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ENGINEERING HUMORLESS ARMREST MODELLING BY USING ROBOT FUNCTIONING ORGANIZATIONS

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ABSTRACT:
A robot manipulator is an electronically controlled mechanism, consisting of multiple segments, that performs tasks by interacting with its environment. They are also commonly referred to as robotic arms. In robotics , a manipulator is a device used to manipulate materials without direct physical contact by the operator . The applications were originally for dealing with radioactive or biohazardous materials, using robotic arms , or they were used in inaccessible places. In more recent developments they have been used in diverse range of applications including welding automation, robotic surgery and in space . It is an arm-like mechanism that consists of a series of segments, usually sliding or jointed called cross-slides, which grasp and move objects with a number of degrees of freedom. In robotics, a manipulator is a device used to manipulate materials without direct physical contact by the operator. The applications were originally for dealing with radioactive or biohazardous materials, using robotic arms, or they were used in inaccessible places. Robot Operating System (ROS) is an open-source robotics middleware suite. Although ROS is not an operating system (OS) but a set of software frameworks for robot software development, it provides services designed for a heterogeneous computer cluster such as hardware abstraction, low-level device control, implementation of commonly used functionality, message -passing between processes, and package management. The Robot Operating System (ROS) is an open-source framework that helps researchers and developers build and reuse code between robotics applications. R

Keywords: *Robotics, Robo Arm, The Robot Operating System (ROS), Artificial Intelligence*

INTRODUCTION:
The manufacturing sector is poised to undergo considerable change over the next decade. Driven by initiatives such as Industry 4.0, the Digital Agenda, and the Internet of Things, the introduction of new technologies and further digitalization will lead to highly connected, and integrated workplaces. These changes will produce new ways of working, and open up new opportunities for innovation and process flexibility. In particular, developments in robotics will enable humans and robots to work collaboratively, maximising the benefits of manual and automated processes. This shift towards human-robot co-working is enabled by the recent development of collaborative robots, including the KUKA LBR iiwa. Such cobots are designed to operate alongside human users in shared environments without safety caging; back-drivable motors and compliant. Available online 1, which we have developed to support our experimental research work, and is now supporting development of new industrial processes. The interface enables control and communication via the Robot Operating System (ROS), but

with minimal installation requirement, and without compromising the inbuilt safety features. Controllers allowing humans to physically interact with the robots without harm. Whilst early adoption focuses on robots working un-caged in human-occupied spaces as assistive tools with little interaction, the full potential of this technology will only be realised through symbiotic human-robot collaborative processes. A major aim for future manufacturing is greater flexibility to support smaller batch sizes and more customization. Whereas existing automated processes are highly repetitive, and difficult to reconfigure for new products or tasks, collaborative robots will support much greater variability through task switching. The added complexity of flexible processes and co-working with robots will require the up-skilling of the human workforce, and highly intuitive interfaces to support more variability in worker roles.To achieve these aims, greater integration of workers, robots, and systems are required. This requires development of robot control interfaces that can safely and flexibly connect to sensors and gather information from external sources; These issues will be exacerbated by the introduction, and up-skilling, of workers without robotics experience. It provides services designed for a heterogeneous computer cluster such as hardware abstraction, low-level device control, implementation of commonly used functionality, message -passing between processes, and package management. Running sets of ROS-based processes are represented in a architecture where processing takes place in nodes that may receive, post, and multiplexer sensor data, control, state, planning, actuator, and other messages. Despite the importance of reactivity and low latency in robot control, ROS is not realtime operating system (RTOS). However, it is possible to integrate ROS with realtime code The lack of 0 for real time systems has been addressed in the creation of ROS 2, a major revision of the ROS API which will take advantage of modern libraries and technologies for core ROS functions and add support for real-time code and embedded system hardware.

LITERATURE SURVEY

Iqbal et al (2012) presented a work on "Modelling and analysis of a 3 DOF robotic arm manipulator", Canadian Journal on Electrical and Electronics Engineering. The behaviour of physical systems in many situations may better be expressed with an analytical model. Robot modelling and analysis essentially involve its kinematics. For robotic manipulators having high Degrees Of Freedom (DOF) with multiple degrees in one or more joints, an analytical solution to the inverse kinematics is probably the most important topic in robot modelling. This paper develops the kinematic models a 3 DOF robotic arm and analyses its workspace. The proposed model makes it possible to control the manipulator to achieve any reachable position and orientation in an unstructured environment. The forward kinematic model is predicated on Denavit Hartenberg (DH) parametric scheme of robot arm position placement. Given the desired position and orientation of the robot end-effector, the realized inverse kinematics model provides the required corresponding joint angles. The forward kinematic model has been validated using Robotics Toolbox for while the inverse kinematic model has been implemented on a real robotic arm. Experimental results demonstrate that using the developed model, Nguyen.H.C (2016) presented a work on "Research on the application of Neural Networks in identification and control of the robotic arms-A nonlinear dynamic object," Journal of Science and Technology – the University of Da Nang. This paper presents a novel inverse kinematics solution for robotic arm based on artificial neural network (ANN) architecture. The motion of robotic arm is controlled by the kinematics of ANN. A new artificial neural network approach for inverse kinematics is proposed. The novelty of the proposed ANN is the inclusion of the feedback of current joint angles configuration of robotic arm as well as the desired position and orientation in the input pattern of neural network. ANN has only the desired position and orientation of the end effector in the input pattern of neural network. In this paper, a Three DOF Denso robotic arm with a gripper is controlled by ANN. The comprehensive experimental results proved the applicability and the efficiency of the proposed approach in robotic motion control. The inclusion of current configuration of joint angles in ANN significantly increased the accuracy of ANN estimation of the joint angles output. The new controller design has advantages over the existing techniques for minimizing the position error in unconventional tasks and increasing the accuracy of ANN in estimation of robot's joint angles. Wang et al (2012) presented a work on "Kinematical analysis and simulation of an industrial robot based on ROS," Jidian Gongcheng/Mechanical & Electrical Engineering Magazine . The history of industrial automation is characterized by quick update technology, however, without a doubt, the industrial robot is a kind of special equipment. With the help of ROS matrix and drawing capacity in the ROS environment each link coordinate system set up by using the d-h parameters method and equation of motion of the structure. Robotics, Toolbox programming Toolbox and GUIDE to the joint application is the analysis of inverse kinematics, so as to achieve the aim of reservation.

METHODOLOGY

This paper mainly deals with robot arm modeling for industrial polishing applications. From this model, we analyze the forward kinematics of the multi-step free controller and calculate the angle of the robot arm's joints based on the inverse kinematic model, thus deducing the controller's dynamics solution. ROS provides a set of software libraries and tools to help developers to build robot applications. Since it is an open-source platform, the main goal of the community is to introduce ROS as a standard in robotics. ROS allows researchers and developers to use different programming languages for creating their applications. ROS works with C++, Python, and Lisp. There is a beta version of client libraries that supports Java, C#, R, and other languages. ROS software is organized in packages. A package might contain nodes, independent libraries, configuration files, third-party software, or anything else that constitutes a useful module. Robot arm development involves several stages, including designing the arm, creating a simulation model, and implementing kinematic equations to control the arm's movement. The first step in creating a URDF model is to design the robot arm. This involves defining the number of links and joints, their dimensions, and their connections. Once the design is complete, the next step is to create a URDF file that describes the arm's physical properties

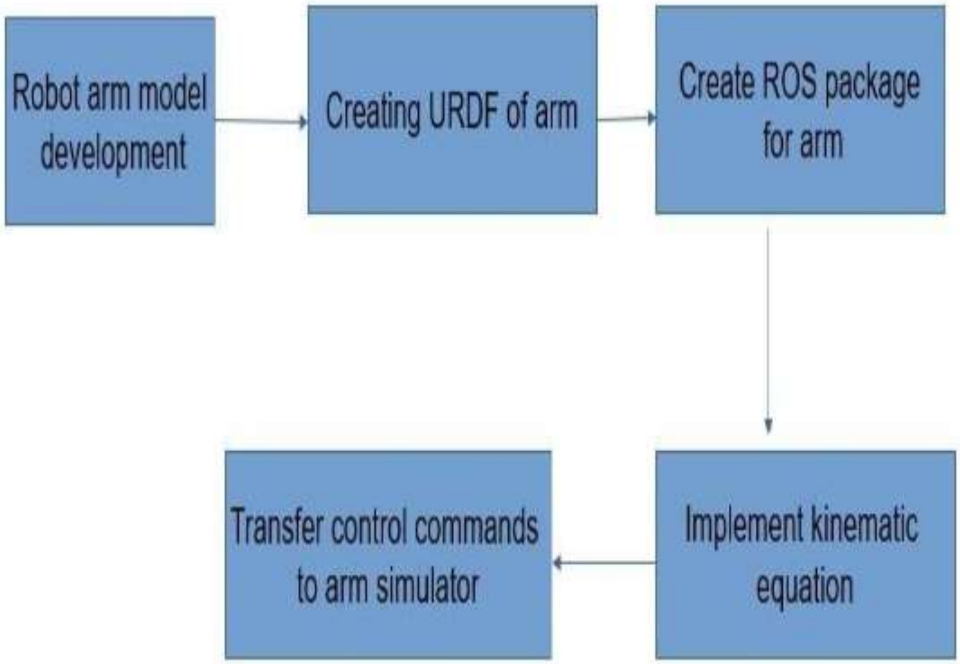

Figure1: Human less Robot arm Process

ROS provides a set of software libraries and tools to help developers to build robot applications. Since it is an open-source platform, the main goal of the community is to introduce ROS as a standard in robotics. ROS allows researchers and developers to use different programming languages for creating their applications. ROS works with C++, Python, and Lisp. There is a beta version of client libraries that supports Java, C#, R, and other languages.ROS program is called a node. Nodes can communicate with each other. Communication between ROS nodes is peer-to-peer. There are three methods of communication: through topics, services, and action services. The main tools ROS provides are rviz, rosbag, rqt_bag, rqt_plot, rqt_graph, command-line tool, and other. For 3D visualization rviz is used as presented. This tool can let you combine sensor data, robot models, and for example work cell 3D model for a better understanding of the ongoing scenario. For data logging and visualization of sensor data, ROS use rosabg and rqt_bag. The tool for making plots is rqt_plot. By selecting the desired topic, this tool automatically generates a plot from its data. And to see what nodes,topics, and services are running on the system rqt_graph is needed. Gazebo software can be used to run physics simulation on the ROS platform.

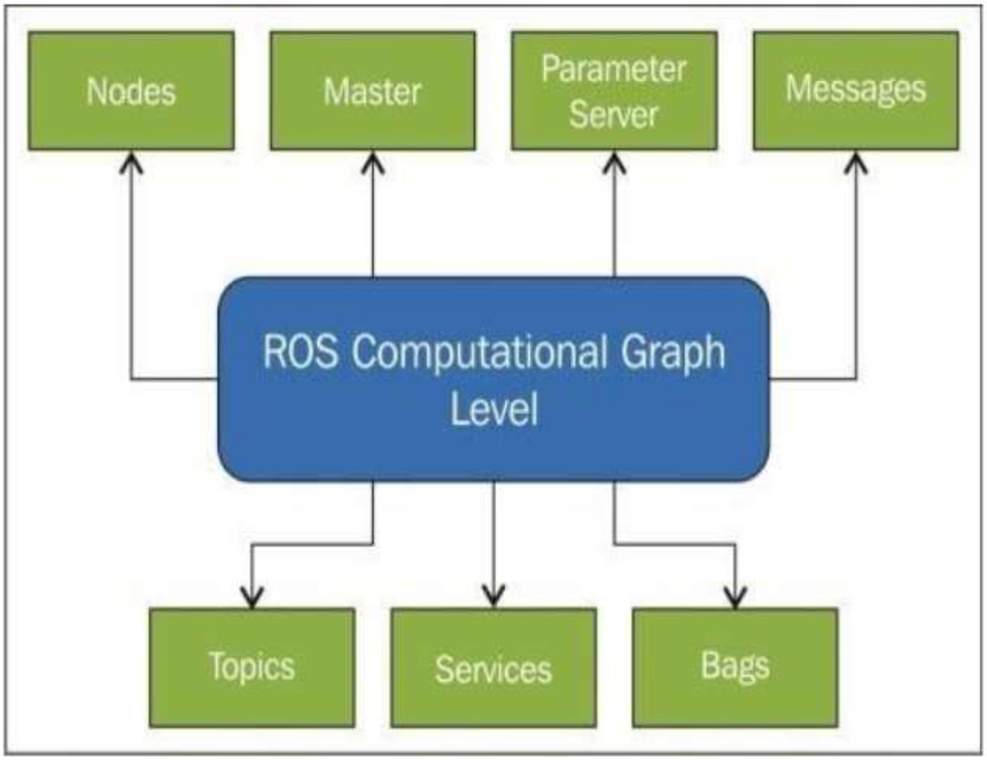

Figure2: Robot Operating System

The main goal of organizing software in packages is to provide easy-toconsume and reusable software. ROS packages follow a “Goldilocks” principle: enough functionality to be useful, but not too much that the package is heavy-weight and difficult to use from other software. In order to control a robot from ROS, appropriate drivers need to be installed. Also, all drivers for any device are organized in packages. One of the most valuable ROS packages for industrial robots is Ros control. The Ros control is a set of packages that includes controller interface, controller managers, transmissions, and hardware interface. The package takes as input joint state data form the robot’s encoders and an input set point. It uses a generic control loop feedback mechanism to control the output sent to actuators. Also, tracking of coordinate frames is very important in robotics. Program is called a node. Nodes can communicate with each other. Communication between ROS nodes is peer-to-peer. There are three methods of communication through topics, services, and action services. Integrate the robotic arm model and control algorithms with other systems and devices, such as sensors, actuators, and user interfaces, using ROS-based software tools. Deploy the robotic arm model and control algorithms in a real-world scenario, and compare the simulation results with the actual performance of the robotic arm.

RESULTS AND DISCUSSION

To evaluate the performance of a robotic arm, we utilized a virtual simulation environment that comprised a 3D model of the robotic arm and the object it had to pick and place. We controlled the simulation using various inputs, such as the object's position, the robotic arm's orientation, and the joint angles During the simulation, we tested various inputs to observe the behavior of the robotic arm when picking and placing the object. These inputs included different object positions, angles of the robotic arm, and combinations of joint angles. The output of the simulation was the object's position and orientation after the robotic arm had picked and placed it. We monitored several metrics and performance indicators during the simulation to assess the robotic arm's performance. These metrics included the time taken to complete the task, the accuracy of the placement, and the smoothness of the robotic arm's movements.

Figure3: Presentation of Robotic Arm

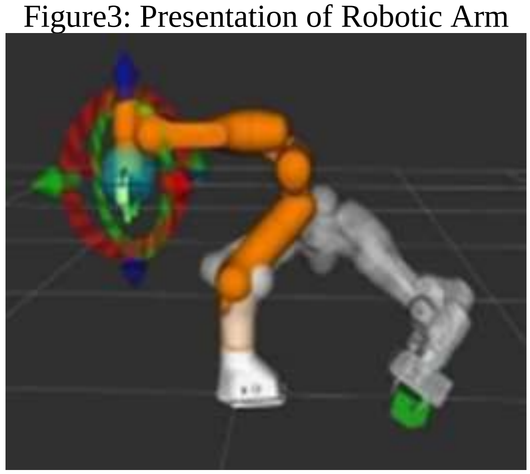

Figure4: Showing Presentation of Robotic Arm

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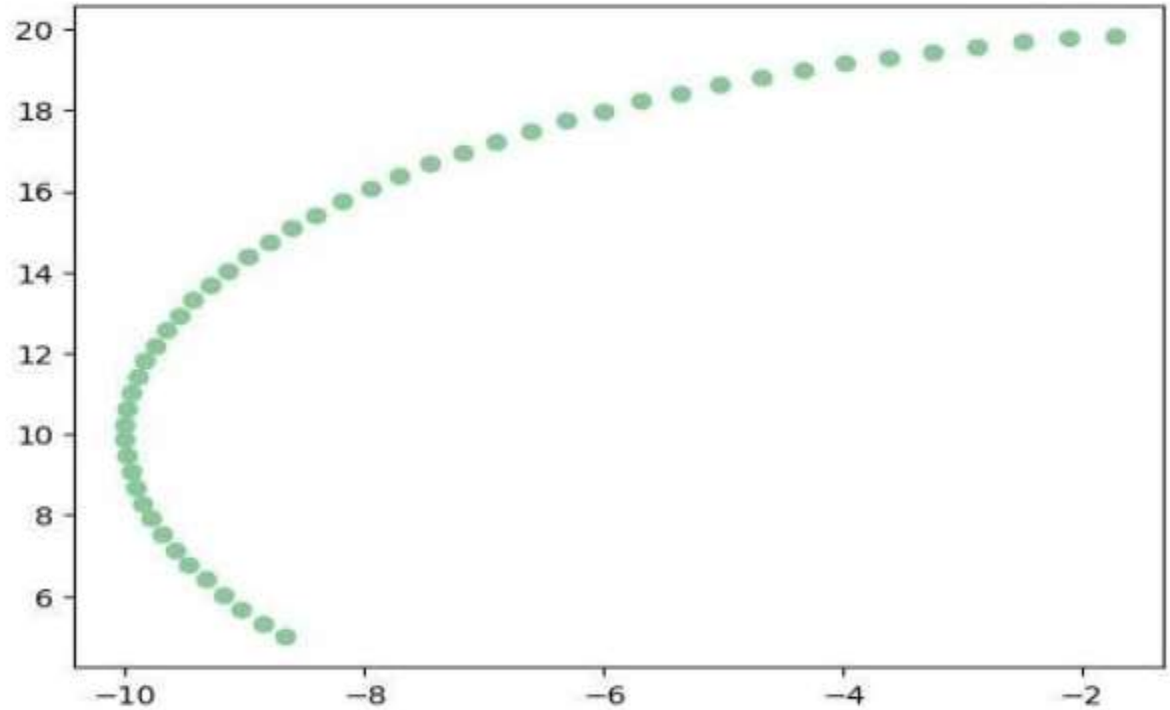

Figure5: Showing Presentation of Robotic Arm

CONCLUSION

This paper presented how ROS can lead to open-source robotics. Although, ROS is not on a level like a commercial manufacturer, because of safety standards and real-time features, the ROS community is making efforts to overcome these problems. This paper also presented basic tools and packages that can accelerate the process of developing and deploying. Use case for industrial robots shown that ROS poses capabilities for running applications in which a force/torque sensor integration. In the case of mobile robots, it has been shown that students can easily learn basic postulates with ROS. Using ROS packages developing specific algorithms becomes an independent task .The objective of the project was to model a in a component-based manner, and implement its dynamic model from Gazebo in a effort to set up the means for simulating a robot with co-simulation support. With Gazebo, simulated robots can be ran with the same software as their real counterparts. A model of a robotic arm was realized using the serial-link structure approach, upholding the component-based goal..

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