# DESIGN AND ANALYSIS OF PLAINT ROBOTIC ARM: THE LIVENER

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Abstract:-
In present world of emerging industries and world -class technologies, there is always a need for human aidin various integration. With growing complexities and payload, there comes a requirement for higher configurated machineries to cope up with needs. Thou, there are numerous support system existing, things ease up when there comes a higher performance with lower requirements. So,our proposal basically suggests it. The objective is to build a plaint arm that can lift up to 5kgs which makes use of lesser complex design and control mechanisms. The control unit makes use normal microcontroller like Arduino UNO and interfacing components like linear actuators, stepper motor, joystick. The robotic arms available in the market have payloads below 2kgs of weight. As an attempt of increasing the increasing the efficiency and to prove simplicity in robotic arms this model has been proposed. This can find uses from a simpler table movement operation to a moving a heavier load in industries by modifications in design.
Keywords— payload, plaint, Arduino, actuators, joystick, efficiency.

## INTRODUCTION

The robotics concept is mainly used in industry, research, and machinery-based sectors to basically reduce the faults caused by humans and to reduce the human workload. This paper describes the design and simplified proposal of the same. The plaint arm is often directed to move a thing from one place to another place. One common example that is seen in industrial atmosphere include moving of a weighed tank or container from one terminal to other by using a robotic arm. The advantage of automated process is that gaining a faster result at a short span of time. This paper also describes the implementation of a plaint arm with remote controlled.

In the field of robotics, the beginner can contribute many functional operations in the world. This arm cansolve and enhance manyhuman's limitations. Limitations like, disable person facing issues to move from one place to another to take things can be overcome by using plaint arm, where it can aid in taking a bottle or things from a kitchen or another. When they use this type of robot, they can solve their problem easily without help other person for its easy operation system. Hence it all depends of how we use and how well we program the plaint arm based on our requirements.

## LITERATURE SURVEY

i. 4DOF Assembling Acrylic Machine Robot Arm with MG90S Metal Gear Servo for Robot DIY

Description: 4DOF Robot Arm, made of Acrylic, weighing About 280 grams of color Black. About Servo MG90S (Metal Gear), Weighing about 13.4Grams of dimension 22.8mm x 12.2mm x 28.5mm of having Stall Torque of 1.8kg/cm (4.8V )2.2kg/cm(6V), it has temperature range 0 degree to 55 degree. The Operating Speed is 0.1sec/60 degree (4.8v), 0.08sec/60degree(6v). The dead band width is 5 Usec. The Gear Type is All Metal gear

ii. DIY 2DOF Robot Arm Manipulator Claw+2pcs Servo Brackets

Description:
The Package total weight is about 112 gm, the Clamp Claw has Weight capacity is about 300 gm objects, is made of Material Full aluminum alloy, the Weight is About 64gm the Maximum angle is 54mm, the Total length is 110mm (paw when closed overall longest length) and the Total width is 94mm (the claws open when the maximum overall width). The Servo bracket used in the shoulders and knees or another joint of humanoid robots, biped robots etc. It Can plant a camera or IR sensor for Robot.

iii. DIY 4DOF Robot Arm 4 Axis Acrylic Rotating Mechanical Robot Arm with Arduino UNO R3 4PCS SG90 Servo

Description:

The name is 4DOF Robot Arm Kit. It belongs to DIY robot and has a DOF of 4 degree of freedom and made of Acrylic. It can be used for age group of 8 years old and above and is weighing about 450gthe Features are

- 4 degree of freedom robot arm with more untrammeled and flexible experience.
- Most parts are integrated punch-formed at one time, which is very strong and easy to install.
- All movement joints are using high quality bearings with good precision.
- Full 4 axis moving to do extra extension and support 180° robot servo.

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Description:

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- 4 degree of freedom robot arm with more untrammeled and flexible experience.
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## OBJECTIVE

When the final product (Robotic Arm) is fabricated and tested for the proper working of the arm, it is expected to lift a weight around 5-7 kgs of weight. Because each of the linear actuators that are being used can lift a weight of 3 kgs and the stepper motor alone can lift or the maximum payload for the stepper motor that we are using is 4 kgs. So, put together by theoretical calculation we can say that the robotic arm can lift of 5-7 kgs to the maximum. The design was also carried out to work according to the lifting of desired load. The load is in KGS because of the present requirements in industries and various stores where they can get their work done with a lesser budget robotic arm.

## METHODOLOGY

The principle which is used is –Forward kinematics. Kinematics studies the motion of bodies without consideration of the forces or moments that cause the motion. Robot kinematics refers the analytical study of the motion of a robot manipulator. It is using the kinematics equations to compute the position of the end-effector from the joint parameter specified values. The kinematic equation finds uses in robotics, computer specific graphics where the application finds higher specification in determining positions. The reverse process of computing joint parameters using the position is called inverse kinematics. It's always important to find the forward kinematics notation in robotics while using a new robot to research.

A manipulator is composed of serial links which are affixed to each other revolute or prismatic joints from the base frame through the end-effector. Calculating the position and orientation of the end-effector in terms of the joint variables is called as forward kinematics

We use this principle to effectively compute the spaces and angles for components in the manipulator.

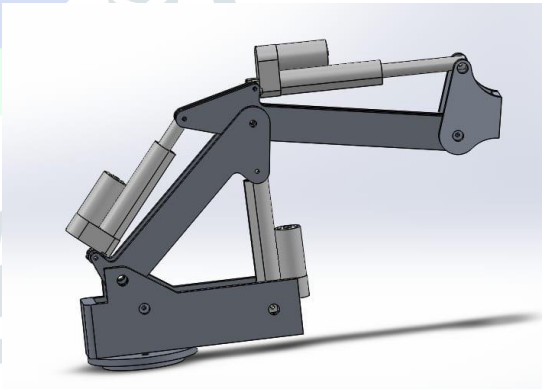


**Fig 1. An illustration of our plaint robotic arm**

## PROPOSED DESIGN

The design makes use of material-aluminum 6061. The construction makes use this metal because of the durability and to give stability for the arm to lift heavy loads. The base facilitates 360-degree rotation. The design is carried by mathematical relations and equations for avoiding failures. The microcontroller is Arduino UNO, for ease of simple usability. The interfacing between the Arduino UNO and arm seems simple with easier coding. The detailed explanation of each component is mentioned below

**MATERIAL USED – ALUMINIUM 6061**

6061 is a precipitation-hardened aluminum alloy, containing magnesium and silicon as its major alloying elements. The metal possesses a good resistance to get welded, and is considered to be one of the popular alloys.

Its forms include pre-tempered grades like 6061-O (annealed), tempered grades like 6061-T6 (solution and artificially aged) and 6061-T651 (solution stress-relieved stretched and artificially aged). The mechanical qualities of the alloy depend on the temperature used, the stress given, the method it's treated.

The common use of aluminum 6061 include

- Used in aircraft bodies due to its mechanical properties.
- Yachts and small boats.
- Automotive parts, such as the chassis of the Audi A8.
- also used for tactical lights

**Fig 2. Bars and rods of Aluminum 6061**

**ROUGH SKETCH OF THE MODEL**

The below sketch fig 3. shows a 2-D view of how the end robotic arm looks. The dimensions and effectiveness of the arm is crossed verified using CADD software. The each and every components dimension are properly calculated and put in the Solid Edge software. The arm mainly contains a rotating arm, the arm supporters and two main body parts. All the components are fabricated using aluminum 6061 metal for its durability and higher efficient user end.

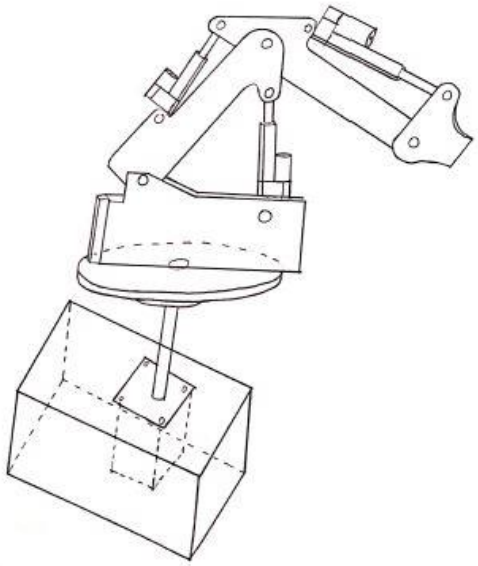
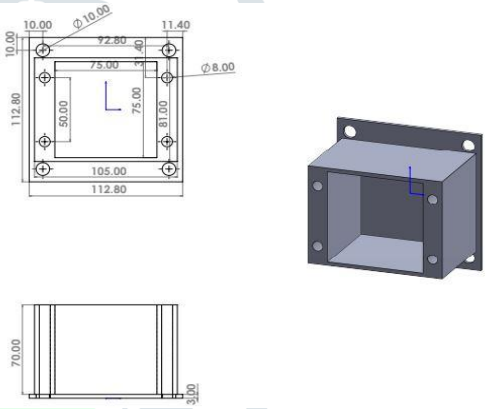
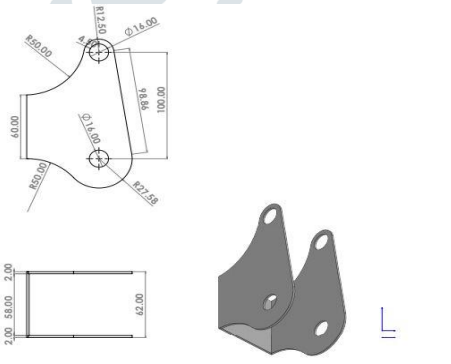


Fig 3. Rough sketch of the plaint arm

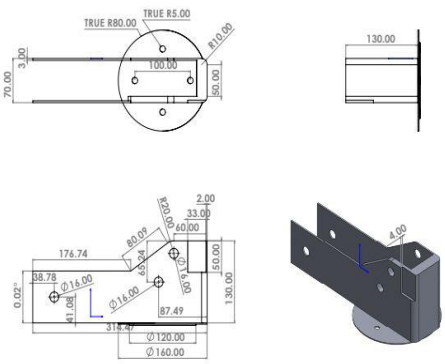
**CADD SKETCH**



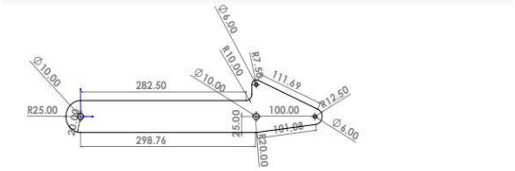
**(a) base**

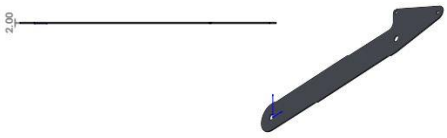


**(b) arm head support**

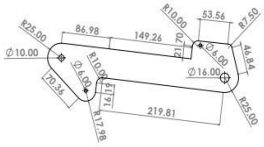


**(c) main arm support**

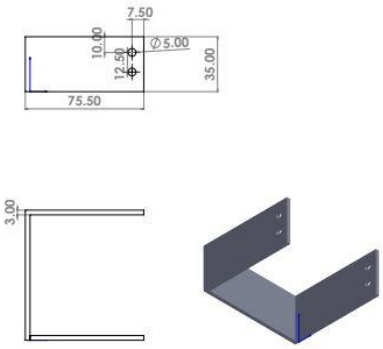


(d) main arm plate 1

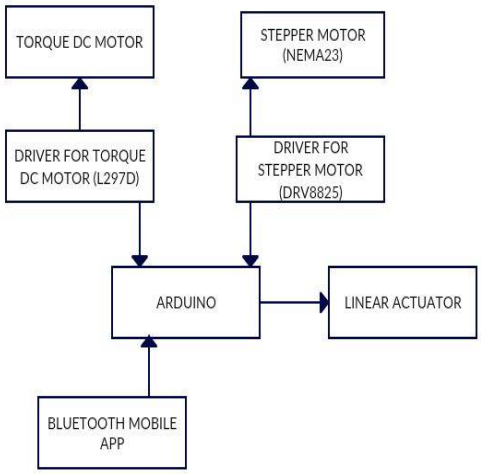



(e) main arm plate 2

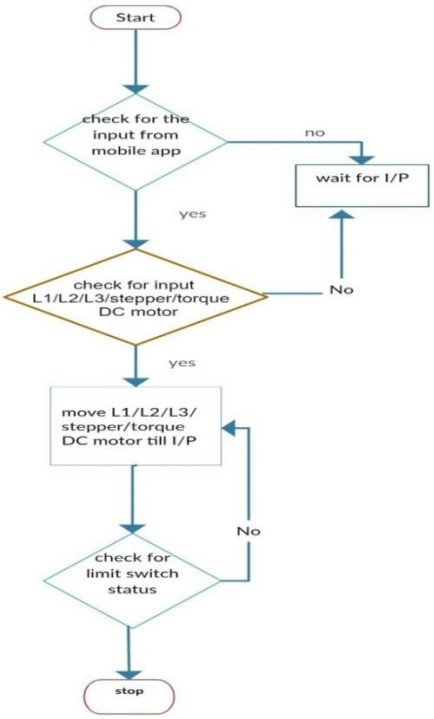



(f) end effector clamp

## BLOCK DIAGRAM




## FLOW DIAGRAM




## CALCULATIONS

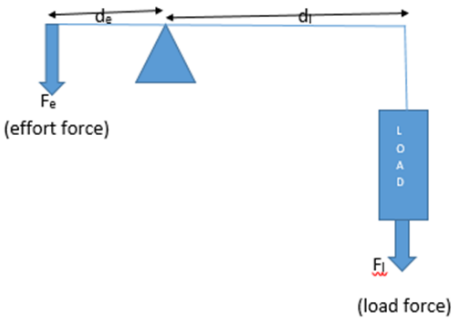
**TO FIND:** Fe

**Given** : dl = 30cm = 0.3m , de = 10cm = 0.1m

(i) Front (F1) = 7kg

(ii) Front (F2) = 10kg

**(i) Arm 1**




Fl = mxg

Fl = 7x9.81

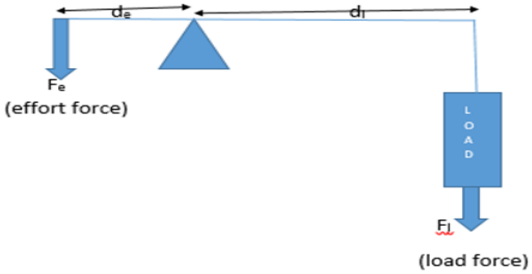
**Fl = 68.67N**

Fe de = Fl dl

Fe = (Fl dl)/ de = (68.67x0.3)/0.1

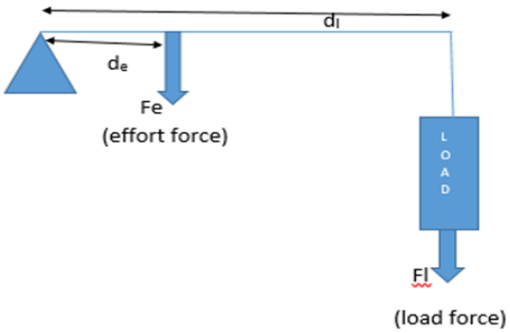
**Fe = 206.01N**

**(ii) Arm 2**



Fl = mxg
Fl = 10x9.81
**Fl = 98.1N**
Fe de = Fl dl
Fe = (Fl dl)/ de = (98.1x0.3)/0.1
**Fe = 294.3N**

**(iii) Arm 3**




Fl = mxg
Fl = 12x9.81
**Fl = 117.72N**
Fe de = Fl dl
Fe = (Fl dl)/ de = (117.72x0.3)/0.1
**Fe = 353.16N**

## FUTURE SCOPE

Robotics is the emerging field in terms of science and technology. The technology and new ideas give up different usages. The arm idea proposed can be a real boon for handicapped people, who areparalyzed or lost their hands in some accident. The arm can be trained to listen to the command from a human and performthat task. Not just for handicapped also for people who are loaded with many jobs it can be used to simplify their workload.

A Precise gesture-controlled system is also possible.Wearable devices can be used to send the command andcontrol the movements of the arm.

A technology calledBrain Computer Interface (BCI) acquire signals from the humanbrain and control the arm. The system can work in the sameway as human arm. A person who may have lost his hand inany accident can resume his life like previous by suchartificial arms. Robotic arms are versatile and haveenormouswaysof implementations. Hence there a ray of hope for people who are disabled and can make use of such helping hand in mere future.

## CONCLUSION

By proper analysis and implementation of the design quoted we were able to achieve a robotic plaint arm which was able to fulfill the needs. When the final product (Robotic Arm) is fabricated and tested for the proper working of the arm, it is to lift a weight around 5-7 kgs of weight. Because each of the linear actuators that are being used can lift a weight of 3 kgs and it has capacity of 206, 294, 353 newtons which made to lift that amount of load. the stepper motor alone can lift or the maximum payload for the stepper motor that we are using is 4 kgs the suitable driver unit is also used to aid it. So, when we put together by theoretical calculation the arm is able to lift the 5-7 kgs to the maximum. The design was also carried out to work according to the lifting of desired load. As the design was verified in software before actual implementation, we had the scope of trying various add-ons to improvise our model.

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