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Application of Robot in CNC Manufacturing Process in Connection with Embedded system

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Abstract: Embedded an Electronic system basically a computer application with dedicated function with a large mechanical and electrical integrated system. The use or application of embedded system in various areas worldwide. Hence in this study, we discussed about the wide area of application and finally we have discussed about the use of embedded system in connection with industrial robot along with CNC technology in flexible manufacturing (FMS) where accurate control of speed and position of DC motor in precession and repeatability in motion control have achieved in servomotor and machine actuators.In the paper Specific Area of Embedded System and its Applications have been used as applications of specific processor and devices such as Robot application of CNC in world Class manufacturing process.

Keywords: *- Embedded system, operating system, robot, CNC, Real time, Process control.*

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Introduction:-

Embedded system is a computer system with dedicated function with a larger mechanical or electrical system, often with real – time computing constrain [1, 2]. It is embedded as part of a complex device often including hardware and mechanical parts. Embedded system control many device in common use today [3]. More than 98% of all microprocessor are manufactured as component of embedded system [4]. Modern embedded system are often based on microcontroller i.e. CPU with integrated memory or peripheral interface [5]. In ordinary microprocessor by using external chips for memory and peripheral interface circuits are commonly used in more complex system. Microcontroller based on single or multidigital panel meter for voltage, current, resistance and frequency.

In either case, the processor(s) used may be types ranging from general purpose to those specialized in certain class or computations, or even customer designed for the application at hand. A common standard class of dedicated processor is the digital signal processor (DSP).

An embedded system is some combination of computer hardware and software, either fixed in capability or programmable, that is specifically designed for a particular function. Industrial machines, automobile, medical equipment's, household appliances, airplane etc., are among the myriad possible with programming interface and embedded system programming is a specialized occupation. Modern Embedded system are based on microcontroller i.e. CPUs with integrated memory or peripheral interface (^ Giovino, Bill,"Microcontroller.com-Embedded system supersite"). But ordinary microprocessor by using external chips for memory and peripheral interface circuits are common, especially in more complex system. The standard class of dedicated processors is the digital signal processor (DSP).

A higher integration level with high performance embedded system debugging, the IEEE-ISTO Nexus 5001 forum standard for a global embedded debug interface, is introduced and is related to the test and debugging requirement of development engineers.

Power related hardware-Software Co-synthesis of heterogeneous distributed embedded system is the process of partitioning an embedded system specification into hardware and software modules to meet performance power and cost goals. Embedded system is generally specified in terms of a set of a cyclic task graphs. According to one embodiment of the invention, a co-synthesis algorithm, called COSYN, starts with periodic task graph with real time constraints and produces low cost heterogeneous distributed embedded system architecture meeting these constraints. The algorithm has a pre-processing phase during which task graph, system/task constrains and resource libraries for the embedded system are parsed, wherein the resource library has different PEs requiring different power supply voltages. The algorithm also has a synthesis phase, following the pre-processing phase, during resource library, based on performance evaluation of one or more possible allocations each of group and edges in light of the system/task constraints. Where in two or more PEs in the embedded system use two or more different powder supply voltage power dissipation is considered along with cost and real time constraints, during at least one of the task grouping, group/ edge allocation and or performance evaluation.

Convergence embedded system and application point-to-point scale (POS) devices in corporate duel display for

advertising complex accounting applications. This system used for planning to buy certain items where inventory system used ABC analysis. Hence planning, scheduling for buying POS give more effective for both sellers and buyers.

Various Useof Embedded System:-

- Telecommunication such as telephone S/cell phone and computer networking uses, such as dedicated route and network bridges to route data.
- Consumer Electronics such as personal digital system, MP3 player, mobile phone, video game consoles, digital camera, DVD player, GPS receiver and printer.
- House hold appliances' such as micro oven, washing machine, dish
- Washer, remote control of TV, Water meter reading etc.
- Advanced HVAC system such as network thermostat, season home automation
  Wired and wireless network such as controlling traffic light, climate, security, audio/visual system i.e. buzzer(sound), andon (visual indicator) system, surveillance etc., all of which are used as embedded devices for sensing and controlling.
- Air Transport system for anti-skid operation of wheel breaking, flight in automation (auto pilot), poke yoke (stand by in L G operation), ADF (Automatic Direction Finder) and Auto landing, inertial guidance system and GPS receiver, automatic fire alarming etc.
- Fax or photocopy or printer or scanner machine.
- Fire and safety and security for automatic fire detecting and alarming, (fail safe technique) including fire extinguishing.
- Banking system such as net banking, ATM credit card transition.
- Signal tracking system such as image filtering and processing. Pattern recognition as well as speech processing and video processing.
- Electronic stability control (ESC/ESP).
- Traction control and signal control in railway.
- Automatic 4 wheel drive, engine control, car-area-network, fuel management, variable cylindrical system including safety in a car (breaking, engine, steering).
- For large complex system like hybrid vehicle, Avionics etc.This complexity varies from low with a signal microcontroller chip to very high with multiple units peripheral and network mounted inside a large chassis or enclose.
- Full applications of Embedded system along with Robot been used in Hotel at Japan.
- Medical equipment or apparatus such as use of vital signs monitoring, electronic, stethoscope for amplifying sound, medical imaging 9PET,SPECT,CT,MRI) for non-inverse internal inspection etc. These all are used through industrial computer. Hence silicon chip revolution make easier to accurate diagnosis of cholesterol monitors, blood glucose level, replacement of organ and tissue etc. Application of Nano robot shall more useful in medical (surgical) purpose.
- For Military applications Armament (missile) Technology is much successful.
- *Space craft and Satellite communication in wide area applications.*

Design of Reconfigurable CNC System, Based on Embedded Technology in FMS along with Robot application for Material Handling.

Embedded processor and embedded real time operating system combined, CNC technology based where the hardware platform a dual CPU model is designed by ARM & DSP, which is used for process control. FPGA model realizes the FMS (Flexible Manufacturing System) system reorganization in shop floor management. This also emphasis about material procurement through the application of computer known as ERP I and ERP II. This can be used for SCM (supply chain management) in production process.

The design of reconfiguration CNC system based on embedded technology.

Inspection controlling Indexing are:

- CNC, Embedded system, field programming gate arrays, FMS, O S (computer), and Production control.

IEEE items are:-

- CNC, Digital signal processing, embedded software, field programming gate arrays, FMS, hardware, O.S., Process and production control, as well as Real-time system.

Accurate control of speed and position of D C motor of CNC Machine:-

In motion control servomotor and machine actuators are available for getting precession motion and repeatability. Hence servo system provides the required torque, speed and accuracy for performing the operation. This also performed the transmission of load, mechanical transformation, the duty cycle of the system i.e. How often starts and stops and how fast the system need to be operated that all are been decided by the embedded system in connection with electrical and mechanical actuations.
Hence for performing the CNC operation sizing software used which contain the mathematicalformula used to find out the inertia of the load, a critical parameter when selecting a servo motor.

The following components been used for getting precession motion control.

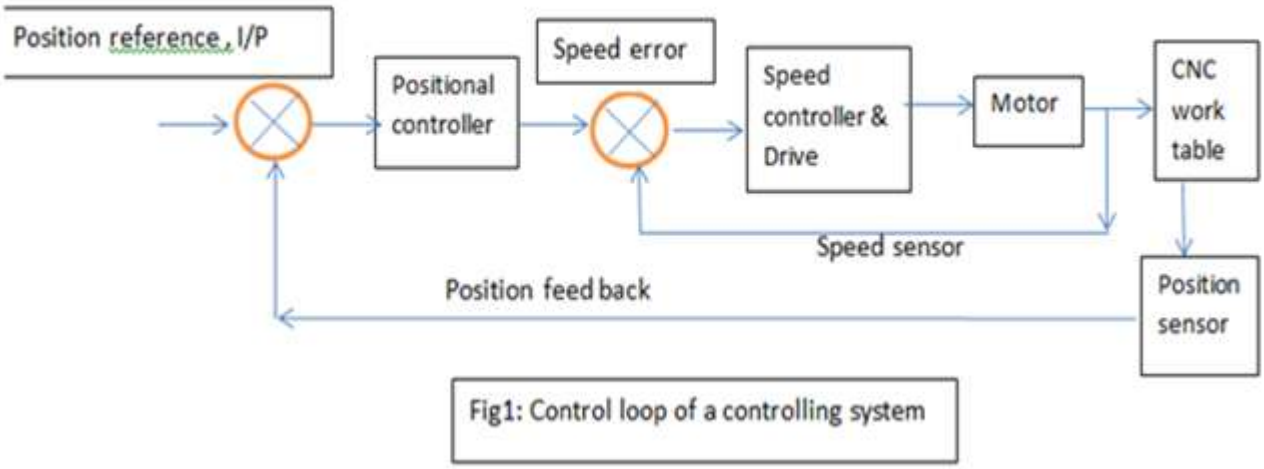

Fig1: Control loop of a controlling system

- Servo motor, Motor Drive, Gear Box, Actuator, Feedback Encoder, Motor control, Control of turning software and Drive communication software.

Servomotor, Encoder and Servo drive works as Amplifier and the Motor is designed for transmitting the load. Reduction Gear box provide the precession, accuracy and repeatability for in CNC machine shop in turn provides higher efficiency. The servo system coupled with planetary gear box to get accurate motion actuation. For accurate control of speed and position of a D C motor, a robotics system, a CNC machine controller been used in production process.

Also PLC programming has been used for motion control or a position control of CNC machine and the position control module are Shaft encoder input, On board dedicated high speed CPU, Motor drive set point output, Digital 10, Programmer port and set point from data bus.

The rotational movements of the motor are calibrated and required movement as per the CAD design is obtained. The motor movement has been calibrated by connecting an encoder to the motor. The close loop control shall be controlled by entering X, Y & Z value manually through GUI develop.

Basic Electronic Components Used in Robot:-

The following are the basic electronic components we have to use in a Robot: - Resistor- Capacitor- Diodes- Transistors- Motors- Power Supply- Sensors

Resistor: Resistors are the obstacles in the path of the electrons flowing in the wire. We use Resistor because: Limiting current to another component. reducing voltage in some parts of the Circuit. Controlling the voltage / current flowing into another component. protecting the inputs of sensitive components.

Types of Resistor: Variable Resistor Light Dependent Resistor Circuit Symbol

Capacitor: Capacitor store electrons by attracting them to Positive Voltage. When the voltage is reduced or removed the electrons move disappear off. These are used for : Creating Timers. Smoothing out voltage. Blocking DC Current. Adjust Frequency. Types of Capacitor: Electrolytic Capacitor Ceramic Capacitor

Diodes: Diode is a two terminal electronic component that conducts electric current in only one direction. Types of Diode: Silicon P-N Junction Diode: Light Emitting Diode Photo Diode Anode Cathode

Transistors: Transistors are a kind of Switches. We can control the switch using voltage on base pin. The transistors we are using are: P-N-P, N-P-N, Phototransistor N-P-N Photo Transistor +V Infrared Photo Transistor +V out θ Resistor (~ 10 K) Working of 2N2222 (NPN) Transistor IR Sensor circuit by Phototransistor

Motors: Motors are used to provide the motion to machine directly. There are four types of Motors: DC Motor, DC Geared Motor, Stepper Moto and Servo Motor

Power Supply / Source : In Robotics we use 12 V and 1 A power supply generally but it can vary up to 12 V and 5 A. It depends upon the Circuit Requirements. We can use the Voltage Regulator to increase or decrease the value of Voltage as per the requirement. 7805 Voltage Regulator

Sensors: Sensors are the devices which are used to sense the changes that occur in their surroundings. Types of Sensors: IR Sensor: There is one emitter and one detector. Emitter emits IR rays and the detector detects it. Black LED is an emitter and White LED is the Photo Diode. It consists of three components: IR LED, Photo Diode, Op-Amp (LM358 IC). IR LED Photo Diode IR LED Op-Amp (LM358) Three Pin Photo Connector Diode Indicator Potentiometer LED

Working of Sensor: Black LED generating IR rays and these rays are reflected by the surface.(If the surface is black, than it will absorb the Light). The Photodiode senses the light and indicator LED shows the result that whether there is an object or not. If indicator, LED is on than the results +ve and when it is off then the results -ve.

What is a Line Follower Robot: Robot which follows a Line whether it is Curvy or Straight orDivergence. We are going to make a machine which will follow a black line onwhite background. If there is any divergence or any cross points in the path of themachine then it will stop in such case. These type of case will be solved by the Intelligent Line Follower. We are using the AVR ATMega16 Microcontroller to build this Robot.

Components Required (1.) Development Board – 1 No.(2.) Caster Wheel – 2 Nos.(3.)IR Sensor Kit – 2 Nos.(4.) Battery – 6 Volt (5.) Wheel Clamps – 2 Nos.(6.)Geared Motor – 2 Nos. (7.) Connecting Chords as required.

Working of Line Follower Left Sensor Right Sensor If left sensor detect the light surface and right sensor detect dark surface then the robot will turn right. Left Sensor Right Sensor If left sensor detect the dark surface and right sensor detect light surface then the robot will turn left.

How Line Follower Works …
How to Program a Robot? It Required Software: OperatingSystem: Windows XP, Vista, Windows 7Tools : AVR Studio. (Current versions has AVR-GCC plug-in to write code in C)Compiler: IAR, Image Craft, Code Vision AVR, Win AVR Loader: AVR Loader by Rob sapiens India Required Hardware: USB Programmer Connecting Cord

SIMPLE ROBOT PARTPROGRAMMING FOR MATERIALHANDLING (Lifting and Loading).

<PICK & PLACE> IN FMS (Flexible Manufacturing System) USING ARISTO ROBOT

OBJECTIVES:

- To learn joint movements.
- To learn format a program for PTP operation or ARISTO Robot software.
- To write a program & make simulation.
- To study co- ordinate system: where some major co- ordinate system based on which robots are generally specified.

The common design of Robot co- ordinate systems are:

- Cartesian co-ordinate system
- Cylindrical co-ordinate system
- Polar or Spherical co-ordinate system

CO-ORDINATE OF ARISTO ROBOT:

After giving the values in the appropriate axis box, we can see the changes in the respective axis in the coordinate position (WCS). Let no see in detail, all the coordinate used in MATLAB ARISTO ROBOT.

WORLD CO-ORDINATE SYSTEM:

Three co-ordinates x, y, z are arranged at right angled as shown in the figure. The co-ordinate system is situated at the center point at the base. Co-ordinate axes are measured in mm & the positive direction are indicated in the figure by arrow tips with the help of this system. We consider the actual location of Robot.

TO LEARN JOINT MOVEMENTS:

The joint movement, the joint axis (for i) is established at the connection of two links. This joint axis will have two normal connected to it, for each of the links w.r.t. relative position of two such connected links (link –i, -1 & i)is given by di which is the distance measured in a plane normal to the joint axis. Hence di and Φi may be called the distance & the angle between the adjacent links respectively. They determine the relative position of neighboring links

TO LEARN FORMAT **A PROGRAM FOR PTP OPERATION - ARISTO ROBOT SOFTWARE:**

- To learn Robot commands.
- Format of program for joint command.

This command is capable of moving the axis one by one. The angular values are provided to it as the parameters for the operation. The individual axis terminates this movement one by one.

FORMAT FOR PTP OPERATION:

This command is capable of moving the entire axis simultaneously. The co-ordinate values are provided to it as the parameters for the operation. All the axes terminate their movement simultaneously.

WRITING THE PROGRAM AND MAKING SIMULATION:

Robot Programming**:-**

SPEED 50
JOINT A1 90.15, A2 90.00, A3 90.00, A4 0.00, A5 90.00, A6 0.01
GRIPPER OPEN
JOINT A1 49.23, A2 89.47, A3 89.71, A4 0.00, A5 90.00, A6 0.01
JOINT A1 49.23, A2 -45.52, A3 45.77, A4 0.00, A5 90.00, A6 0.01
JOINT A1 49.23, A2 -45.52, A3 45.77, A4 0.00, A5 -7.67, A6 0.01
JOINT A1 49.23, A2 -45.52, A3 67.82, A4 0.00, A5 -23.26, A6 0.01
JOINT A1 37.75, A2 -45.52, A3 67.82, A4 0.00, A5 -23.26, A6 0.01
ATP X +473.67 Y +382.282 Z +229.54 W 38.41 P 84.04 R 0.66
ATP X +473.52 Y +382.17 Z +213.88 W 85.54 P 89.09 R -0.79
GRIPPER CLOSE
PTP X +493.05 Y +381.86 Z +255.46 W 38.42 P 88.93 R 0.67
JOINT A1 37.75, A2 -71.29, A3 80.74, A4 0.00, A5 -20.38, A6 0.01

JOINT A1 -47.54, A2 -71.29, A3 80.94, A4 0.00, A5 -20.37, A6 0.01
JOINT A1 -47.54, A2 -97.29, A3 85.62, A4 0.00, A5 -20.38, A6 0.01
PTP X +355.48 Y -388.49 Z +355.25 W -47.42 P 83.94 R 0.1L
PTP X +356.46 Y -389.57 Z +324.23 W -47.42 P 84.27 R 0.1L
GRIPPER OPEN
JOINT A1 90.15 A2 -90.00 A3 90.00 A4 0.00 A590.00 A6 0.01

Conclusion:-

Use of industrial robot in CNC manufacturing in conjunction with Embedded system i.e. Robot with application of Computer with respect to dedicated function within a larger mechanical and Electrical system in connection with CNC controller in flexible manufacturing (FMS) ,there is a remarkable increase in productivity in terms of quality and quantity which reduces the generation of scrap(MUDA). In CNC manufacturing system automated material handling with the help of Industrial robot and automated tool changing in magazine box as-well-as automated speed and feed control, real time feedback facility in multi axis CNC machine provides high performance in CNC manufacturing process. Thus use of robot in CNC manufacturing in conjunction with embedded system becomes enormous world-wide in wide area of applications.

Bibliography:-

[1] Michael barr," Embedded system glossary", neutrino technical university, retrieved 2007-04-21.
[2] Heath, steve (2003), Embedded system design, EDN series for design engineers(zed)
a. newness,p2, ISBN
[3] 978-0-7506-5546-0,"An embeded system is a microprocessor based system that is built to control a function or a range of functions.
[4] Michael barr, Anthony J. massa(2006)," Introduction ,programming embedded system ,with C and GNU development tools@`reilly , pp 1-2,ISBN978-0-596-00983-0.
[5] Barr, Michael (1 auguest 2009), "real mean programme in C ", embedded systems design. Tech in sights (business media),p2 retrieved 2009-12-23.
[6] C Macnamee and D. Heffernah. Vol ii, issue 6, dec 2000 pp 295-303.
[7] Encyclopedia "Embedded system".
[8] CNC, MAZAK Lathe Step- 7 micro/ win 32, manual from Yamazaki Corporation.
[9] Reni Shaw apply innovation, H- 2000-3020-06-A, Technical specifications, "Probing system for CNC machine tools".
[10] Siemens energy and automation Inc, for PLC programming.
[11] Encyclopedia, use of Nonconventional Machining.