DESIGN OF PRODUCT- A CASE STUDY

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ABSTRACT

Design of any product is very complex process. It needs thorough knowledge of Engg. Subjects, data from Historical past incidents or accidents so, that same mistake or defect may not be repeated in future. A dedicated team which needs good experienced and learned Head who can enlighten the path of team members through his knowledge and experience. He must promote and appreciate the new and correct innovative ideas of junior team members and must check any new component rigoursly in experimental lab, considering and encompassing all standards and safety features. This paper deals in the design process and phases and responsibility of design engineers & manufacturers.

Key Words: Design, Morphology, Product, Probability

INTRODUCTION

Design is a process which is concerned with generating ideas and suggesting ways to turn these ideas into reality to satisfy some needs optimally under the relevant constraints. Designer has the responsibility of his professional knowledge and society (people or users). Design product must follow the safety standards and specifications.

Any design process can be dived into three phases:-

1. Divergence Phase
2. Transformation Phase
3. Convergence Phase
1. **Divergence Phase** :- It consists of establishing a preliminary statement of need an analysis of needs. This analysis of need consists of exploring the design solution, establishing the specifications of the system desired. In this phase designer gathers all the essential informations from all the resources, Historical backgrounds and present conditions.

2. **Transformation Phase** :- It consists of one major step where in effort is made to conceive of a number of plausible alternate solutions to the problem. In this step the ingenuity and creativity of the designer come into full play.

3. **Convergence Phase** :- This phase starts with narrowing down the field of plausible solutions to the most feasible and reliable solution. Considerations of functional suitability, production methods, handling, maintenance, use and appearance all go in this step to determine the best arrangement of component parts and elements.
MORPHOLOGY OF DESIGN

There are many options available but which is the best. It needs lots of experiments, reliability and feasibility. Designer’s confidence is measure of realizability index of 0.75 means that it means that odds in favour of his completing designs are 3 to 1.

DESIGN CONCEPT D

Q1
D11 D12
Q111 Q112

Q2
D21 D22 D23
Q121

Q3
D31

Sub-problem
solution

Sub-problem

DESIGN TREE

Case :- The design concept D in above fig. depends on the solution of three sub-problem Q1, Q2 and Q3. A number of solutions may be proposed for each of these. D11 and D12 are possible solutions of Q1; D21, D22 and D23 are of Q2; and D31 is a possible solution of Q3. Each of these sub-solutions depends on the successful of further sub-problems, Q111 and Q112 for D11, and Q121 for D12. Now the realizability of the design concept D depends on the simultaneous solution of the three-level sub-problems Q1, Q2 and Q3. Thus, if p(D) represents the probability of the physical realization of the concept D and p(Q1) and p(Q2), represent the probability that the sub-problems Q1 and Q2 are resolved successfully, then.

\[ p(D) = p(Q1 \text{ and } Q2 \text{ and } Q3) \]

Where \( p(Q1 \text{ and } Q2 \text{ and } Q3) \) stands for the probability of all three sub-problems being resolved satisfactorily. The theory of probability can be used for calculation the probability for simultaneous solution of Q1, Q2 and Q3 using the probability of the solution of the individual sub-problems. To find the probability of solving a sub-problems, we examine the solution suggested for it. For Q1, two solutions are proposed. Only one of the alternate design D11 and D12 needs be realizable for Q1 to be solved. Thus,

\[ p(Q1) = p(D11 \text{ or } D12) \]

If D11 and D12 are known, p(D11 or D12) can be calculated. If it is possible to estimate p(D11) and p(D12), we can calculate index of physical realizability of the concept D. if, however, we are not able to estimate the probabilities at this level, we may have to go down one step further, that is we may have to determine the sub-problems Q111 and Q112.
on which the realization of D11 depends; Q121 and Q122 on which that of D12 depends; and so on. And then we think of possible ways of resolving these sub-problems. Thus, instead of the second level, we go to the third level. If it is not possible to make satisfactory judgments about probability even at this stage, one may go further down to the fourth level. In short, we go down to the level at which the problem is best understood, and then work our way up.

Any product which has been designed after considering all design details, safety, standards, maintenance facilities etc. has to be manufactured lastly by our manufacturers. So, special attention to be paid towards manufacturing machines available, processes, materials and there fabrication problems if any. Design must be altered if there is any manufacturing problem in fabrication and a common solution must be worked out collectively for example we have a Historic Event of Titanic Ship this ship sank in Atlantic sea on 15 April, 1912. Though various factors were responsible for it but one major factor which has come in light is that the manufacturing team was facing problem in hot riveting (Machine Operated) the steel plates from which the hull of the ship is going to be made and the forend of the ship due to limited space and design of shape. So, instead of Mild Steel manufactures used Wrought Iron (Hand Operated) rivets were fitted which no DESIGN ENGINEER can specify to perform the operation but due to the definite period of time manufacturers took decision of their own without consulting the designers team. These wrought iron rivets (Hand fitted) could not stand the blow impact of ice berg and all joints made were failed and result is just sinking of ship within 2 hrs : 40 mins. So, Designers & manufacturers must work collectively and elaborating their common problems and bring out best solutions which is beneficial and easy to perform for both the teams. This modern approach is Concurrent Engineering which encompasses all the factors of designers and manufactures.

CONCLUSION

Design is a team work. Designed product is finally for the use of society and placed an important role in day to day life of everyone so, it should not harm any one like environment, natural resources and human beings while using for performance.

REFERENCES

4. www.titanicship.com