

STUDY ON ROBOTICS AND ITS SUB SYSTEM

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Abstract: Robots are helpful for the human resources in many ways. It helps them by doing their work But at first it was actually developed to do the works of human being as a slave. At present it was doing all the works and obeying to the commands of humans and becoming the master of humans. Each and every thing has some advantages and disadvantages too. But disadvantage depends on how they are using the robots.

Keywords: *Robotics, Electronics, Programming, Motion*

I.INTRODUCTION

Robotics: it is an multi processing to do design , create and perform actions said by the user. It is also called as an engineering methodology and a knowledge base applying using robots in human endeavors. it is similar to automation process. It deals with multidisciplinary engineering like mechanical, electrical , electronics and programming with computer science. We should always follow the rules and laws of physics. Robot: it is an mechanical device ,reprogrammable ,multifunctional manipulator designed to move material parts or specialized devices through variable programming motions for the performance of variety of tasks. It is an programmed device to perform multiple activities.[1]

a). Robots Association

There are many association for robots few of them are,

- JIRA -Japan Industrial Robotic Association
- RIA – Robotics Institute of America
- WRO- world robotic Olympiad
- IFR –international federation of robotics
- CRIA-china robot industry alliance
- AFR – association francaise de robotique
- ISO – international standards for organization
- IEE robot& automation society - Institute of electrical engineers robot & automation society[1]

b).History of Robotics

- Karel capek the Czech novelist in 1920 in his plays coined the robot .
- Robot in Czech is a word for worker or an servant or an slave.
- Leonardo da Vinci sketched the first humanoid robot in 1495
- World's first robot company was started in 1956 by George Devol and Joseph Engelberger the company named as an animation company.
- The unimate robot was designed in 1961 called as an launch robot
- First artificial robotics arm to be controlled by computer was designed at rancho los amigos
- First mobile robot was controlled by artificial intelligence in 1970[1]

c). Types of Robots

The robots are classified by the associations as

JIRA

It is a birth place of robot. Which has classified robots into 6 types as

- Class:1 Manual handling device ,example: joystick
- Class:2 Fixed sequence robot, example: pick and place robot with fixed memory
- Class:3 Variable sequence robot example : multiple task performer with variable memory
- Class:4 Playback robot ,example: combination of fixed and variable memory
- Class:5 Numerical robot ,example: with an specified task
- Class:6 Intelligent robot, example: which can independently work[1]

RIA

They have agreed with JIRA types from class 4,5,6.

AFR:

They have divided into 4 types as

- Type A: handling device with manual
- Type B: automatic handling device
- Type C : servo controlled robots from point to point
- Type D: humanoid robot and extension of type C[1]

d).Laws of robotics:

In 1942 Isaac Asimov who is called as a father of robotics proposed three laws of robotics as

- Law 1: robot should not injure human beings means of disobeying or obeying to the command to hurt other human
- Law 2: it must obey the order of human but should not hurt other human .it must not conflict with the law 1
- Law 3: it must protect itself but should not overcome law 1 and law 2[1]

e).Basic terminology used in robotics :

It consists of following terminologies as ,

- Joint: the device which allows relative motion between two links in a robot
- Kinematics: the study of motion without regard to forces
- Dynamics: the study of motion with regard to forces
- Actuator: provides force for robot motion to the motors
- Sensor: reads the variables of a robot motion for use in control also a way of connecting to the real world
- DOF : Degrees of freedom the no. of motions take place
- Manipulator: it acts as a combination of arm ,body , wrist

- Anthropomorphic: like human beings also called as an humanoid
- End-effector : the tool , gripper or other device mounted at the end of a manipulator for accomplishing useful tasks (wrist of the robot)[1]

f).Advantages of robots:

- Robots can work in the hazardous environment without the need
- Robots need no environmental comfort
- Robots have repeatable precision at all times
- Robots can be much more accurate than human
- Robots replace human workers creating economic problems
- Robots can process multiple stimuli or multiple tasks at a time simultaneously[1]

g).Disadvantages of robots:

Lack of capability to respond in emergencies

They are costly due to the initial cost of equipment , installation costs, need for peripherals, need for training, need for programming.[1]

II.ROBOT MOTIONS

Arm and body joints are designed to enable the robot to move its end effector to a desired position

Three degrees of freedom associated with the arm and body motions are

- Vertical traverse
- Radial traverse
- Rotational traverse

Vertical traverse :It provide up and down motion of the arm

Radial traverse:It provide in and out movement of the arm

Rotational traverse:Rotation of the arm about its vertical axis

Wrist motions:

The wrist movement is depending upon the end effector properly with task to be performed as

- Wrist roll: it is also called as wrist swivel that involves rotation of the wrist about its axis.
- Wrist pitch: it is also called as wrist bend that performs up and down rotation of the wrist
- Wrist yaw: it performs left and right rotational of the wrist.[1]

III.SUB SYSTEM OF ROBOTS:

Major sub systems are

- Manipulators,
- Sensors,
- Actuators,
- Transmission,
- Controllers.

Parts of a robot:

They are

- Controller,
- End effectors,
- Actuator,
- Manipulator,
- Transmission,
- Sensor.

Let us discuss about their role in detail

a) Controller:

- It is an brain of robotic system. It need to perform three operations.
- They initiate and terminate the motion of individual components of the manipulator in a desired sequence and at specific point.
- They store position and sequence data in the memory.
- Allow the end effectors to interface with environment.

This system receives high level orders and translates them into commands for actuators.

It primarily consist of following things as

- Digital controller
- Digital to analog controller
- Amplifier

Digital controller: it is a special electronic device that has CPU and memory to store the programmed data. It is used to control the movement of manipulator and end effectors.

DAC: Digital to Analog Converter. Supporting element of DC .it converts digital signal to analog to activate actuators. and it converts binary to analog to activate robot for mechanical actions

Amplifier : supporting element of DC and DAC. The control commands from the digital controller converted to analog signal by DAC is very weak so need to amplified to drive.

b) End effectors:

Robot's wrist is a hand which is called as an end effector. Part attached to end of a robot manipulator. endeffector movements are controlled by body and arm joints and wrist joints.

The end effectors are mainly of 2 types

- Grippers – vacuum, magnetic..
- Tools – welding machine , painting brush, gas cutting torch.

Types as :

- Vacuum cups,
- Magnetic grippers,
- Mechanical grippers ,
- Speciality.[2]

c).Actuators:

These are muscles of robots which convert stored energy into movement .actuators provide motion to manipulator links and end effector

There are three main types of actuators as:

- Electric
- Hydraulic
- Pneumatic

The motors used for actuators are

- Stepper
- DC
- Servo
- Pneumatic
- Hydraulic

It is a drive system which provide the mechanical motion to the manipulators.

d).Transmissions:

- It is an muscle fibers of the robot
- Links and joints of a robot will require anyone to drive systems(electric, hydraulic, pneumatic) to perform several motions. It is an element which is used to transmit motion for actuator (drive systems) to links of

manipulators. The necessary speed is not gained with the use of an actuator. As a result, the mechanical transmission system is applied.

The transmission elements are

- gears,
- Belt and chain drives,
- Link mechanism,
- Screw mechanism.

e).Sensor:

It is a basic component of a transducer. Transducer means to convert one form of energy to another form. The sensor output signal may be in the form of voltage, current or charge.

Types of sensor:

- Active and passive which is also called as contact and non contact sensor
- Contact sensor and non contact sensor joins to give internal and external sensor. Internal sensor which gives robotic information. External sensor which gives information about outside environment.
- Examples are force sensor, range sensor, velocity sensor, velocity sensor, tactile sensor, slip sensor, proximity sensor

f).Manipulators:

It is a combination of joint, arm and wrist and assembly of arm, body, joint. Normally robot have been divided into two sub categories as

- Arm and body
- Wrist

The robots are classified according to their 6 degrees of freedom and depends on the characteristics as

- Robots configuration
- Size of the arm, body and wrist components
- Limits of the robots joint movements

IV.ROBOTS CONFIGURATION

There are 5 robots configuration

- Cartesian robot
- Cylindrical robot
- Spherical or polar robot
- SCARA robot
- Articulated or jointed arm

Cartesian robot

- It is also called rectilinear. There are three linear joints as
- In and out
- Back and forth
- Up and down
- It's kinematic designation is xyz robot or 3p robot or rectilinear or gantry robot

Cylindrical robot

- It has one rotary and two linear joint
- The rotational axis
- Up and down axis
- In and out axis
- It's kinematic designation is RRP

Spherical or polar robot

- It is an earliest machine
- It has one linear and two rotary
- It's kinematic designation is RRP

Articulated or jointed arm

- It's also called as an anthropomorphic robot
- It is mostly human like robot
- They are connected by two rotary joints corresponding to the shoulder and elbow
- It's kinematic designation is RARE
- It is also known as jointed arm robot

SCARA robot

- Selective compliance assembly robot arm
- It is mostly used in assembly robot
- It's kinematic designation is RRP[1]

V.CONCLUSION

Now a days we are moving towards the new technologies and many technologies were getting developed day by day. In these robots have been also used in developing areas it helps as in lifting the objects and moving the objects, fixing the objects. In this we have come to know about the history and subsystems, advantages and disadvantages of robot and its configurations.

VI.REFERENCE

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