iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** IV **Month of publication:** April 2018

DOI: http://doi.org/10.22214/ijraset.2018.4307

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue IV, April 2018- Available at www.ijraset.com

Kinematic Moving Machine

Thalaieswaran S[1], Moorthy G[2], Chitharthan S[3]
[1, 2, 3]PG Scholar, M.E Manufacturing Engineering, Government College of Technology, Coimbatore.

Abstract*: Four bar linkage are the closed loop kinematic linkage; they perform a wide variety of motions with a few simple parts. This project discusses the design & fabrication of one such mechanism called kinematic moving machine. Legged locomotion is a proper solution for movements on loose-rough-uneven terrains. This advantage of legged locomotion is mostly due to the fact that legged systems use isolated footholds. Wheeled and tracked systems follow the surface in a continuous manner; therefore their performance is limited by the worst parts on the terrain. A legged system, on the other hand, can choose the best places for foot placement. These footholds are isolated from the remaining parts, hence the performance of the legged system is limited by the best footholds. This machine uses a typical four bar linkage so as to produce continuous relative motion. As the first step, CREO 2.0 model was created for various dimensions to the links and we observed the working of the machine using the motion study in CREO 2.0 software. The designed model was converted into physical model by various machining operations. Machined links were connected by joints and rotary power is given to the crank by the D.C. Gear motor and the process was achieved. The process can be enhanced further by using a motor of high horse power.
Keywords: Aluminium plate, Kinematic links, Sprocket and Chine, Motor, CERO 2.0.

I. INTRODUCTION

In the "KINEMATIC MOVING MACHINE" Legged locomotion is used which is a proper solution for movements on loose-rough-uneven terrains. This advantage of legged locomotion is mostly due to the fact that legged systems use isolated footholds. Wheeled and tracked systems follow the surface in a continuous manner; therefore their performance is limited by the worst parts on the terrain. To overcome these difficulties legged system is used. A legged system, on the other hand, can choose the best places for foot placement. This machine is incorporated with the use of simple kinematic links. It consists of four kinematic links through which the power is transmitted because of which continuous relative motion can be achieved. A voltage eliminator is used to vary the voltage thus varying the speed (rpm) of the DC motor. Depending upon the speed of the DC motor which is given as input to the crank (rotary motion) by means of chain and sprocket mechanism. From there the motion will be transmitted to all other linkages and finally to all of the three legs. Thus the legged motion will be obtained. This machine finds applications such as in agricultural vehicles it by preventing damage to the crops by reducing contact area on the agricultural lands, travel in rough surfaces. By placing bomb detectors in the machines we can easily detect the bomb without harmful to humans, etc.

A. Kinematic Link

1) Each part of a machine, which moves relative to some other part, is known as kinematic link or kinematic element.
2) A link may consist of several parts, which are rigidly fastened together, so that they do not move relative to one another.
3) A link or element need not be a rigid body, but it must be a resistant body.
4) It should have the following two characteristics:
5) It should have relative motion.
6) It should be a resistant body.

B. Kinematic Pair

The two links or elements of a machine, when in contact with each other, are said to form a pair. If the relative motion between them is completely or successfully constrained i.e. in a definite direction, the pair is known as kinematic pair.

C. Kinematic Chain

1) When the kinematic pairs are coupled in such a way that the last link is joined to the first link to transmit definite motion i.e. completely or successfully constrained motion, it is called a kinematic chain.
2) It is the assemblage of rigid bodies connected by joints that is the mathematical model for a mechanical system.
3) Example: The simple open chain formed by links connected in series, like the usual chain, which is the kinematic model for a typical robot.
4) A chain having more than one link is called as the compound kinematic chain.

5) The following are the three types of kinematic chains with four lower pairs, each pair being a sliding pair or twisting pair.
6) Four bar chain or quadric cyclic chain.
7) Single slider crank chain.
8) Double slider crank chain.

D. Mechanical Linkage

A mechanical linkage is an assemblage of bodies connected to manage forces and movement. The movement of a body or link is studied using geometry, so the link is considered to be rigid. The connections between links are modeled as providing ideal movement, pure rotation or sliding for example, and are called joints. A linkage modeled as a network of rigid links and ideal joints is called a kinematic chain.

Linkages may be constructed from open chains, closed chains, or a combination of open and closed chains. Each link in a chain is connected by a joint to one or more other links. Thus a kinematic chain can be modeled as a graph in which the links are paths and the joints are vertices, which is called a linkage graph.

II. COMPONENTS

A. Power Source

The following components are used for the power transmission.

1) Gear Motor (12 V; 60 RPM): A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM .The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. This Insight will explore all the minor and major details that make the gear head and hence the working of geared DC motor.

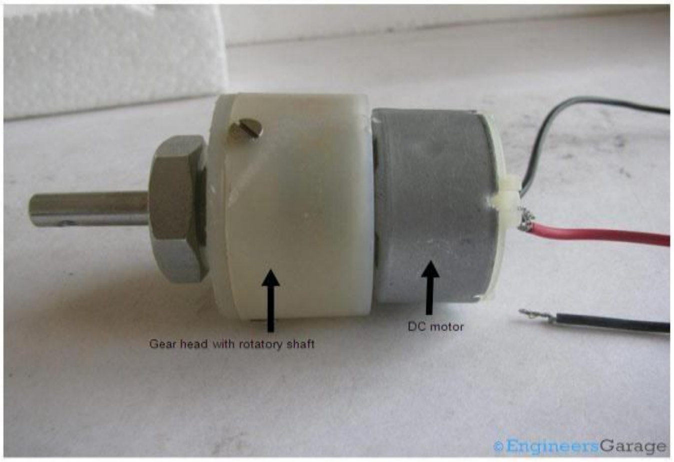


Figure 1. Gear motor

An internally threaded hole is there on the shaft to allow attachments or extensions such as wheel to be attached to the motor. The lateral view of the motor shows the outer protrudes of the gear head. A nut is placed near the shaft which helps in mounting the motor to the other parts of the assembly.

B. Voltage Eliminator

A voltage eliminator is another electrical device with which voltage can be varied from 0 V to 12 V. With the reduction of voltage, the RPM of the motor is decreased thus varying the distance between two consecutive holes in the work piece.

A voltage eliminator is a device powered by an electrical source other than a battery, which then converts the source to a suitable DC voltage that may be used by a second device designed to be powered by batteries. A battery eliminator eliminates the need to replace batteries but may remove the advantage of portability. A battery eliminator is also effective in replacing obsolete battery designs.

A voltage eliminator is used as an alternative for DC batteries. So it is also called as battery eliminator.

Figure 2. Voltage eliminator

C. Power Transmission

The following components are used for the power transmission.

1) Sprocket: Sprockets are the simplest type of gears. They consist of a cylinder or disk with the teeth projecting radially, and although they are not straight-sided in form, the edge of each tooth is straight and aligned parallel to the axis of rotation. These gears can be meshed together correctly only if they are fitted to respective chain drive.

Three sprockets are used, one fixed with the motor shaft (small sprocket) and the other two are bigger sprockets meshes with the chain drive to transmit power.

2) Chain drive: A chain are made up of no of rigid links which are hinged together by pin joints in order to provide necessary flexibility for wrapping round the driving sprockets.

The purpose of chain drives are

It can be used for the wide range of center distances. A number of shafts are driven in the same or opposite direction by means of a single driving sprocket.

NChain drives is not slip to that extent. Chain drives is a positive drive.

NIt is easy to replace.

D. Kinematic Link Arrangement

The following components are used for the fabrication of Kinematic link arrangement.

1) *Kinematic Links:* The Age hardened Aluminum alloys plate is used for the manufacturing of the kinematic links of the four bar mechanism. The plate is initially 12 feet length was machined according to the dimensions obtained from the motion study in CRE
2) software.*:* The link material having the following characteristics. Light weight.
3) corrosion resistance.
4) *Bolts and nuts :* The bolts and nuts of 6 mm diameter and lengths 40mm, 60mm, 80 mm are used for making binary joints of the kinematic links. This bolts and nuts are provided with 0.25mm clearance for their smooth movement within the holes made in the kinematic links. Since there should be a free movement for one link with respect to another link, nuts are used for one bolt accordingly so that the required movement of the links can be obtained.

The bolts and nuts are made up of mild steel. It is having shear strength of 1.7 kgf / sq. cm and also having a good wear resistance.

III. LINE AND PART DIAGRAM

The line diagram is the simplified form of representing all the links used in kinematic moving machine. The line diagram gives the clear picture of the exact dimensions of all the links.

The dimensions that were determined using the trial and error method was converted into line diagram. This line diagram is the base for the creating the CREO 2.0 model. This is then converted into the real physical model.

In other words, it is the simple two-dimensional representation of the all the links involved in this mechanism.

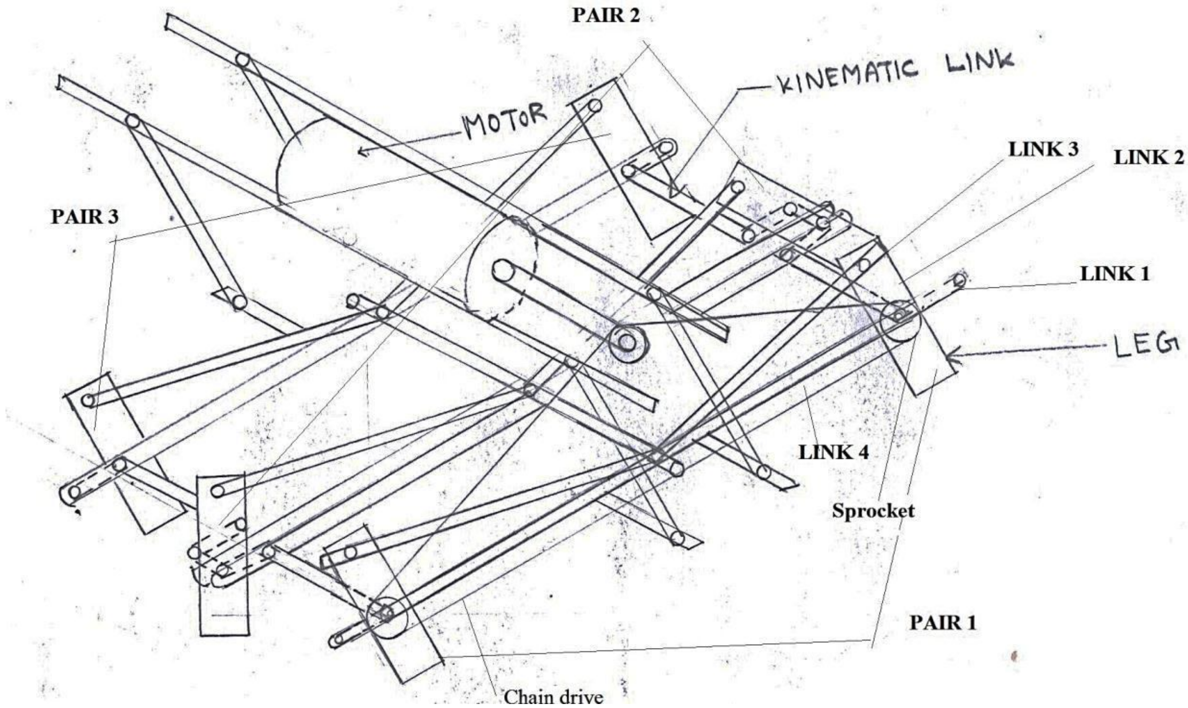


Figure 3. Line diagram

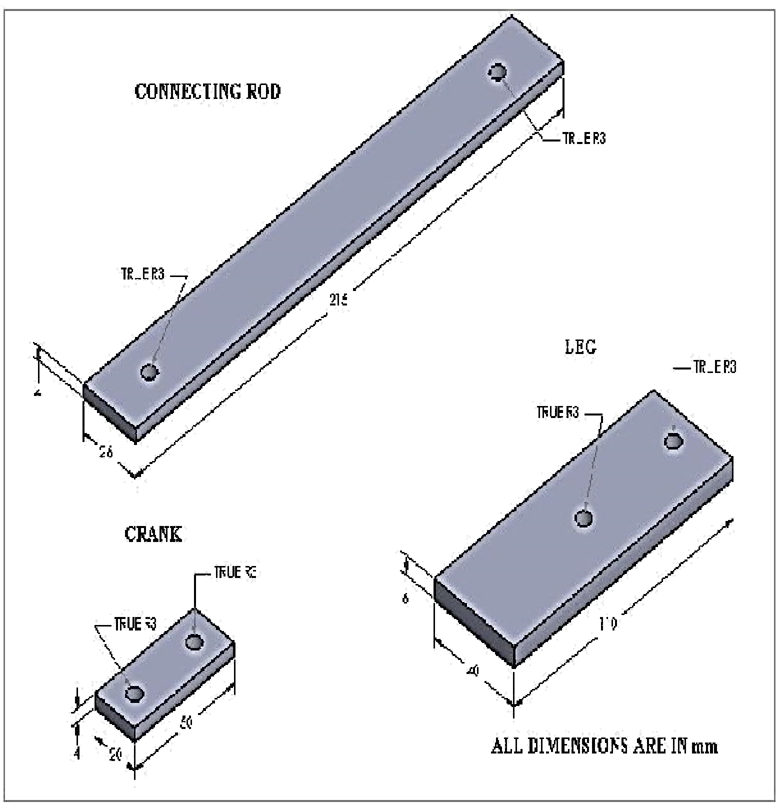


Figure 4. Part diagram

From the above line diagram, we infer that the Grashof's law is verified and the dimensions are correct.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue IV, April 2018- Available at www.ijraset.com

IV. DESIGN CALCULATIONS

Here the power transmission is from the motor to the driving sprocket through the spindle of the shaft. And then the power will be transmitted to the two driven shaft respectively by means of chain drive mechanism.

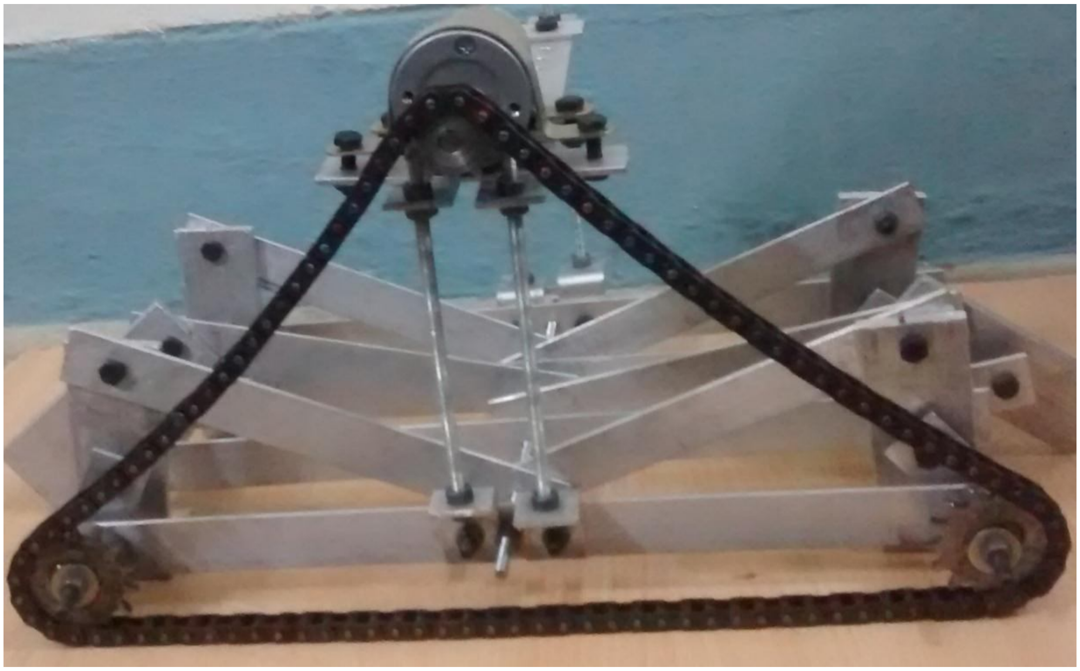


Figure 5. Transmission system

A. Design Of Chain Drive And Sprocket:

Let Z1 be the no of teeth on driving sprocket
Let Z2, Z3 be the no of teeth on driven sprocket
Let N1 be the speed of driving sprocket
Let N2, N3 be the speed of driven sprocket
To get efficient speed transmission the speed ratio must be taken as 1.75
The no of teeth on driving sprocket Z1 =15
No of teeth on the driven sprocket Z2, Z3 = i x 15
= 1.75 x 15
= 27

Pitch center distance, a = (30-50) x pitch
147 = 30 x pitch
Pitch of driving sprocket = 147/30
= 4.9
Pitch of driven sprocket = 147/50
= 2.94

Exact centre distance, $a = (e + \sqrt{((e^2) - 8m)}) / 4$
$e = L_p - (Z_1 - Z_2) / 2$
= 30 – 27
= 3

Centre distance, a = 14.91 cm
Pitch circle diameter of smaller Sprocket, d_1 = 24mm
Outer diameter of smaller sprocket, ` D_1 = 35 mm
Pitch circle diameter of larger sprocket, d_2 = 40 mm
Outer diameter of larger sprocket, D_2 = 50 mm

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue IV, April 2018- Available at www.ijraset.com

Length of chain, l_p = 194.9 mm

Total no of links in the chain, n_p = 30 nos

B. Calculation For Velocity Of Machine

The velocity of machine depends upon two factors:

1) length of crank lever
2) motor speed.

The movement of crank follows the circular path. So during velocity calculation length of crank consider as a diameter of circular path.

Velocity of machine, v = (3.14 x D x N) / 60
= (3.14 x 2.5 x 60) / 60
= 7.5 cm / sec

Velocity, v = (Displacement) / Time

So that

Displacement, x = Velocity x Time
= 7.85 x 60
= 471.1 cm

V. MODELING

A. CREO 2.0 Model of Link

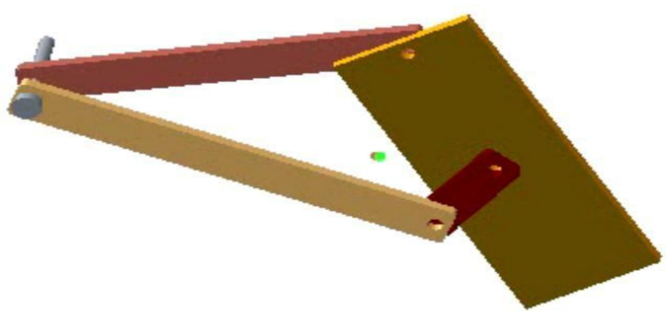


Figure 6. CREO 2.0 Model

B. Physical Model

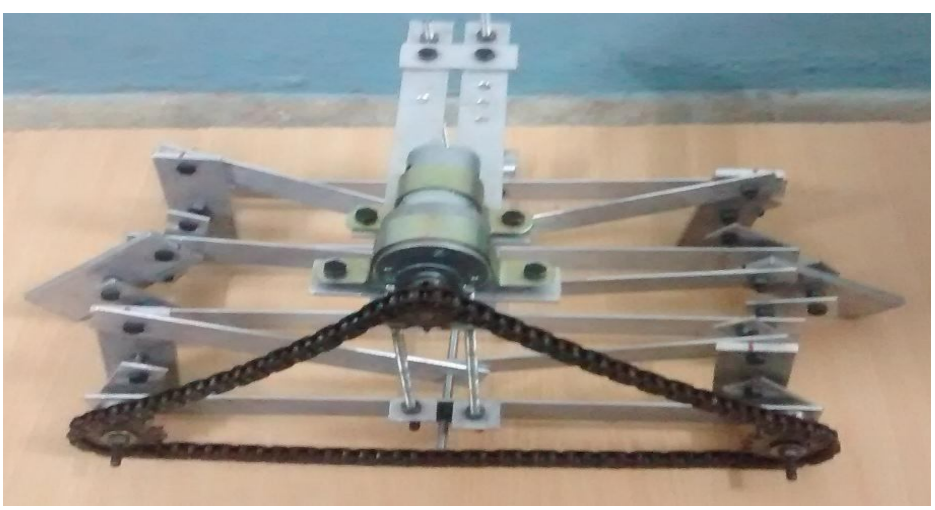


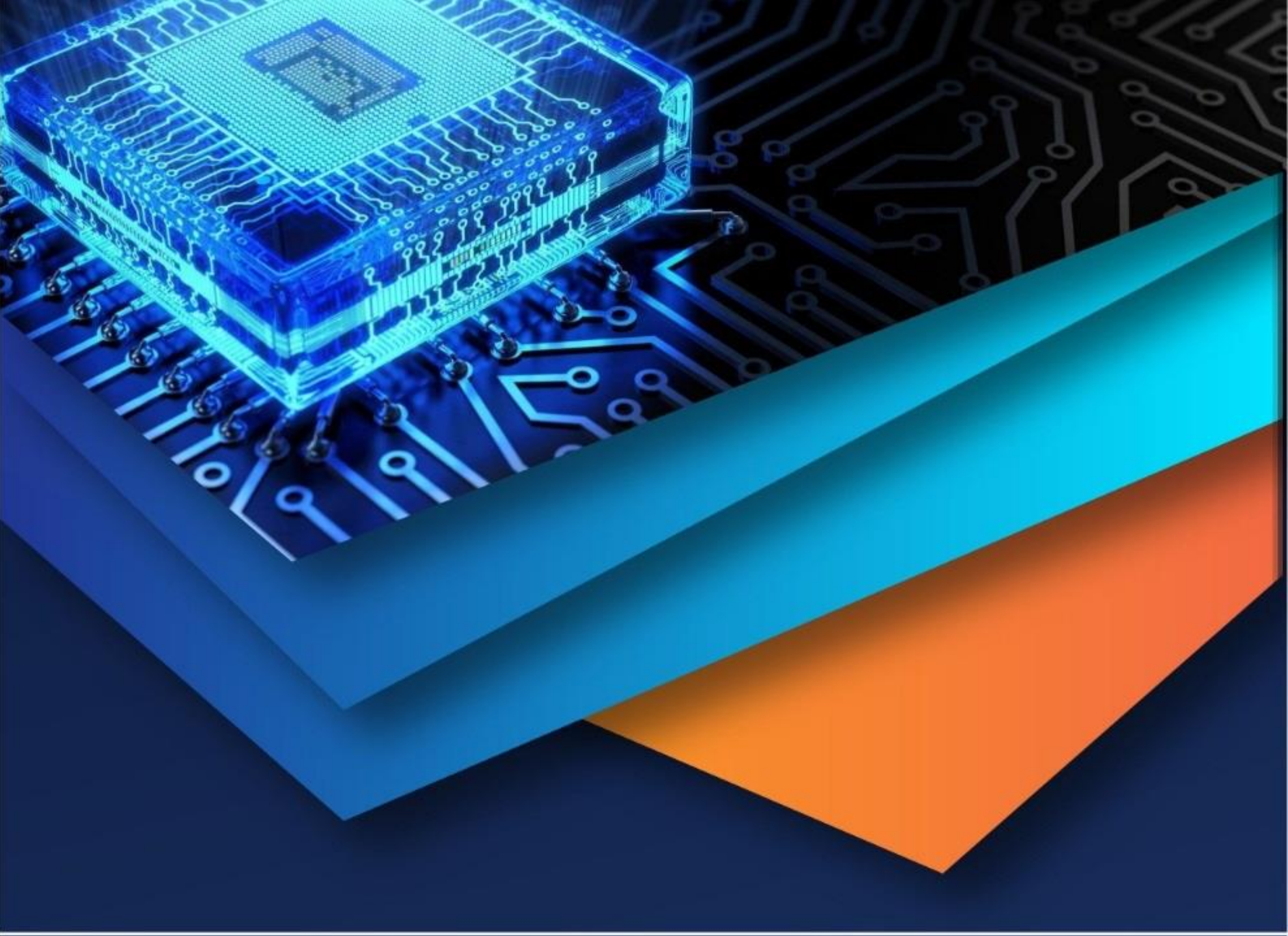
Figure 7. Physical Model

VI. CONCLUSION

Thus the KINEMATIC MOVING MACHINE was designed and fabricated successfully. Various observations were made during the stage of fabrication of the project. At the maximal stage, the machine moved. Motion is transmitted uniformly through the four bar mechanism and a continuous relative motion of the kinematic links were achieved. Ultimately, all the problems stated above were rectified. Thus the fabricated machine can move in uneven and rough surfaces.

REFERENCES

[1] Theory of machines"
[2] R.s.khurmi & j.k.gupta (chapter 5).
[3] "machines and mechanisms"
[4] Uicker, pennock and shigley, fourth edition, oxford, 2010.
[5] "a textbook of "machine design"
[6] V.b.bhandari
[7] Web reference
[8] http://www.howstuffworks.com/search.php?terms=link
[9] http://www.hpalloy.com/



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)