Training Industrial Robot Management In Institutions Of Higher Education.

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ABSTRACT

In this article, the role of robotics science in our life and ideas about its application to production were highlighted.

Keywords: Industrial robots, robotics, automation, Sensors and IoT technologies, simulators, automation.

Today, we will be able to see the direct intervention of robots in the field of robotics and in all areas of our daily life. In order to create such smart robots, teaching students how to develop industrial robots in higher and secondary special educational institutions remains relevant. Therefore, teaching and applying the science of robotics is the same thing.

The following steps and methods are important for learning to control industrial robots:

1. Fundamentals of Mechanics and Electronics: The basic stage of industrial robot control is the fundamentals of mechanics and electronics, which includes the study of concepts such as manufacturing, design, construction and structure, and experience with electronics and sensors in creating robots.

2. Robotics and Automation Programming: Programming is of great importance in controlling industrial robots. In this step, automation and robotics programming languages (such as PLC programming, robot control programming, robot design, simulation, and 3D modeling) are studied.

3. Sensors and IoT technologies: In the control of industrial robots, sensors and Internet of Things (IoT) technologies are very important. Through these technologies, robots and industrial systems can be monitored, status can be determined, and automatic reactions can be implemented.

4. Robot control and automation systems: At this stage, students can analyze robot control and automation systems, program them, control and monitor them, in particular, PLC (Programmable Logic Controller) and SCADA (Supervisory Control and Data Acquisition) systems, explore systems such as robotic control and monitoring platforms.

5. Hands-on activities and projects: It is very important for students to organize hands-

on activities and projects in learning robotics. They allow students to create experiences, practice control, and master industrial robots at a higher level.

6. International cooperation: International cooperation is also very important in learning to control industrial robots. International projects, scientific conferences, shared experiences play an important role in students' cooperation and self-development against global problems [1].

The following ways and methods are used for teaching control of industrial robots in higher educational institutions:

1. Hands-on training and labs: Students are given the opportunity to learn how to operate industrial robots through hands-on training and labs. These labs and activities provide an ideal environment for students to learn how to operate, operate, and troubleshoot industrial robots.

2. Simulators and Virtual Tutorials: Simulators and virtual tutorials are very effective in providing interactive lessons and activities to students in learning to operate industrial robots. They allow students to create a virtual environment for hands-on training and learning to operate industrial robots.

3. Practicums and work experience: It is very important to provide students with work experience and practicums in learning to operate industrial robots. These practicums help students control and troubleshoot industrial robots.

4. Programming and Robotics Courses: Programming and Robotics courses help students to program industrial robots and run programs on them. These courses introduce students to new technologies and information, help them to use them and apply them to the control of industrial robots.

5. Entrepreneurship: Being given the opportunity to work in business environments, industrial plants, or other areas where industrial robots are employed will help students gain hands-on experience and learn how to operate industrial robots.

6. Training and research: Various training and research should be organized for students to learn how to operate industrial robots. This training and research enables students to learn advanced skills and knowledge in controlling industrial robots[2].

Practical exercises, laboratories, simulators, virtual tutorials, programming courses and work experience should be widely used in order to achieve high results in the process of teaching the control of industrial robots. These methods help students gain hands-on experience and become highly skilled in operating industrial robots.

Industrial robots are divided into several classes according to the control method;

- According to the management method;
- In accordance with the purpose;
- By the level of specialization;
- According to the nature of the operations;
- By type of procedure;
- By the size of the load;
- By the number of manipulators;
- Speed and accuracy of movement;
- By mobility levels;
- Classified by placement method.

It is distinguished by the method of management:

- Program-controlled robots (first-generation robots) operating according to a fixed program;
- Robots with sensing devices and therefore can work in unpredicted and changing conditions, with adaptive control, for example, can grasp freely located objects, go around obstacles, etc. (second generation robots);
- Intelligent (artificial intelligence) controlled robots (third-generation robots) with human-like behavior in analog situations, provided with an external information processing system.

According to the suitability of the purpose: robots can be divided into several groups. For process automation in mechanical engineering, mining and oil industry (service, assembly and repair of drilling rigs), metallurgy, construction (assembly, finishing, transport works), light, food, fish industry robots are different. In recent years, robots have entered transportation (creating walking vehicles), agriculture, healthcare, and the military.

Industrial robots, widely used in industry, are used in mechanical engineering. They are divided into the following groups:

- To provide service to foundry production processes (caster);
- To automate the production of stamps (presser);
- To provide service for mechanical processing processes;
- To service the welding robot process (welder);

To service the assembly production process (assembler).

According to the level of specialization: all industrial robots are divided into 3 types, regardless of their function: universal, specialized and special.

- Universal (multi-purpose) robots are used to perform various operations and, at the same time, various types of work on technological equipment.
- Specialized (targeted) robots have a narrower task and perform one defined operation (for example, welding, painting, servicing equipment of a specified appearance).
- Special robots perform only one specific operation (for example, servicing a specific model of technological equipment)

Industrial robot management training should focus on institutions, practical training, initial training, technology use, applications and projects, and monitoring and evaluation processes. They play an important role in ensuring individual and overall academic success.

According to the nature of operations, all industrial robots are classified into 3 groups:

- Production (technological), performs basic technological production operations and participates in it as a manufacturer or processing machine (welding, assembly, etc.).
- Lifting - transportation (auxiliary), used in performing auxiliary operations for servicing the main technological equipment, as well as warehouse-transport operations;
- Universal – performs a variety of basic and auxiliary technological operations.

By type of procedure. According to the procedures used in robots, they are divided into the following:

- Electricity;
- Hydraulic;
- Pneumatic;
- Pneumo-hydraulic.

They are often used in combination, for example, in the links of the manipulator with a large load, hydraulic is used, and in its gripping device, a simpler and less powerful pneumatic drive is used.

Industrial robots are divided into:

- Very light - up to 1 kg;
- Light - up to 10 kg;
- Medium - up to 100 kg;
- Heavy - up to 1000 kg;
- Very heavy - more than 1000 kg.

The carrying capacity of the robot is determined by the carrying capacity of its manipulators, and when there are several manipulators, the carrying capacity of the most powerful of them is taken into account.

Industrial robots by the number of manipulators:

- One manipulator (one-handed);
- Two-handed;
- Three-handed;
- It is divided into four arms.

In most cases, the number of manipulators in robots is limited to one. Generally, multi-arm robot manipulators perform the same task, but there are also different designs of manipulator robots. For example, industrial robots that serve for cold stamping presses with two different manipulators: One is the main one - to pick up the die and install it on the press, and the other is a simplified design - to perform more simple operations such as pushing the finished part into the hopper [3].

Classification of robots according to the speed and accuracy of movement. These parameters are related to the dynamic characteristics of robots and are characterized by these characteristics. These features are fundamental in robotics.

The speed of movement of the manipulator is determined by the speed of its movement on separate levels of excitation. Commonly used robots can be divided into the following 3 groups according to the speed of movement:

• Lower - up to 0.5 m/s at linear speeds according to individual levels of excitability;

• Medium - Linear speeds above 0.5, up to 1 m/s;

• High – Linear speeds greater than 1 m/s.

Most modern robots have an average movement speed, and only 20% of their total fleet has a high movement speed. The speed of movement of modern robots is still not high, and it is required to increase it at least twice. The main challenge here is the apparent trade-off between speed and accuracy.

The accuracy of the manipulator is characterized by the resulting positioning error (in continuous motion) or the operation of a certain trajectory (in continuous motion). Most of the time, the accuracy of robots is characterized by absolute error.

The accuracy of commonly used robots is divided into 3 groups:

• Lower – Linear error of 1 mm or more;

• Medium - Linear error from 0.1 to 1 mm;

• High – Linear error less than 0.1 mm.

By levels of mobility. The number of degrees of movement is the sum of possible coordinate displacements of the manipulated object relative to the reference system.

According to the placement method, industrial robots are stationary and mobile (mobile, pushable).

They are divided into floor-mounted, suspended (moves along a raised rail), and mounted on other equipment (for example, on a service machine) and others. The mobility of the robot is determined by the presence or absence of its mobility device[4].

To summarize the above, it is important to facilitate the use of hands-on activities, projects and technologies between teachers and students, learn new skills, and develop international activities in the field of robotics.

In learning to manage industrial robots, connecting theoretical knowledge with practical work, using technologies, and learning teamwork are of great importance. These approaches are of great importance in preparing students as skilled professionals in the field of industrial robot control.

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