SYNTHESIS OF MECHANISM FOR STUDY CUM COMPUTER TABLE

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ABSTRACT

In our project we used this CAD software for the analysis of mechanisms. Also the 3D model of the study cum computer table with the mechanism incorporated was made on solid works. The 2D sketch of mechanism was made on solid work with arbitrary link lengths. Then providing constraint according to our requirement, the link lengths were obtained for the mechanism that was running successfully, using hit and trial method. After determination of link length dimensional analysis of all the link were done so that to determine link lengths. After determining the dimension of all the links model of all the links were made which can be seen in isometric view, trimetric view. Then all the links were assembled together to form the complete three dimensional view of the table. Also we have used solid work to make the animation of the table which show the complete motion followed by the mechanism.

Keyword - *CAD software1, Computer Table2, Mechanism3, and Fabrication4.*

1. INTRODUCTION

Usually we purchase two separate tables for domestic use i.e. one for studying, which has flat table top and other a computer table. The tables being used these days for the combine purpose of study and computer follow different mechanism for key board tray, the table has no space for the storage of the TFT and therefore for study purpose space available is not sufficient thus separate tables have to be used for these purposes. In this project we have combined the features of both these tables. The aim of this project is to synthesize planar mechanism like slider crank, four-bar, and five bars and toggle mechanism etc. for a study cum computer table.

In kinematic synthesis of mechanisms, intuition and experience of the designer play a major role compared to other design stages. However, just like in every engineering problem, synthesis problems require the solution of mathematical and/or geometrical systems as well.

Even though calculation procedure can be carried out in many programs easily, without a user interface the synthesis task becomes a cumbersome and time consuming problem. Computer programs with user interface not only take over the duty of solving the mathematics and/or geometry of the problem from the designer but also help the user visualize the design. At the end, the designer will have to use his intuition and experience for the selection of the most suitable mechanism out of the possible combinations.

As a whole the necessity of using computer programs for synthesis become abundant in our time with the arising development in computer technology. The computer programs are capable of reaching the best solutions with user interaction at every design stage both in analysis and synthesis.

Many machine design problems require creation of a device with particular motion characteristics. Synthesis of mechanism refers to design a linkage for a prescribed motion or path or velocity of tracing joint or link there are types of synthesis technique available in literature. The following methods of synthesis are commonly found in literature: (i) Qualitative synthesis, which is a creation of potential solution in the absence of an algorithm that configures or predicts solution, (ii) type synthesis, which is a definition of proper type of mechanism best suited to the problem and is a form of qualitative synthesis and (iii) dimensional synthesis, referring to the determination of lengths of links necessary to accomplish the desired motion.

Type synthesis refers to the kind of mechanism selected; it might be a linkage, a geared system, belts and pulleys, or even a cam system. This beginning phase of the total design problem usually involves design factors such as manufacturing processes, materials, safety, space, and economics. The study of kinematics is usually only slightly involved in type synthesis. Number synthesis deals with the number of links and the number of joints or pairs that are required to obtain certain mobility. Number synthesis is the second step in the design. The third step in design namely determining the dimensions of the individual links is called dimensional synthesis.

The Project aims toward conversion of the pull or push linear motion of keyboard tray into the rotary motion of TFT flap. For this a correlation between the linear motion of keyboard and angular motion of TFT has to be established. In this chapter a systematic approach for the optimum synthesis of mechanism has been presented in graphical and analytical form. A detailed methodology has been presented which had been applied for the calculation of linkage dimensions of typical mechanism. It was decided that instead of standard method available in the literature as discussed in chapter 2 a trial and error method can solve the problem of art. With the help of CAD software the analysis has been done successfully and also presented in the result and discussion.

2. BLOCK DIAGRAM

A systematic approach for the synthesis of mechanism has been used in the project. This has been presented in the figure 3.2. In the first step the force applied to the sliding member of the mechanism has been calculated and the corresponding displacement analysis has been carried out. As per the requirement of the project the possible mechanism studied in detail to satisfy the functional requirement.

An ergonomic analysis has also done before finalizing the output of the mechanism

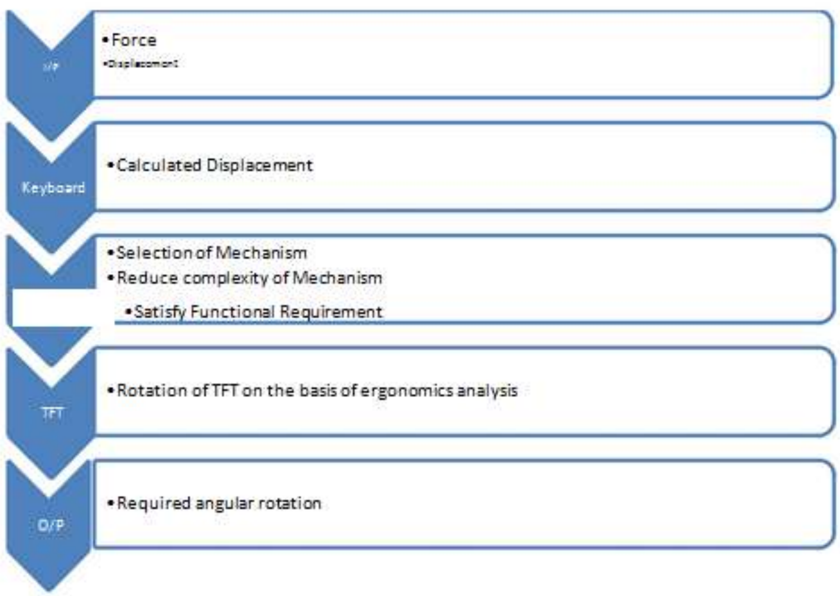

Figure 1. Block diagram showing the systematic way of synthesis of mechanism

3. 3D MODEL BASED ON FINAL MECHANISM

In the previous chapter the mechanism synthesis and analysis are presented. After concluding the suitability of the mechanism for the purpose the task left is FABRICATION.

The following chapter provides detailed information regarding the MODEL as whole, explanations of 3D MODEL as designed on the Solid Works Design software, Drawings and screen shots of individual links.

Table 1: TFT Box dimension and material

TFT BOX	1) **Material:** ply wood 2) **Dimensions :**380mm x 445mm 3) an arrangement is made at the middle for the adjustment of the TFT screen
	1) **Material :** ply wood

Table 2: Table dimension and material

Table top	2) **Dimension :** 910mm x 610mm
Link 1	1) **Material:** mild steel 2) **Dimension :** 120mm
Link 2	1) **Material:** mild steel 2) **Dimension :**120 mm
Link 3	1) **Material :** mild steel 2) **Dimension:**220 mm
Keyboard frame	1) **Material :** mild steel 2) **Dimension: 450x 220x150**

4. 3D MODEL: EXPLOSIVE MODEL

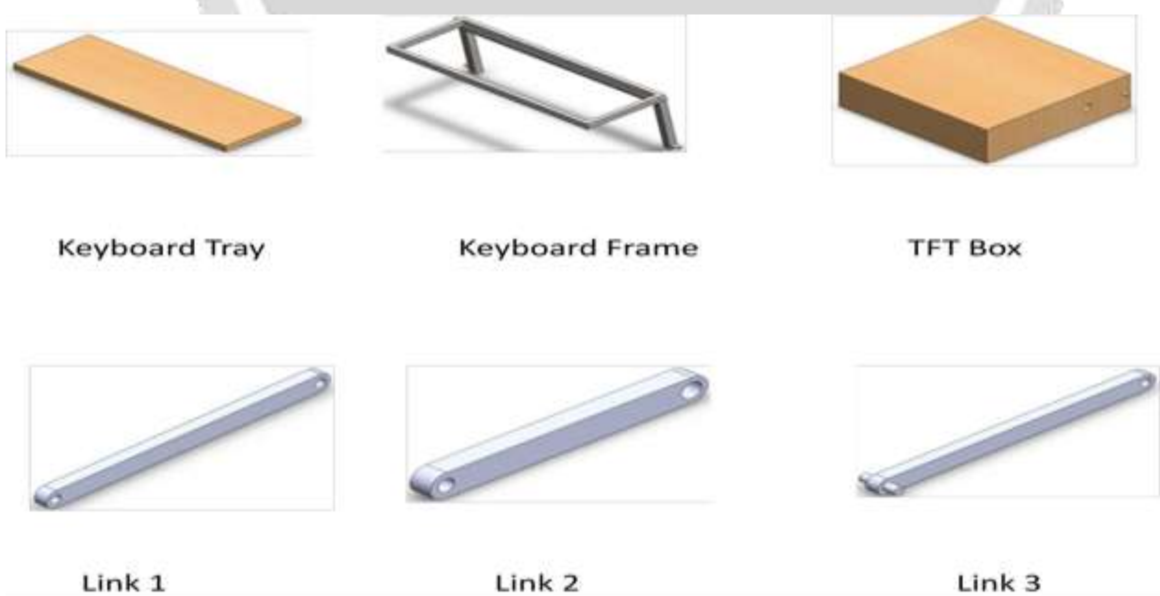

Figure 2. Parts of Assembly

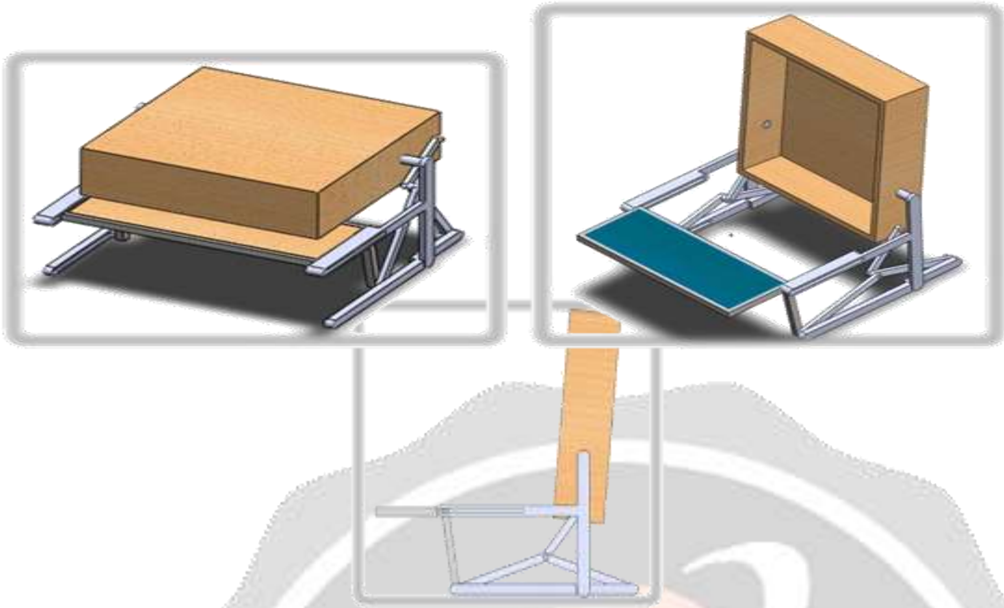

Figure 3. Mechanism of Assembly

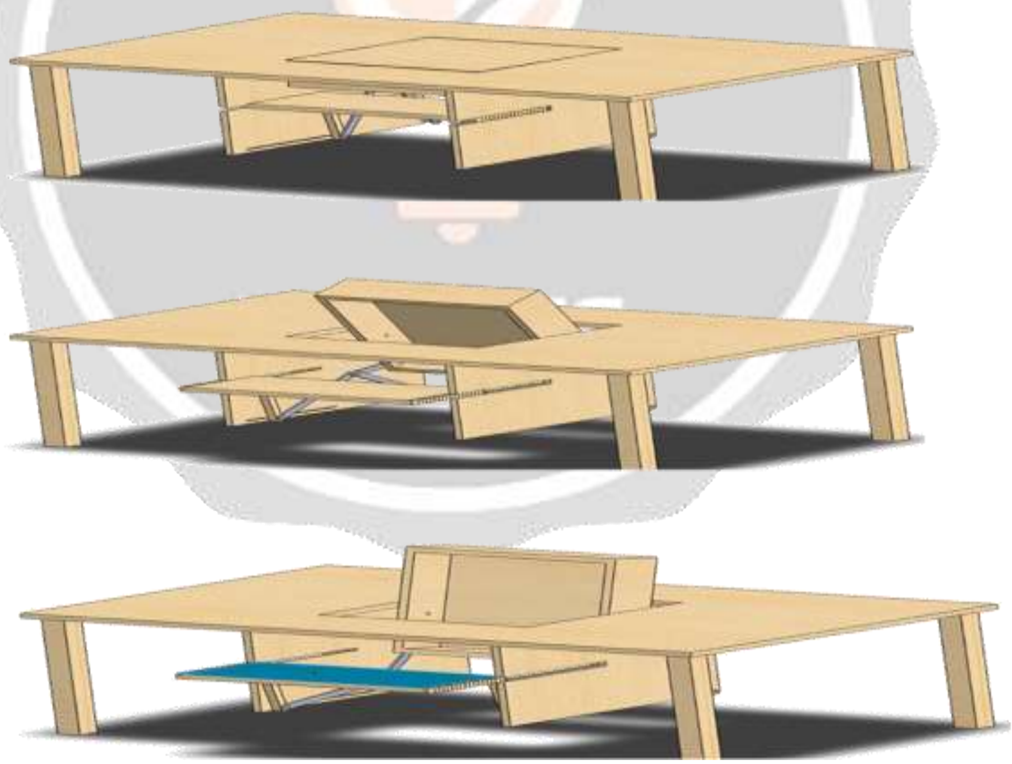

Figure 4. 3D model of Study cum computer table at different position

5. RESULTS AND DISCUSSION

From the static and kinematic analysis of modified snap action mechanism we found that the motion of mechanism smooth. The results are as follows:

5.1 Graph of Statics Force & Different Position of TFT

ANGLE	FORCE APPLIED
0	1.1973
15	0.6354
30	0.20234
45	0.1028
75	0.0826
90	0.7091
105	1.5936
107	2.101

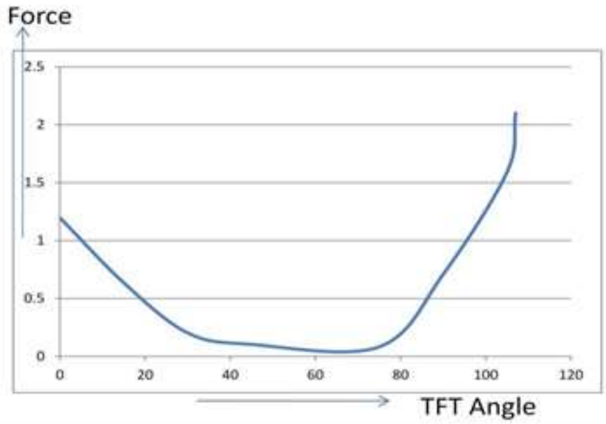

Figure 5. Graph of Velocity and Acceleration at different angle position of TFT

From the kinematic analysis it is clear that this mechanism is operate at low speed so that there is very less effect of inertial force that are to be neglected. So that in this case we only consider statics force analysis.

ANGLE	ANGULAR VELOCITY
30	0.175
60	0.1775
80	0.317
95	0.577
105	0.79

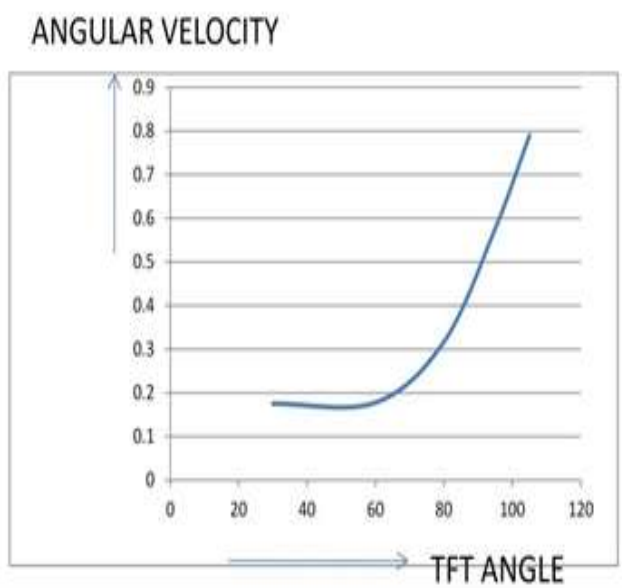

Figure 6. Graph of angular velocity

ANGLE	ANGULAR ACCELERATION
30	0.8
60	0.9
80	1.2
95	1.4
105	1.52

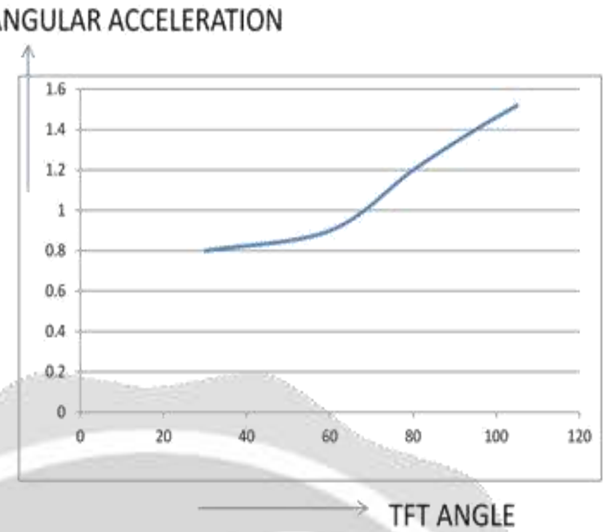

Figure 7. Graph of angular acceleration

6. CONCLUSION

In the present work we have focused on the problem of space availability due to use of separate things for different applications. As its solution we proposed the idea of a table which used as study table as well as computer table as per users choice. For this purpose we synthesized a mechanism out of given all mechanism to solve this purpose. Motion analysis & dimensional analysis for all mechanisms is to be done and derived the results for suitable motion. For the required purpose of study cum computer table, the snap action mechanism is modified. Static force analysis and kinematic analysis is also done. In final the virtual 3D model of the mechanism is run in solid works successfully.

7. FUTURE SCOPE

Even this work has concentrated on path synthesis part with some important constraints, some more motions and advantage of the linkages and flexibility effects can be also considered to get the accuracy. There are some other modifications and addition can be done like:
1. Self-locking as per users requirements of the screen (TFT)
2. For the ease of operations of table hydraulic and pneumatic system can also be used.
3. Study of selection of the materials for the fabrication for the mechanism.

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