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Smart Gym Trainer

P Shiva Shankar[1], P Sowmya[2], P Kavya[3], P Nandini[4], Sudhakar Avareddy[5]
[1, 2, 3, 4, 5]*Ballari Institute of Technology and Management, Ballari*

Abstract: ***Nowadays, health is wealth as recently we all faced Covid-19 disease. If take into an account, maintaining our health was much important for that we must always do diet, mediation, and exercising, these are the most vital factors for measuring a healthy life. To be free from injuries and obtaining the foremost from our workout proper form of exercise is important. Doing an excessive amount of repetition and over training can cause muscle soreness. Unceasingly doing exercise incorrectly may eventually cause severe future injuries. The rest between the sets ought be optimum depending on the repetition of the exercise, what muscle group is being trained and the load that's being place within the muscle. Maximum Muscle hypertrophy is achieved with the proper type of exercise. The goal of the project is to build an exercise repetition counter and form corrector in a way so that the optimum growth is often achieved with the help of cutting-edge technology. We tend to the area units that are able to observe and notice errors in user's activity (pose) by effectively supporting some threshold deviation between the limb angles. If a person is doing exercises with the help of this system, the user\'s form is checked (corrections in form also will be given if any) repetition's status and count is displayed, beside this the AI dietitian calculates the performance, total workout, etc. and produces the detailed report of that user. This can increase muscle hypertrophy and scale back the injury.***
Keywords: Pose estimation, Muscle hypertrophy, AI, BMR Calculator.

I. INTRODUCTION

Fitness is a fashion today. Every year the fitness business grows by 8.7%, according to the Wellness Creatives report, and fitness apps have not spared this field. There are many cases of how technologies might facilitate to boost your body - from tracking exercise activity to adjusting nutrition. The question is how much better can such apps facilitates to improve the performance of physical exercises compared to human coaches? Personal trainer apps based on AI are becoming increasingly prevalent with the advent of human cause estimation technology. Being power driven by computer vision, human pose estimation and natural language process algorithms, these technologies lead end-users through sort of workouts and provides time period feedback.

While specific exercises like squats, deadlifts, and shoulder presses can be beneficial to health and fitness, if performed incorrectly, they can even be dangerous. Muscles and ligaments can be severely injured by heavy weights during these workouts. Several folks estimate and perform these exercises ,but don't maintain the right type (pose), this would possibly result to a inadequacy of formal coaching through categories or a personal trainer, or could also be due to muscle fatigue or mistreatment for an excessive amount of weight. For our course project, we tend to get to help folks in performing the correct posture for exercises by building Pose Trainer, a software application that detects the user's exercise pose and provides helpful feedback on the user's type, using a combination of the most recent advances in pose estimation and machine learning.The goal of Pose Trainer is to reduce injuries and improve quality of workouts through simple computer and webcam use. Human pose estimation is the first step in Pose Trainer, a field of computer vision that is difficult but highly applicable.

II. LITERATURE REVIEW

1) *Toshev and C. Szegedy, "DeepPose: Human Pose Estimation via Deep Neural Networks",2014*

The author iintroduced how a pose estimation is formulated as a CNN-based regression problem towards body joints. The model consisted of an Alex Net backend (7 layers). The model is trained using L2, loss for regression. This approach reasons about pose in a *holistic fashion*, i.e., even if certain joints are hidden, they can be estimated if the pose is reasoned about holistically. The paper argues that CNNs naturally provide this sort of reasoning and demonstrate strong results.

2) *J. Tompson, R. Goroshin, A. Jain, Y. LeCun and C. Bregler, "Efficient object localization using Convolutional Networks," 2015.*

The author discussed about the method that predicts the estimates and then correct them iteratively. Instead of directly predicting the outputs in one go, they use a self-correcting model that progressively changes an initial solution by feeding back error predictions, and this process is called Iterative Error Feedback (IEF).

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It employs a standard Conv Net architecture pre-trained on ImageNet: the very deep google net.

3) J. Carreira, P. Agrawal, K. Fragkiadaki and J. Malik, "Human Pose Estimation with Iterative Error Feedback," 2016

The author generates heatmaps by running an image through multiple resolution banks in parallel to simultaneously capture features at a variety of scales. The output is a discrete heatmap instead of continuous regression. A heatmap predicts the probability of the joint occurring at each pixel. A multi-resolution CNN architecture (coarse heatmap model) is used to implement a sliding window detector to produce a course heatmap output.

4) M. Fieraru, A. Khoreva, L. Pishchulin and B. Schiele, "Learning to Refine Human Pose Estimation," 2018

The author describes about the “Learning to Refine Human Pose Estimation” have given insights on refining the human pose estimation where It takes the help of RGB image and body pose estimate as input to render out the suitable output and Exploiting the dependencies between the image and the predicted body pose makes it easier for the model to identify the errors in the initial estimate and how to refine them along with methods to achieve state-of-the-art results on the challenging MPII Human Pose and Pose Track benchmarks

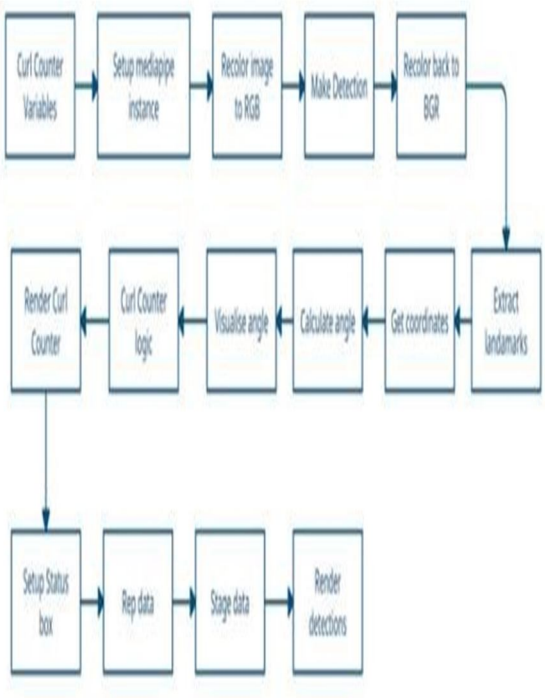
5) Z. Cao, G. Hidalgo, T. Simon, S. -E. Wei and Y. Sheikh, "OpenPose: Realtime Multi-Person 2D Pose Estimation Using Part Affinity Fields”,2021

The author introduced about the “Open-Pose: Realtime Multi-Person 2D Pose Estimation using Part Affinity Fields” suggested the usage of 2D pose of multiple people in an image where “OPENPOSE” 2D human pose estimation as an input for their systems, where they used COCO human pose datasets for training data sets and getting the desired output.

6) S. Thys, W. V. Ranst and T. Goedemé, "Fooling Automated Surveillance Cameras: Adversarial Patches to Attack Person Detection," 2019

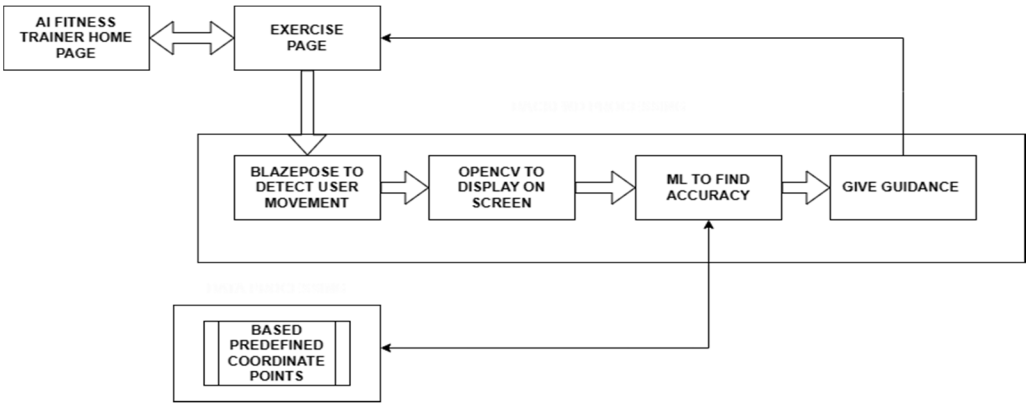
In this research work they describes about “Fooling automated surveillance cameras: adversarial patches to attack person detection” Object detection of this paper they target the popular YOLOv2 object detector, An example of real-world adversarial attack. Sharif et al. demonstrate the use of printed eyeglasses that can be used to fool facial recognition systems for making the patches more robust. Thus, vulnerability of certain neural networks has been exposed.

III. METHODOLOGY



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IV. SYSTEM ARCHITECTURE



The architecture of the proposed system is shown below the UI of the system includes following fields to be manually entered by the user the fields are:

1) AI Fitness Trainer Home page
2) Exercise page
3) Blazepose to detect user movement
4) Opencv to display on screen
5) ML to find accuracy
6) Based predefined coordinate points

a) AI fitness trainer home page consists of user details and profile like mail and name as well as password. It also consists of several exercises, where user can select exercises
b) The exercise page will take the user to the respective exercise, which the user has been selected on the AI fitness trainer page.
c) Blazepose is an algorithm which detects the
d) user movements.
e) Opencv is a module present in python library, which captures the user exercises.
f) The work of accuracy is to check whether the user movements will match with the criteria.
g) If the user does correct exercise, then it will count the exercises correctly, when user did the exercises wrongly then it will give guidance to the user.
h) Smart gym trainers can use pre-defined coordinate points to help users perform exercises correctly. Coordinate points are preset guidelines that provide users with visual cues on how to move their bodies to complete each exercise. These points can be used to help users maintain proper form, keep their bodies in the correct position, and avoid injury.

V. EXISTING SYSTEM

The AI Smart gym trainer is a fitness machine equipped with various sensors and artificial intelligence capabilities to provide a personalized workout experience. The machine has a touchscreen display that allows users to select their workout programs and track their progress.

The AI Smart gym trainer uses machine learning algorithms to analyze the user's performance data and adjust the workout program accordingly. It can adapt to the user's fitness level, goals, and preferences to create a tailored workout plan.

The machine is equipped with sensors that can monitor the user's heart rate, blood pressure, and other vital signs. It also has cameras and motion sensors that can track the user's movements and provide feedback on their form and technique.

Additionally, the AI Smart6 gym trainer is designed to connect to other fitness devices and apps, allowing users to seamlessly integrate their workout data and track their progress across multiple platforms.

Overall, the AI Smart6 gym trainer is an advanced fitness machine that leverages AI and sensor technology to provide a personalized and effective workout experience. authentication option.

DISADVANTAGES OF EXISTING SYSTEM

1) Risk of injury
2) Expensive

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VI. PROBLEM STATEMENT

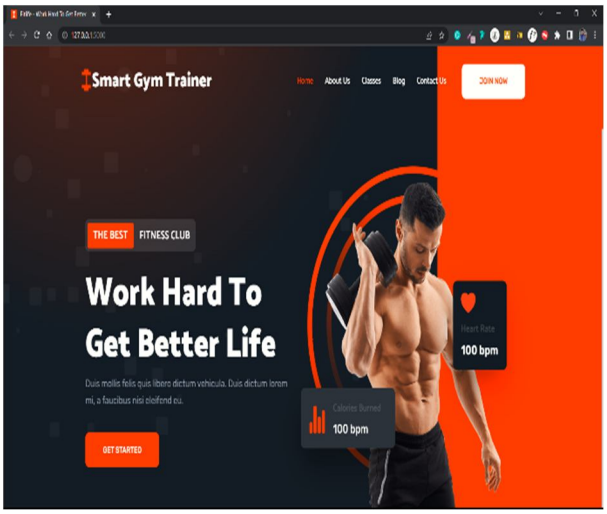
To design and develop a smart web-based gym application, that facilitate user to maintain good health.

ADVANTAGES OF PROPOSED SYSTEM

1) It is affordable
2) Equipment less
3) It is user-friendly

VII. OBJECTIVE

1) To find errors in user's activity (pose) by effectively supporting some threshold deviation between the limb angles
2) To Providing the correct guidelines to achieve the optimum growth.
3) To Calculate the performance and total workout of the individuals
4) To increase muscle hypertrophy and reduce the risk of injury.



VIII. RESULTS

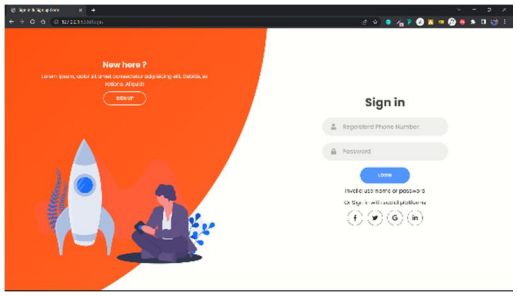


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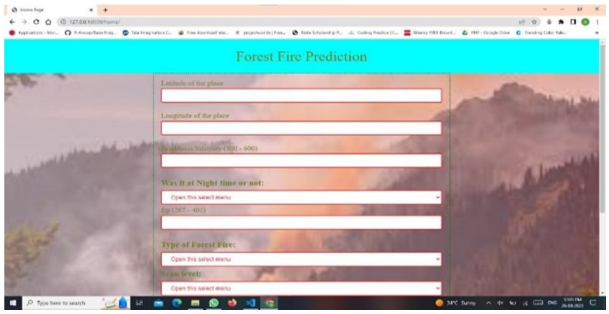


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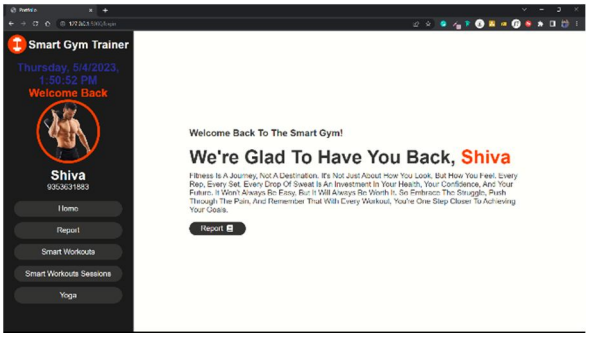


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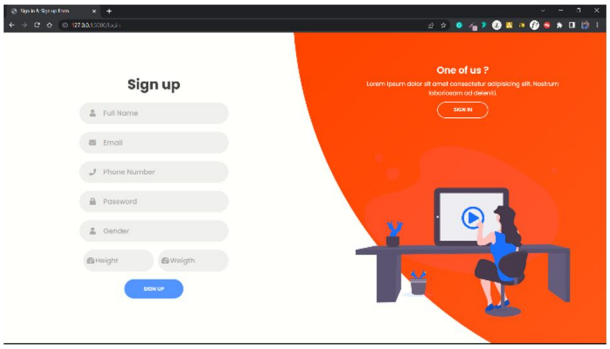


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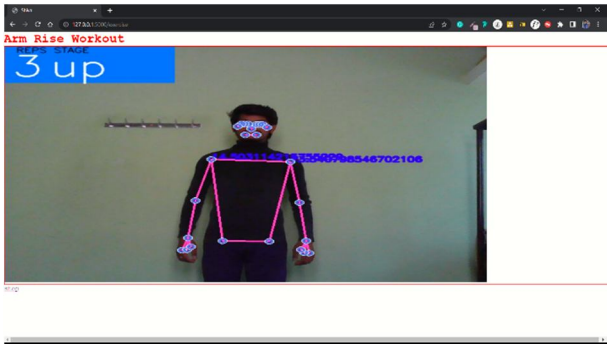


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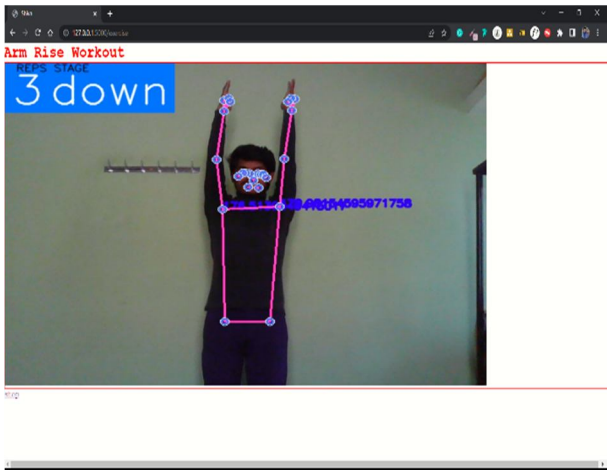


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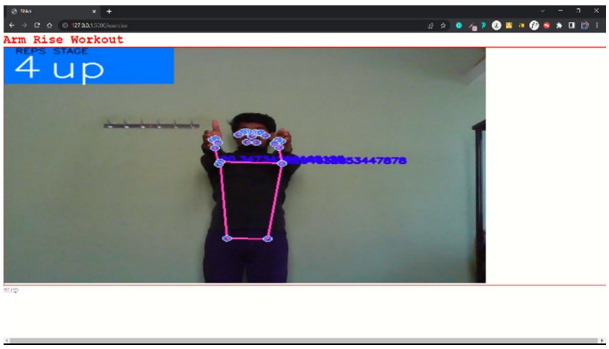


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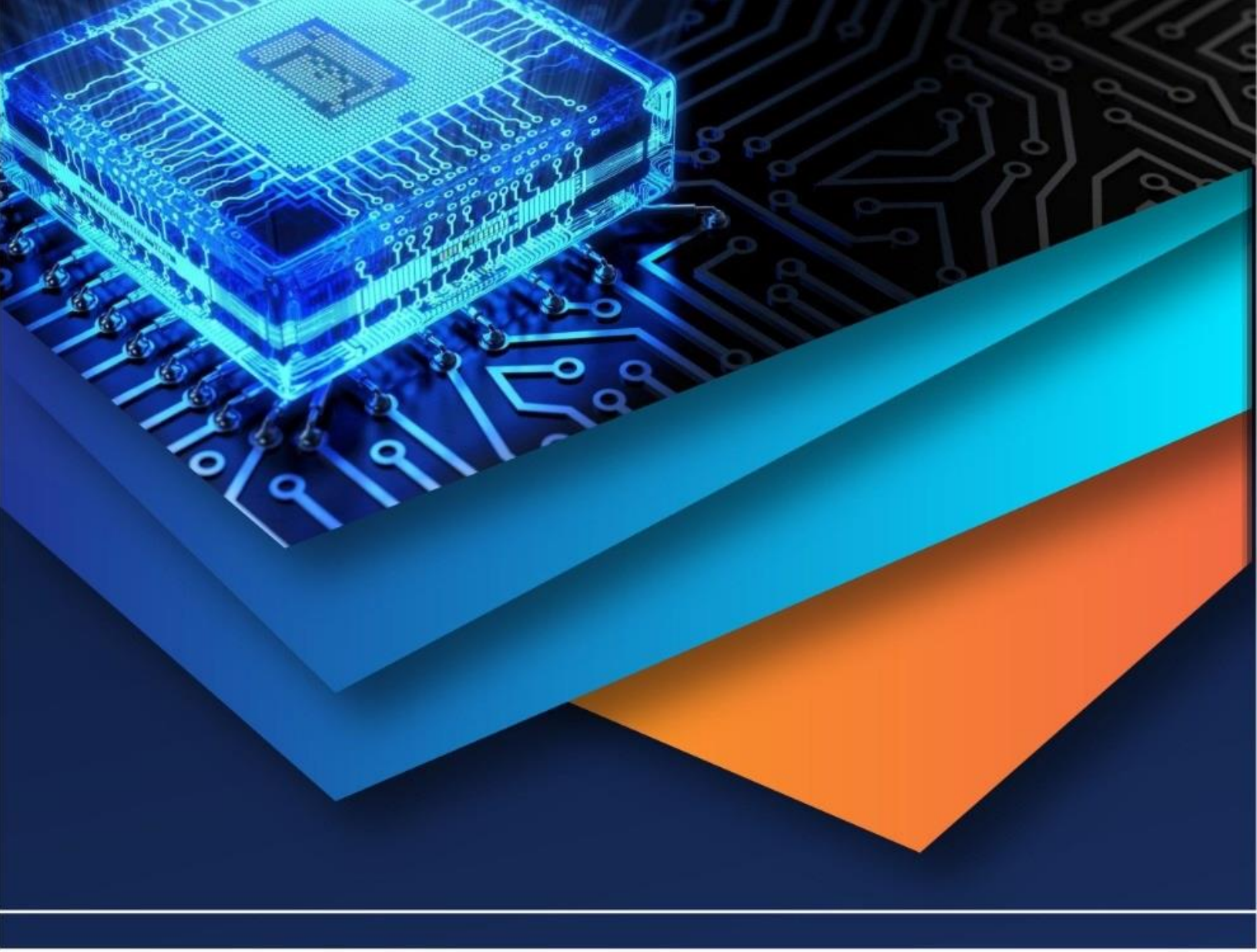
IX. CONCLUSION

The AI Gym trainer is an automatic system based on machine learning and computer vision technologies. This system is successfully able to calculate the repetitions of gym exercises and proper quite the exercises that's vital for muscle hypertrophy. At the facet of these decisions, the system includes a metabolism calculator that calculates the macros (i.e. daily demand of supermolecules, fats, protein) in step with users fitness goal.

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