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Conferences in the Ethical Issues Inherent In Any Engineering Product Design

Abstract

No one can deny the fact that technology has been the principle contributor to mankind's immense development. It is, therefore, permissible to assert that the people who make these technological developments possible should be given all the credits for the level in which humanity is presently. These are the people that work day and night, studying sciences, its applications, and several other things. They make decisions about the products that are needed to improve the lives of man. In order for these product decisions to be made Engineers are always first saddled with the task of creating product designs.

This paper describes the ethical issues inherent in any Engineering Product Design. It discusses the standard and ethics regarding the design of products, and the level of their compliance. This paper provides detailed background ethics and ethical issues and why they are an integral part of engineering. The paper presents information about the moral responsibilities of the engineer in the design processes. Also, the general standards pertaining to the design process of products are presented.

Keywords: Standards in engineering product design, engineers, ethics in engineering design of products, moral responsibilities of engineers.

Introduction

Technology has had a great influence of man ever since he came into existence. The human life, in its totality, depends on technology. However,

there had been many instances of quite a number of disasters that occurred as a result of misuse or inaccurate use of technological principles. These inaccuracy or misuses are, usually, due to human negligence or errors; it can also be said sometimes to be due to limited knowledge. A good example of such disasters is the Vasa sinking that occurred in August 1628. This disaster was reported to have occurred as a result of the King ordering the engineers to ignore the standards and extend the length of the ship. This resulted in the design of a heavily armed ship with a length that is too long and a height that is too tall relative to its beam and its ballast. It is this error in design that resulted in the sinking of this great Vasa ship . Several other great disasters in the past have been linked with the decision to go against some engineering design standards and ethics.

The advent of new technologies and products have brought in new possibilities and, hence, new risks. Also, these new technologies and products have brought about a couple of new ethics and standards aimed at ensuring that the deployment of these technologies does not result in disasters. This paper is aimed at presenting the standards, ethics, ethical issues, and their level of compliance in engineering designs.

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Engineering Ethics and Design Processes

Just as stated above, this research paper would describe the ethical issues encountered by engineers and how this issue is handled in the design processes of products.

Ethics in Engineering

In this section, a complete overview or literature on engineering ethics will be presented. Descriptions of the main issues will be a point of focus and the position of this research paper pertaining to the issue will be presented.

Engineering ethics is an aspect of engineering that has been saddled with the responsibility of focusing on the ethical aspects of, both the individual and collective, decisions and actions of an engineer. It ranges from professional codes and conducts, privacy, multinational corporations, conflicts of interests, liability issues, dealing with risks and safety, and whistle-blowing .

It is noteworthy to mention that most of the literatures on engineering ethics were created based on studies of disaster like that of the Challenger disaster . Also, engineering ethics is seen as a professional ethics in countries like the United States . They see an engineer as a professional who does not only have obligations to his or her employers but has obligations also to the whole society just like lawyers and doctors. Engineers are thereby expected to adhere strictly to the professional codes of conduct of the engineering profession. For instance, the engineer is expected to hold the welfare and safety of the public paramount in every situation. Citing the case of the Challenger disaster, Davis was able to emphasize the difference between managers and engineers. He stated concisely that it is incumbent of all engineers to hold safety paramount, thereby strictly adhering to their professional norms as opposed to the managers who has no such professional norms of such to adhere to . The regard of engineering ethics as a professional ethics is the reason most engineering ethics textbooks has

made the individual engineers and their responsibilities in their job and profession as a point of focus. This same reason is responsible in whistle blowing found in several literatures on engineering ethics.

There is a need to point however out the fact that in design processes the marketing specialist and the managers work hand-in-hand with the engineer to create the design of a product. It is, therefore, necessary to not exclude the managers and the marketing specialist when presenting the ethics.

Ethics in Design Processes

There are no doubts that one of the core activities of an engineer is a design. Empirical data showing how engineers are expected to handle ethical issues in design has been duly presented by Lloyd and Busby in their book entitled “ Ethical reasoning in a normal engineering design process”. In the book, three ethical theories was made use of and at the end of it, it was stated that a lot of design decisions that seems to be ethically neutral number can combine to result in ethically relevant consequences .

In several design processes, determining the ethical problems is, usually, a very difficult task especially because smaller ethically relevant decisions are made in every one of these tasks. What compounds the problems more is that of trying to regard every decision are being ethically relevant. No doubts, there are some values that cannot be classified as moral, example of such is “ efficiency”. According to Lloyd and Busby, efficiency is not seen as an ethical issue but decisions regarding efficiency can be classified as relevant only when it is related to things like sustainability . A good example of this can be seen in the creation of a more energy efficient product. In this

case, efficiency is seen as ethically relevant as it is a part of the designing a product with a better sustainability. Also, decisions pertaining to simplicity are sometimes linked with moral values. When related to ease of operation, simplicity might be considered to be an ethical issue otherwise it is not an ethical issue & .

Another author that goes by the name Van de Poel was however able to distinguish five different actions that take place during the design process which are ethically relevant. Below are the five actions that may be ethically relevant during the design process.

- The choice that are to be considered in the course of the design process and the actual selection made among these alternatives at another stage of the process.
- The decisions made about the scripts and its assessments coupled with the social and political visions that are inherent in the design process.
- The goal formation, criteria of the design, and the requirements along with their operationalization.
- The decisions about the acceptability of the risks assessments and the secondary effects.
- The assessments of the trade-offs between the acceptability of specific trade-offs and their design criteria.

What can be implied from this approach is that things like “ formulating requirements” can be classed as ethically relevant. This can be seen when the safety requirement is formulated. Since this requirement would require operationalization it, therefore, makes the operation ethically relevant . If we are to go by the Van de Poel’s approach then all these actions would be seen

as ethically relevant whenever they are related to moral values .

There is a concept that has been designed in the field of human-computer interface design and computer ethics. This concept is named “ value-sensitive design”. It has been defined as

“ Value Sensitive Design is a theoretically grounded approach to the design of technology that accounts for human values in a principled and comprehensive manner throughout the design ,” .

Though, from the above definition it can be seen that this concept is not meant to be applied only to the field of computer and software design.

However, at this present time of ours, the concept has been applied majorly to only these two fields. The main essence of the value sensitive design is to try to make software design that can account for moral values such as autonomy and privacy.

The Design Process

The design process is defined as the process of products or tools creation to suit human purposes . According to the model presented by Cross, the design process is made up of three phases namely; the generation phase, the evaluation phase, and the communication phase. The first phase involves the generation of the product concept. It is incumbent on the designer to understand the design problem and simultaneously get possible solutions to them. The possible solutions aid the designer in getting a better comprehension of the design problem. It is during the second phase that the evaluation of the decision will be done. The essence of the evaluation stage is to determine whether the proffered solution meets with the requirement.

More often than not, the adaptation of one part of the design could result in problems in other parts of the design. It is, usually, therefore, necessary to make more than one iterative steps. Then the third phase involves communicating the result gotten from the second phase to the people responsible for the production. &

Ethical Issues

Ethical issues are relevant during the formulation of criteria and requirements for the design and in the acceptance of trade-offs between requirements. A problem is regarded as an ethical or moral problem if moral values are at stake. Ethical theories are, usually, focused on one of the sources of values. Utilitarianism only focuses on utility. Kantianism only accounts for universal rights. The focus of the value ethics is on the perfectionist end of self-development. It is worthy of note to mention that, as far as this paper is concerned, "ethical issues" means that the ways in which engineers handle issues can be evaluated from an ethical point of view.

Many of the ethical issues can also be legal issues, a good example of this is safety issues. In issues like this, the way engineers deal with them should be evaluated from both legal and ethical points of view.

Lots of standards, codes, and legislation exists about the design and safety. These makes the decisions pertaining to safety very ethically relevant and provides the rules for engineers to follow from a legal perspective during decision making.

- 3. 2. Inherent Ethical Issues in Product Design

The main focus would be on the ethical issues that have a direct impact on

the design of a product and how to make use of them. Focus would be on the sustainability and safety of such products.

No doubts, whenever the issue of safety and sustainability of a product comes up ethical issues will always come to play . Almost all the processes involved in product design involves the making of decisions pertaining to sustainability and safety, though their level of importance could be different. There are cases in which engineers will not discuss or put into consideration sustainability and safety; that does not however mean that the engineer didn't make any choice that pertains to sustainability and safety.

Citing two examples that shows the lasting effect of the decisions made during the design process pertaining to sustainability and safety. In the process of designing the copier machine, it is necessary to make a choice whether or not the copier is required to make two-sided printing. After this choice has been made, other choices about the default properties of the copier would need to be made. If the default option is chosen to be a two-sided copying, the users will have to be given the choice of selecting to print one-sided. Whenever the two-sided printing default option is switched off by the user, the machine will permit one-sided copying. It can be seen that two-sided copying would save more papers than the one-sided. These reduction in the use of papers will result in a reduction in the quantity of wood used in the production of paper. The reduction in the quantity of paper used will thereby result in the use of lesser resources for production that will be significant on a global scale. This is a good example which illustrates how a seemingly small design decisions taken at the decision stage of a product have great environmental effects

The other example of the ethical effect of decisions made during the decision-making process is that of the car. Speed limits can be implemented on cars to regulate the speed of cars. If speed limits are imposed, though the drivers may drive as fast as their car can permit but stand the risk of getting fined if they go beyond the speed limits. However, car engineers can design a car in such a way that the car would not be able to exceed the speed limits. In countries like Netherland, trucks are being installed with speed regulating devices which make them unable to exceed the 90 km/hr speed limit. It is, therefore, obvious that an engineer has a lot of influence on the speed of a car; they can be it higher, and they can place a restriction on the magnitude. No matter the regulation or speed limit an engineer can decide to design cars with lower or higher to speed & . If a car with lower top speeds is designed, good quantity of fuel will be saved because lower speed cars consume less fuel than higher speed cars. The lower fuel consumption will result in a decrease in the emission of carbon into the atmosphere. Also, if cars and trucks have just a little speed differences between them, there would be a reduction in the amount of road accidents. More lives will be saved and also many injuries, as a result of accidents, will be avoided.

Whenever there are problems with the design, if the solution is determined only by the requirements, the engineers may declare that they won't be held responsible for any ethical issues that may come up. This declaration can be made because the requirements determine everything and the customers determine the requirements.

It is being argued by some authors that engineers should not be made to determine the ethical relevance for the formulation of goals and

requirements; arguing that the role of an engineer should be the finding of solution that technologically works best under specific situations. Since this should be the task of the engineer, and then ethically the task is neutral. Design problems do not get solved most of the times completely. One can say that design problems have more or less badly structured problems. Engineers are required to formulate separately the solutions and requirements. However, if the design problems are not structured well, independent formulation may not be possible. Even if an existing design is to be redesigned part of the requirements may be formulated from the inception of the design processes but the requirements cannot be said to be independent of the solution. When it comes to redesigning, the solution space is limited, and some specific features of the products cannot be altered. When a new product is to be designed, and the design problems are not well-structured, the beginning of the design process would only allow for some vague requirements to be made.

A good example of a badly structured problem is that which occurred in the mid-1990 during the search for the substitutes of Chloro-Fluoro-Carbon (CFC) as refrigerator coolants. The need to get a substitute for the CFC arose as a result of the discovery of the negative effects on the ozone layer. During this search, two alternatives (hydrocarbons and HFC 134a) were proposed both having their advantages and disadvantages. The hydrocarbon, for instance, are flammable using them as a coolant would cause the alteration in the design of the existing refrigerator. Also, the HFC 134a looks less damaging than Chloro-fluoro-carbon but would still have a negative effect on the environment, if released. In cases like this, engineers would need to make a

choice; a choice made would most likely not lead to one solution. If the design problem is badly structured, multiple solutions may arise with each one being valid.

When it comes to issues like these, all possible views need to be brought together since all parts would need to be made to fit each other and function together.

Conclusion

It is quite difficult to recognise ethical problems in engineering. I thereby agree with Lloyd and Busby that smaller ethically relevant decisions need to be made in every decision-making process. Regarding all decisions pertaining as being ethically relevant is not good enough. As not all decisions falls under the engineering ethics.

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