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MULTIUTILITY AND MULTIPURPOSE TABLE

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ABSTRACT

Moving forward from regular tables with little to no utility except as a desk to write on, there is a need for new innovation to make it more worth the value. A student spends most of his active time studying at a table. The table is full of important documents, stationery, gadgets etc.; having separate compartments or facilities to store them will make their life very easy.

The current state of the art includes drawers or under desks, which increases the cost of manufacturing and items need to be appropriately classified. A more specific utility is required for a cost-efficient but multi-purpose table.

This paper examines the design of a Multi-Utility Study Table and how feasible it will be given the budget and resource constraints. The design has facilities for keeping stationery, built on a wood/polymer pen stand. Attached to the table will be a laptop stand made of primarily polymer alongside a bottle holder as well. Building the table will mostly work around the carpentry, metal cutting and rapid prototyping trades. Keeping the table stable with attached legs will also be a crucial task to do. The study table could then be used by any of the students or working personnel for their work and study purposes.

1. INTRODUCTION

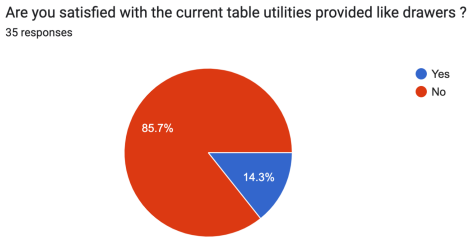
Nowadays, people are so busy and inconsiderate that they rarely maintain their tables tidy. Now, we can never find anything in that clutter when we actually need to find it. Due to this, a lot of our belongings and essential documents have been lost, thus we need something to keep everything organized. Seeing the hostel rooms of our friends and classmates, the situation seems to be very problematic. Moreover, who doesn't sit for hours working on their computer? This leads to a lot of back strain along with eyestrain.[1]

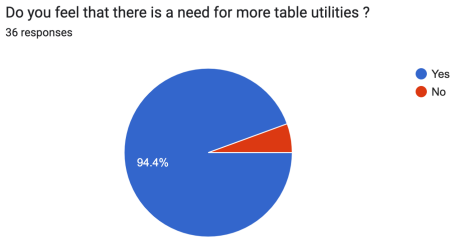
There are many different solutions available already. Currently in order to keep pens and the other stationary things arranged and organized, we use a pen stand which can be kept on the table. But this pen at the end of the day will roll here and there in most of the student's rooms. Also, we have portable laptop stands but they all are rarely used in daily life due to busy schedules.

There is a need for a different solution so that all of our belongings (at least the important ones) stay organized and everything doesn't end up being messy. That is why we have decided to make a multi-utility table which will not only solve

our problem but help to keep everything in one place. It will really be the table which everyone desires.

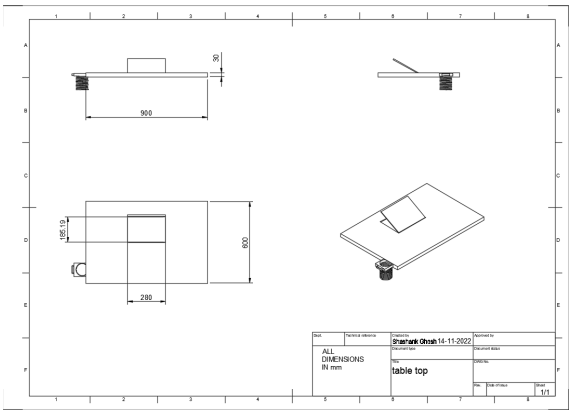
Here are the responses of a form we have floated among the student community which clearly indicates the need for concrete table utilities.

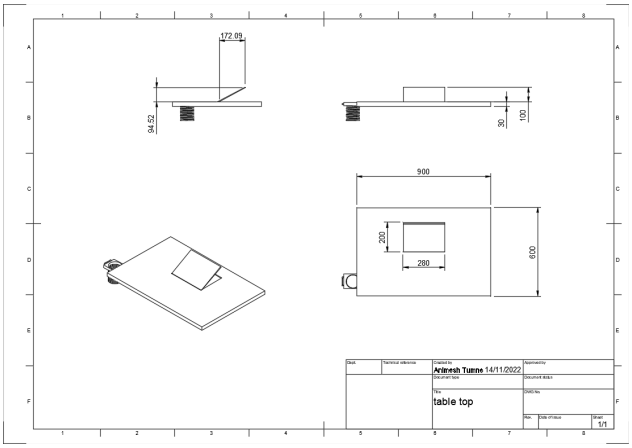




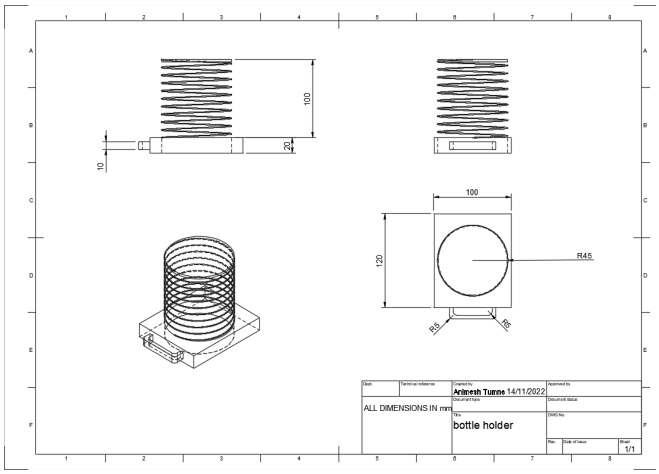
2. DESIGN

The description of our finalized design includes various features - A pen slider, a Bottle Holder and a laptop stand. The laptop stand rests in the middle of the table-top, and provides enough space for any size laptop to fit into it. It can also be doubles as a textbook holder, which reduce the students' eyestrain and provides them the freedom to sit in a comfortable and relaxed posture, by providing the user many modes of operation (i.e. the angle at which the stand rests is variable) The CAD drawing of the mentioned stand and the tabletop is depicted in the figures given below:

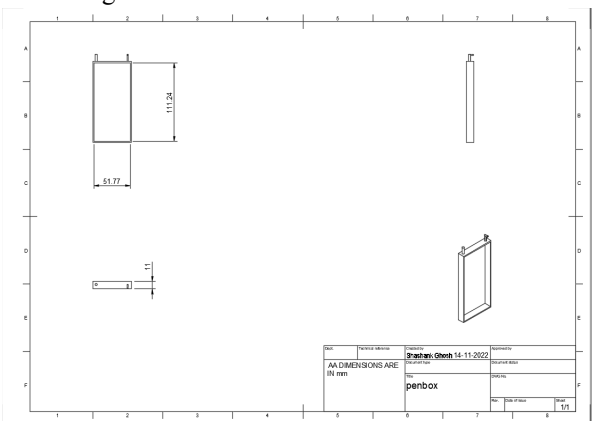




The second included feature is a glass holder that can be folded up and slid into the table top itself. It contains a sprig that expands on opening, and can fold up and contract when the user is not using it. The CAD model is depicted down below:

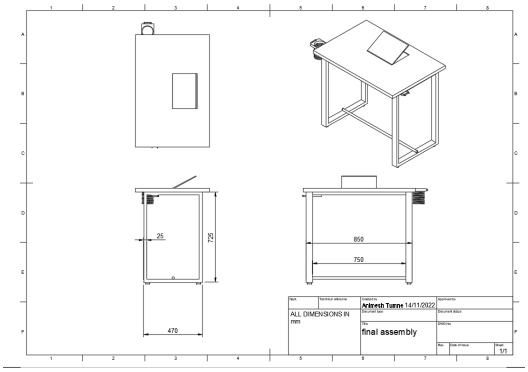


The third element of our table top setup is a slidable pen box/holder that can be easily accessed by the user. The user can rest assured that their pens are never now going to roll off the table again. Its mechanism is simple and intuitional. The CAD model drawings are included below:



We are adding many utilities which add to the value of our table. We have tried to add the additional features without consuming extra area. The features we add are an embedded laptop stand, a pushable bottle holder, and a foldable pen stand. These would help to keep things in an organized manner on the table and could help in overcoming the messy conditions of the table as there are specific locations for everything. We would implement these by implementing the various manufacturing processes - additive, subtractive, and joining wherever necessary. The laptop stand can be pulled out when used and can be adjusted to the necessary height. The laptop stand helps in overcoming the issues of neck pain caused due to incorrect posture and laptop positioning. The bottle stand would be slidable on the side of the table, in order to hold water in position and in a comfortable position for drinking while studying.

The final model CAD drawing can be found below:



3. MATERIALS AND MANUFACTURING PROCESSES

Material used:

- Plywood
- Mild steel
- Sun-mica sheet
- Sheet metal- Aluminium
- MDF
- Fevicol
- Nuts and bolts

List of various components:

- Steel Frame
- Table top
- Laptop stand
- Pencil/ component stand
- Bottle holder

Material selection:

- Plywood: Plywood is a basic component of the table top on which it is used. It is cost-effective. It is easily available in any market and is strong enough to be used as a table. If hardwood is used the cost will be high enough for anyone to buy a table.
- Mild Steel: This steel is used to create the frame of the whole table on which plywood is fixed. It acts as a base and is strong enough to hold the entire table together.
- Sun-mica sheet: It is used to design the tabletop or the plywood. It is stuck on the plywood using Fevicol.
- Sheet metal - Aluminium: It will be used to make the pencil stand which will be embedded in the tabletop multipurpose use.
- MDF: used for the foldable part of the laptop stand by 3D printing
- Fevicol: It is used to stick two plywoods together and also to stick the sun-mica sheets to plywood.
- Nuts and Bolts: It will be used to join together the mild steel frame and the plywood together to remain intact.

4. MANUFACTURING PROCESSES

We are using 5 different processes in the Manufacturing of our final product. We ensured that the final product uses all three manufacturing types required:

- Additive Manufacturing with 3D printing.
- Subtractive Manufacturing using Carpentry, Rapid Prototyping, and Cutting and Fitting.
- Joining: We shall use Joining in Carpentry, Rapid Prototyping, and Welding.

We are using 5 different Manufacturing processes:

- Cutting and Fitting:
  We are using Cutting and Fitting for the Legs of the Table and the finishing of the edges. We will ensure that the table legs and the frame we make are not sharp and do not cut the person using the table
- Carpentry:
  Carpentry is being used for the tabletop, as we will be using wood/plywood for the same. We will be using multiple plywood instead of a single piece, as it will make our job easier for cutting space for a pen stand, bottle holder, and laptop stand. We can carve shapes, but it might give a good finish, use more material and prove more expensive.
- Rapid Prototyping:
  We shall use Rapid Prototyping for the Bottle Holder, 3D printing, and Laser Cutting using MDF sheets for the Laptop stand. We also wished to do 3D printing for

the laptop stand, but we realized that it would not give enough strength for the same[2]. Using MDF sheets will provide enough strength to the laptop stand to support the laptop's weight.

- Welding:
  We will use Welding to join the metal bars and create a frame that will support the entire project. Welding will allow us to permanently join the legs and the body of the table. Welding would be the most practical and easy way to produce the frame.
- Sheet Metal Operations:
  We will use sheet metal for making the penbox. The Penbox of Sheet metal will have more strength as compared to carpentry. Also, the thickness of the sheet will be less, so it will occupy less space on the borders. Fixing the base of the penbox will be a challenge in the process.

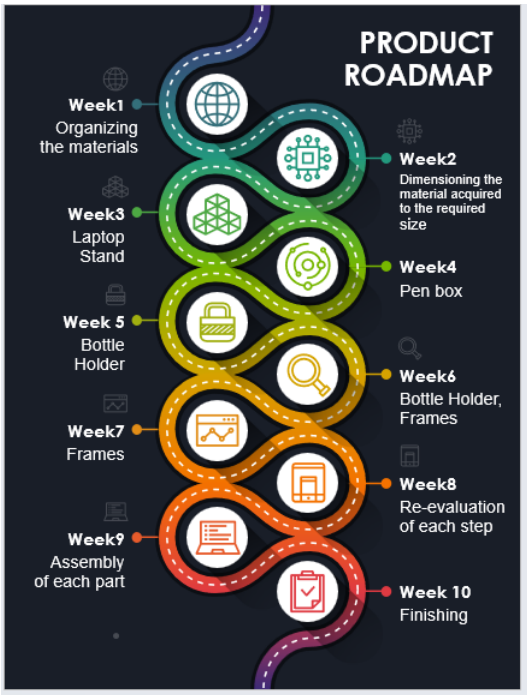
5. BILL OF MATERIALS

MATERIALS	RATE	AMOUNT	TOTAL COST
Plywood	70/sq feet	x2	3360
Mild steel	40/feet (20 feet)	x2	1600
Fevicol	400	1 kg	400
Sun-mica	1000+500	2 sheets	1500
Hardware	-	-	1000
Pine MDF(3*2feet)	230/sheet	1	230
1 pair of telescopic slide	300	1	300
Al sheet	320	1	320
Extra			1000
		Total	9710

6. TASKS AND TIMELINES

Task 1 : Organizing the materials
Task 2 : Dimensioning the material acquired to the required size
Task 3 : Laptop Stand(Dimensioning,laser cutting and joining)
Task 4 : Penbox (Dimensioning and cutting)
Task 5 : Bottle Holder (Dimensioning and making actual design)
Task 6 : Frames (Welding and polishing)
Task 7 : Re-evaluation of each step
Task 8 : Assembly of each part
Task 9 : Finishing

Each of the members does tasks 1 and 2.
For Task 3, the Cad model will be done by Aaryan Darad, Animesh, and laser cutting will be done by Nishant, Aaryan. Cutting the plywood into the required dimensions for the table top will be done by Sharika and Pushkar.
For Task 4, Dimensioning the sheet and cutting will be done by Alok Vidyarthi. Fixing of the base and other operations will be done by Kaushal Kothiya.
For Task 5, The Modelling of the Bottle Holder will be done by Nishant, and Aaryan will look over the 3d printing and attaching to the table.
For Task 6, the Welding of the frames will be done by Nishant, and Shashank will do the Polishing.
Task 7: Everyone will re-evaluate each part and correct the mistakes before assembly.
Task 8, Sharika and Pushkar will fix the telescopic ball bearing and the upper part of the table. Nishant and Shashank will fix the frames into the lower part of the table. Alok and Kaushal will set the penbox into the table like a drawer.
Task 9, Finishing, will be done by Animesh, Kaushal, and Sharika.



7. CONCLUSIONS

For the reasons mentioned above, we have decided to make a customized study table that adds functionality to existing designs that we find lacking. This shall greatly help many students who currently have to use different arrangements for their possessions and also arrange things in an ordered manner. This design allows us to make use of the manufacturing techniques that we have learned and apply them to real-life applications. It will help us to learn the various challenges that Engineers face in real life and how to properly tackle them. We might have to work under some constraints which happens in nearly any real-life problem statement. The values and lessons learnt will always be helpful to us for our future endeavors as Engineers.

ACKNOWLEDGEMENTS

We are grateful to Prof. Madhu Vadali for giving us the opportunity for brainstorming on daily life problems and coming up with a solution making practical use of the skills we learnt.
We are also thankful to Prof. Pradipta Ghosh for directing our thoughts and shaping our ideas for the solution.

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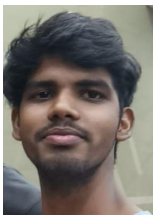
[2] C. B. Sweeney, Matthew L. Burnette, Martin J. Pospisil, Smit A. Shah, Muhammad Anas, Blake R. Teipel, Bryan S. Zahner, David Staack, Micah J. Green, "Dielectric Barrier Discharge Applicator for Heating Carbon Nanotube-Loaded Interfaces and Enhancing 3D-Printed Bond Strength." *Nano Letters*, 2020

CONTRIBUTIONS

All the members have contributed by providing ideas through brainstorming, problem analysis and coming up with various solutions.

Aaryan Darad- Introduction and abstract writing. Providing ideas and clarifications regard rapid prototyping and cutting and fitting.



Alok Vidyarthi: Ideating on the sequence of tasks and making charts for task analysis. Providing ideas about implementation of sheet metal operations for the pencil box.

Animesh Tumne: Autodesk drawings and design description. Design and dimensioning of the laptop stand.

Kaushal Kothiya: Autodesk drawings and design description, designing and dimensioning of bottle holder, helping in overall design of our product-multiutility table.

Pushkar Parakh: Writing part of the materials used, its description and budget details. Providing ideas about implementation of carpentry.

Nishant Tatar: Writing part of manufacturing processes and providing details about welding and rapid prototyping.

Sharika S: Writing part of values added, acknowledgement and budget details. Providing ideas on how to implement carpentry for the product.

Shashank Ghosh: Autodesk modeling and design description, designing and dimension of Table-Top.