Study And Analysis Of Micro Level Examination Of Robot Arm Using Simulation For Improving The Path Motion Of Arm With Reduced Time And Dof

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Abstract - In the growing context productivity plays a major role in the organization to improve the processes and activities in the minimum possible way. Simulation gives the solution to the real-world problems by modelling the behaviour of existing system using software by virtual analysis. Based on the results given by simulation we can able to improve the existing processes by slightly adjusting the behaviour of system. In this paper attempt has been made to study and analyse the path movement of robot arm using simulation software the detailed analyse carried for different combination of sequences, Degrees of freedom and sample size these are the factors taken for study . In this number of sequences of arm movement and degrees of freedom are the controlling factors which studied to improve the minimum possible degrees of freedom to reduce the complexity of path movement of arm by minimizing the run time of simulation experiment using ROBO DK software.This can be designed by studying the drawbacks of simulation later and modelled as prototype and then fabrication of real product.

Keywords: ROBO DK , Path movement ,Simulation , Run time

I. INTRODUCTION

Automated robotic arm is a mechanical item, its assembling and sold rate is high over the world. Thousands kind of arm are accessible in the market furthermore, created by various organizations. Mechanical utilization of the mechanical arm is more than the homegrown in light of the fact that as of now robot are not utilized for typical design; it's constantly utilized for explicit reason and in the business some condition where people can't work for example high temperature, contaminated air zone, substantial weight lifting and so forth.Automated arm likewise utilizes for high exactness places where mistake not permitted. Mechanical arm is set a task and perform it precisely in the different condition. A mechanical arm is implied a lot of unbending jointed bodies ready to take distinctive design, and to move between these designs with recommended limits on speed and quickening.Modern automated arm contrasts by the size of the fixed bodies, the kind of joint, the grouping where the joints are associated and the scope of movement satisfactory at each joint. The individual fixed bodies are called joins. Mechanical arms are fabricated by utilizing various boundaries like number of hub, level of opportunity, working envelope and working space that arm spread, kinematics, payload, speed and increasing speed, exactness and repeatability, movement control and drive of an arm and so on. This review papers to sum up the advancement in an automated arm.
In this study, we examined papers as per the diverse boundary of an automated arm.

A. Axis

Axis are utilized for development sign, one use for a line, two for a plane and three for a point at anyplace in space. Move pitch and yaw control are the fundamental elements of a mechanical arm pivot, use for full control. Before 1987 robots mechanical arms are working. In [2] 2-axis and 3-pivot. However, presently there in [3] 4-pivot, in [4] 5-axis, in [5] 6-axis and in [6] multi-axis automated arms are accessible. Uninhibitedly moving are useful for three measurements, pivoting hub arm must be positive intelligent for good solidness. Mass of arm should be less for less power of dormancy at various joints, lighter arm performs more powerfully than massive arms at same security level. Modern mechanical arms are utilizing cumbersome apparatus and weight of arm likewise high, use for huge development. Robots may get adaptable and less in weight by utilizing different pivot arms.

B. Degrees of freedom

Mechanical arm control all focuses (directionally) utilizing their degrees of opportunity. A human arm control by seven degrees of opportunity, explained arms ordinarily have up to six level of opportunity. [8] A mechanical arm is made by utilizing diverse strong part, join by n number of joint associated, each joints having one level of opportunity on the off chance that there n number of the joint, at that point arm have n level of opportunity (DOFs)We can comprehend by n joint arranges otherwise called inner directions. All directions rely upon joints and depict the overall movement of alongside joins. In [10] automated arm with three joint having 8 degrees of opportunity and when we incorporate five finger of hand then it became 17 degrees of opportunity. In [11] a mechanical arm mounted on wheelchair having 6 degrees of opportunity and control by a shading vision framework for legitimate article finding, a power and force sensor, driving by great UI gadgets. In [12] 3D vision following of flight, an item is conceivable without making solid presumptions with 7 degrees of opportunity arm. [13] Gives catching Robot Workspace Structure with double arm each having 7 degrees of opportunity. [14] an automated arm that carry on like a human simple movement, this arm was structured with 7 degrees of opportunity for expanding intuitiveness with people, power sensor was connected to wrist sensor work in six hub and utilized figuring power apply at the arm.

C. Design of Work volume and Working Shell

The automated arm can cover hover in space is a working envelope of a mechanical arm. Envelope implies the range can cover by arm or scope of development. In the event that we utilize the arm in various potential ways (advance and in reverse, all over) at that point one 3D shape is an envelope, it rely upon an automated arm and number of hub, the pivot can control the scope of movement.The locale where a mechanical arm can completely work with no obstructions is a working space of that arm. Working space of mounted arm is less. Spread whole space for their working. An arm mounted over table need half circle of sweep equivalent to an automated arm.

D. Kinematics

Automated arm has an alternate joint of Cartesian, enunciated, circular and equal and so forth., we organize them for controlling a movement of a mechanical arm. Robot kinematics is use for finding the development of multi-hub and multi-level of opportunity. A chain of kinematic is utilized for making structure of robot.The need of structure is various parts (inflexible bodies) are appropriately associated at joint to give phenomenal turn, automated kinematics use for think about speed, increasing speed also, position of all unbending body part in the mechanical framework and chose all control development. It likewise ascertains definite power, force, choose the function of movement, latency and mass at each part of a mechanical arm for making an effective arm. [28] The kinematics having condition and change between working space and arranges of Montana traces equation, this strategy choose fixed body, movement and pace of progress of associated facilitates. Its assistance to keep up arm and use for speed examination, it's restricted to one investigation.Nonredundant robot setup tackled kinematics issues, however it's hard to comprehend precision and dynamic impact, this issue understood by excess. An excess robot can't work in a one of a kind way so it's hard to characterize next move of excess robot. This issue understands by genuine vision work screen. [8] The disseminated situating is utilized for human arm movement, joint meddle estimation called kinematic weakness this idea otherwise called essential kinematic contribution, in this work they talked about some help and results.

II. LITERATURE REVIEW

Mohd. Nayab Zafar [1] This paper centres around progression of a self-sufficient robot controller for pick and spot applications utilizing Artificial Intelligence Technique. The portable robot conveys a four Degree of Freedom (DOF) automated arm for picking a specific article from a given introductory situation to the necessary objective situation in an obscure static condition, while handling impediments and actualizing way arranging calculation utilizing man-made brainpower method. The proposed computerized reasoning method utilizes the streamlining procedure, in view of a novel metaheuristic approach for versatile robot way arranging.The adequacy of the technique was tried and checked by means of re-enactment mode on four distinct directions. From the re-enactment results, it was discovered that around way length and slipped by season of three-sided shape, tapered shape, cubical shape&S-shape deterrents situations are 70.22,70.92,71.29 and 70.36 pixels and 117.93,73.94,122.86 and 117.87 seconds individually.

Bahaa Ibraheem Kazem [2] This paper proposes hereditary calculation (GA) to streamline the highlight point direction anticipating a 3-connect (excess) robot arm. The target work for the proposed GA is to limiting voyaging existence, while not surpassing a most extreme pre-characterized force, without crash with any deterrent in the robot workspace. Quadrinomial and quintic polynomials are utilized to depict the fragments that

associate beginning, moderate, and last point at joint-space. Direct kinematics has been utilized for evading the particular designs of the robot arm.

Virendra patidar [3] This is a study paper on an automated arm and their turn of events. It gives a specialized prologue to a portion of the ongoing examination work in this field. This is a working field of research in which there are various exceptional open issues and a zone of investigation. These days, an alternate assortment of mechanical arms are industrially accessible. Some of them are astounding in exactness and repeatability. In this paper, we comprehend the advancement of mechanical arm in most recent 20 years and portrayed various boundaries of an arm. Sort of automated arm just relies upon these boundaries. Our study might be utilized for information and rules for future examination work. The paper closes with research holes and proposed work. Automated arm utilizes in the various fields like a family unit, work environment, and working station.

Jun Kurosu [4] Double arm robots are relied upon to perform work in a unique situation. One of the most essential undertakings that a double arm robot does is pick-and-spot work. Nonetheless, this work is more confounded when there are a few articles in the robot's workspace. Also, it is probably going to set aside a long effort to complete the work as the quantity of items increments. Along these lines, we propose a strategy utilizing a blend of two ways to deal with accomplish productive pick-and-spot execution by a dual arm robot to limit its activity time. Initially, we utilize blended number straight programming (MILP) for the pick-and-spot work to figure out which arm should move an article and in which request these items ought to be moved while considering the double arm robot's activity go. Second, we plan the way utilizing the quickly investigating arbitrary tree so the arms don't impact, empowering the robot to perform productive pick-and-spot work dependent on the MILP arranging arrangement. The adequacy of the proposed technique is affirmed by recreations and investigations utilizing a real double arm robot.

David Galva Wall [5] This article gives a novel direction age calculation which is reasonable for working in bound and risky conditions. A procedure is created which can, progressively, compute the presence of a sheltered way for exploring a mechanical controller arm between hindrances without crash and precisely producing an effective way between them. A guide of nature is made in the control servo area utilizing existing condition information where each component of the guide space speaks to one of the degrees of opportunity of the controller. The guide is a multi-dimensional space that speaks to the control scopes of the controller and which contains impediments to be evaded. The beginning and wanted areas of the arm end effector can be changed over into this space so a way can be created between them. The space is part into a diagram of hubs, and a Dijkstra's most brief way calculation is utilized to create a sheltered direction. On the off chance that a fruitful direction can be discovered, at that point the arm wanted area is feasible and the rundown of hubs that make up the direction structure a lot of control prerequisites that can be followed to drive the arm to its ideal math.

Ahmed El-Sherbiny [6] Robot arms are basic apparatuses these days in ventures because of its precision through fast assembling. One of the most testing issues in modern robots is settling converse kinematics. Backwards Kinematic Problem worries with finding the estimations of edges which are identified with the ideal Cartesian area. With the advancement of Softcomputing-based strategies, it's gotten simpler to take care of the converse kinematic issue in higher speed with adequate arrangements as opposed to utilizing customary techniques like mathematical, mathematical and logarithmic. This paper presents a near report between various delicate processing-based strategies (Artificial Neural Network, Adaptive Neuro Fuzzy Inference System and Genetic Algorithms) applied to the issue of backwards kinematics. With the assistance of proposed strategy called limited blunder work, both ANN and ANFIS can outflank different techniques. The trial test are finished utilizing 5DOF robot arm and examining the outcomes demonstrated the reproduction results.

Stefan Klanke [7] We present an on-line, powerful, and productive way organizer for the excess Mitsubishi PA-10 arm with 7 degrees of opportunity (DOF) in non-fixed conditions. As a result of the explicit kinematic model of the arm, way arranging can be first decreased to an excess 6-DOF issue in a 5D arrangement space, which can be additionally disintegrated into two problems:(i) 3D position arranging in Cartesian space and (ii) arranging in a 3D space made out of two direction points and an unequivocal definition of the arms repetition. Position and direction arranging are interlacing and performed "on-thefly" without unequivocal worldwide information on the earth utilizing two occasions of the dynamic wave development neural organization (DWENN), a viable strategy for way age in self-assertively evolving situations. The dynamic and explorative nature of the DWENN calculation permits to treat fixed and dynamic snags in a brought together way. Through various simulative tests, we show that the organizer is equipped for arriving at both a palatable vigor level and continuous execution, as required by numerous viable applications.

Liang Yang [8] Robot 3D (three-measurement) way arranging focuses for finding an ideal and impact free way in a 3D workspace while considering kinematic requirements (counting mathematical, physical, and worldly imperatives). The motivation behind way arranging, not at all like movement arranging which must be mulled over of elements, is to discover a kinematically ideal way with minimal time just as model the earth completely. We examine the essentials of these best robot 3D way arranging calculations which have been created as of late and focus on generally relevant calculations which can be actualized in flying robots, ground robots, and

submerged robots. This paper groups all the strategies into five classes dependent on their investigating components and proposes a classification, called multifusion based calculations. For every one of these calculations, they are investigated from a period productivity and implementable zone point of view. Besides a thorough material investigation for every sort of strategy is introduced in the wake of thinking about their benefits and shortcomings.

Giovanni Carabin [9] In the most recent decades, expanding vitality costs and developing ecological mindfulness have driven designers and researchers to discover new answers for decreasing vitality utilization in assembling. Albeit numerous cycles of a high vitality utilization (e.g., synthetic, warming, and so forth.) are considered to have arrived at significant levels of effectiveness, this isn't the situation for some other modern assembling exercises. In reality, this is the situation for mechanical and programmed frameworks, for which, before, the minimization of vitality request was not viewed as a plan objective. The correct plan and activity of modern robots and mechanization frameworks speak to an extraordinary open door for diminishing vitality utilization in the business, for instance, by the replacement with more productive frameworks and the vitality advancement of activity. This audit paper groups and investigations a few approaches and advancements that have been created with the point of giving a reference of existing strategies, procedures and innovations for upgrading the vitality execution of mechanical automated and mechatronic frameworks. Equipment and programming techniques, including a few subcategories, are thought of and analysed, and rising thoughts and conceivable future viewpoints are talked about.
T. Pardi [10]This paper presents a method for constrained motion planning from vision, which enables a robot to move its end-effector over an observed surface, given start and destination points. The robot has no prior knowledge of the surface shape, but observes it from a noisy point-cloud camera. We consider the multi-objective optimisation problem of findingrobot trajectories which maximise the robot's manipulability throughout the motion, while also minimising surface-distance travelled between the two points. This work has application in industrial problems of rough robotic cutting, e.g. demolition of legacy nuclear plant, where the cut path need not be precise as long as it achieves dismantling. We show how detours in the cut path can be leveraged, to increase the manipulability ofthe robot at all points along the path. This helps avoid singularities, while maximising the robot's capability to make small deviations during task execution, e.g. compliantly responding to cutting forces via impedance control. We show how a sampling-based planner can be projected onto the Riemannian manifold of a curved surface, and extended to include a term which maximises manipulability. We present the results of empiricalexperiments, with both simulated and real robots, which are tasked with moving over a variety of different surface shapes. Our planner enables successful task completion, while avoiding singularities and ensuring significantly greater manipulabilitywhen compared against a conventional RRT planner.

III. RESEARCH GAP

In the above literature authors have used different methods like algorithm, simulation and mathematical models to predict the behaviour of arm in robot. But in the above literature there is no such analysis like micro level examination in reducing the degrees of freedom (DOF) constraints in arm of robot. Hence attempt has been made to simulate the experiment under 8 possible iterations to find out the simplest motion of arm by minimizing degrees of freedom (DOF) with reduction in the simulation run time of experiment based on that we can do modified design and fabrication in future for real environment.

IV. METHODOLOGY

In this paper simulation is carried out for two types of robots in terms of degrees of freedom, number of sequences and simulation run time using software ROBO DK. The main objective of problem is to study and analyse the micro level examination of robot arm within a work environment when it is subjected to do various tasks. So, we have treated degrees of freedom as one of the primary parameters to measure the simplified motion of robot arm in this paper attempt has been made to solve the problem by reducing the simulation run time for minimum degrees of freedom such that the work can be performed with time efficient manner. In that way we have taken simulation analysis for two robots namely Doosan and ABB robot the common parameters are considered for both the robots as shown in table 1 and 2 respectively. The corresponding simulated images are given in Fig 1 and 2 as shown below

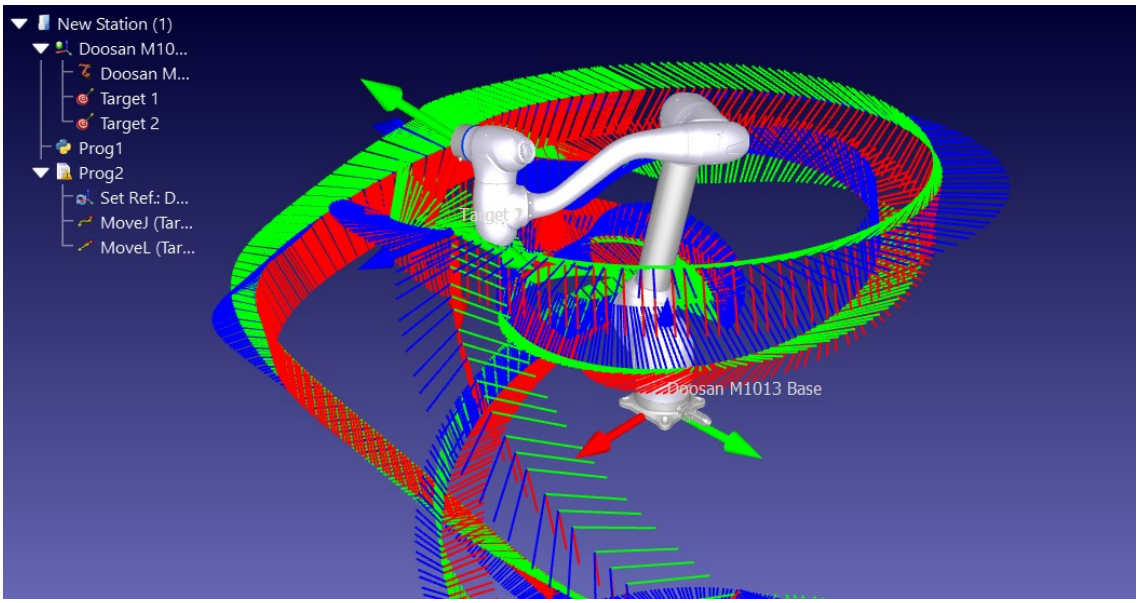


Fig 1. Simulated view of Doosan robot using ROBO DK SOLVER

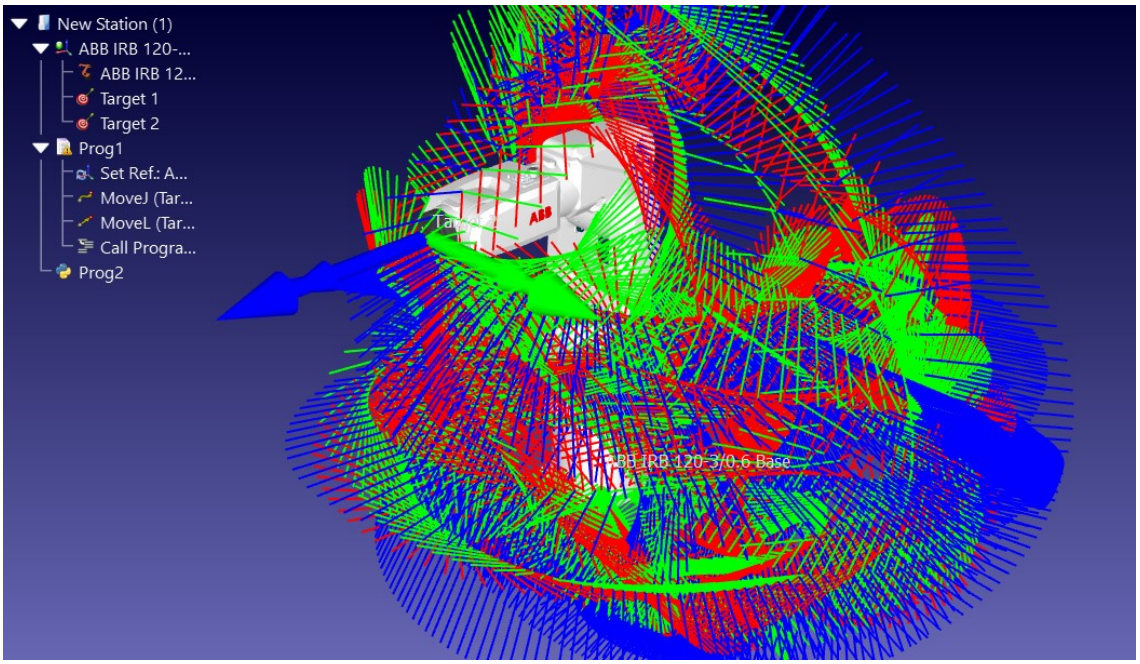


Fig 2. Simulated view of ABB robot using ROBO DK SOLVER

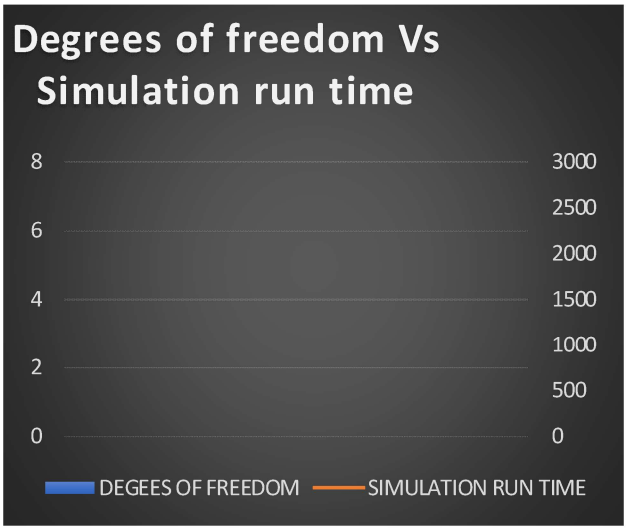
V. RESULTS AND DISCUSSIONS

In this paper different problem size, edges per samples and degrees of freedom are taken to measure the simulation run time of the experiment under each possible step. From table 1 the results clearly shows that for large problem size the simulation run time is more especially for problem size 1 as shown in table 1 simulation run time is 2700 seconds similarly for small problem size the simulation run time is 60 seconds this clearly tells about the simplicity of design and kinematics of machine in terms of degrees of freedom . the results are shown in graph 1 as indicated below . the same thing is done for another machine as given in table 2 and graph 2 as shown below:

VI. SIMULATION STUDY FOR DOOSAN ROBOT:

S.NO	Number of sequences	Edges /samples	Degree of Freedom	Simulation Run time (secs)
1	202	40	7	2700
2	178	37	6	2100
3	121	25	5	1800
4	100	22	4	1500
5	49	18	3	1080
6	40	12	2	780
7	07	09	2	120
8	05	06	2	60

TABLE1 .



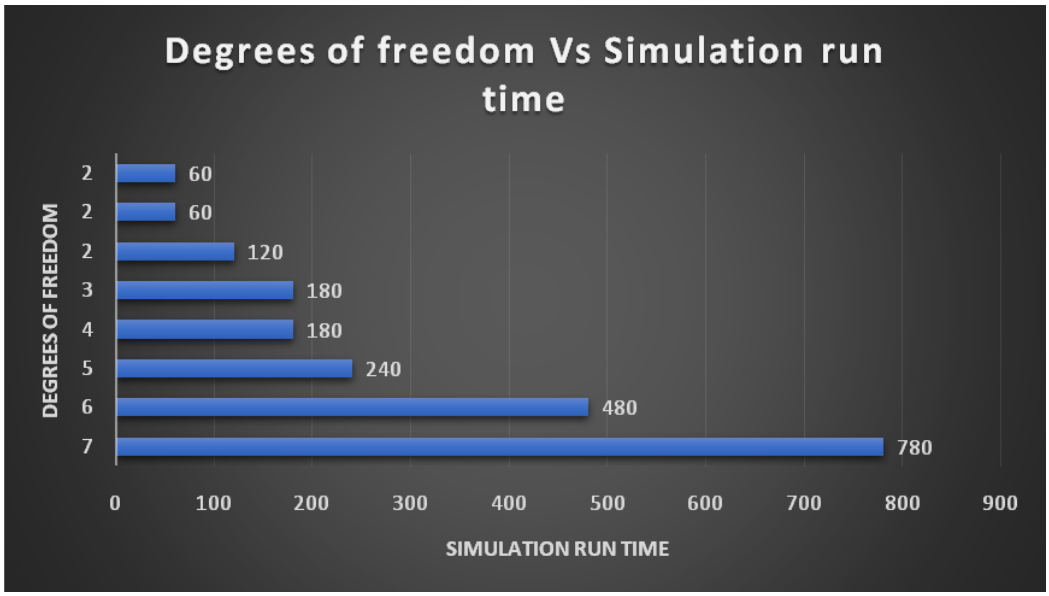
Graph 1.

Simulation study for ABB Robot:

S.NO	Number of sequences	Edges /samples	Degree of Freedom	Simulation Run time (secs)
1	202	40	7	780
2	178	37	6	480
3	121	25	5	240
4	100	22	4	180

5	49	18	3	180
6	40	12	2	120
7	07	09	2	60
8	05	06	2	60

Table 2



Graph 2

VII. CONCLUSION

In this paper we have considered the minimum degrees of freedom with reduced simulation run time for both the cases. By doing so we can able to find out the optimum run time for the given degrees of freedom such that we can able to redesign the set up with reduction in degrees of freedom by improving the time efficient operation in working environment. Through simulation studies we are doing this analysis that will be extended as fabricated model in real system later.

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