage machine learning will rise in value. Hence TAN recommends new IVCs move beyond mechatronics credentials (which are also valuable) to machine learning credentials from a "name brand" institution.



FIGURE 1: PATIENT CONTROLLED ANESTHESIA PUMP