Statement of Purpose

Product design and development has provided users with products and technology that can be seamlessly incorporated in our everyday lives. I am intrigued by the fact that the utilization of digital tools in design methodologies augments the cognitive and analytical abilities of designers, allowing them to propose and evaluate new ideas rapidly and effectively thereby impacting the approach of a design team. This is most evident with the modern immersive interfaces which allow us to virtually visualize products that would have been difficult to visualize otherwise. These can then be made with rapid prototyping machines like 3D printers thus easily allowing virtual objects to become a reality. It would be challenging and rewarding for me to envisage processes beyond the obvious and investigate and explore the very fabric of the design methods used so that we can interweave designers, users and products into one successful system. In general, our social objective should be to create user friendly technological advancements that allow a seamless integration of user expectations with the design and final manufacture of products that people would want.

I am fascinated by this field and challenges it possesses to innovate products by improving our understanding of design methodologies that could change the way we function. I would therefore wish to pursue the S.M. program in Engineering Systems leading to a PhD in the Engineering Systems Division (ESD) at Massachusetts Institute of Technology (MIT) with special interest in **Product Design and Development.** I visualize a better exploitation of immersive technology by developing interfaces which allow a new design paradigm and mass collaboration. This approach to automating standard design procedures and developing the interfaces would lead to more creative design procedures that are more in tune with user expectations and industrial capabilities.

My own experience with research began when I applied to the interdisciplinary Smart and Sustainable Environment Laboratory (SSEL) in Korea Advanced Institute of Science and Technology (KAIST) South Korea for my post-sophomore year summer internship. Under the guidance of Professor Seongju Chang, a visiting scientist at MIT Media Labs, I was exposed to the idea of a reconfigurable space concept design to address the problem of space management. This first research experience allowed me to involve myself in the concepts of urban design planning and management. I was required to conceptualize the design of a house which could transform itself to create a ubiquitous and smart space. I learnt the art of visualization and was allowed to imaginatively explore the customization of several household objects like the kitchen table, shower booth and sink so that they can dynamically compose and decompose themselves. By extensive literature review, I learnt how the field of design, architecture and electronics can synergistically produce modern living spaces addressing the problem of space management. I also learnt the importance of systematic documentation as it helped me manage a multifaceted project with ease. The internship, most importantly, introduced me to the beautiful field of design and enabled me to generate ideas to develop interfaces that provide immersive experience to the user.

I subsequently started exploring various other design disciplines like systems design, product design and interaction design. After reading extensively about several design disciplines I was captivated by the field of **Systems Engineering and Design.** However, it was only by pursuing a formalized course in design in my undergraduate curriculum, I was able to better appreciate the intricacies involved in a design process. My coursework on machine design taught me the skills of utilizing flow charts, graphs and other ways of data representation. I realized that although some design methodologies were well established there is still a lot of scope for improvement and that there is also a need to develop novel methodologies that could fully utilize modern technology like rapid prototyping and virtual design in order to improve the overall final product.

I applied to the Collective Systems Laboratory (ColSys Lab) at Purdue University, Indiana, USA for a post-junior year summer internship. In the project, guided by Professor Jitesh Panchal, the idea was to develop an interface that would execute an efficient system reanalysis to understand if customization could help in product development. This internship experience tested and strengthened my mathematical knowledge exhaustively. I learnt various numerical methods and

optimization techniques to recalculate matrix inverses. I was exposed to the research culture of a US university and it helped me grow as a researcher. I chose to continue my post-junior year summer internship project as my senior year Bachelors Thesis Project (BTP) as I would like to delve further into product development and design. We have been able to successfully demonstrate a significant reduction in the overall time and computational complexity through our approach for real-time modification. Interestingly, my elective courses like Cultural Theory and Practice and Language and Communication in Humanities and Social Sciences department have also helped me to involve ideas for, interface design keeping subjective experiences in mind while addressing issues of intellectual property in mass collaboration and customization in the course of my BTP.

These research experiences have allowed me to explore and expand both my academic and non-academic boundaries. I have enjoyed researching in the domain of design and it brings me immense satisfaction to interact with and to be able to effectively describe my thought processes to others. As the students head in high school and also later in college as a senior mentor I gave various motivational lectures to students where I was able to impress upon them how formalized coursework can develop deeper insights. Thus, the prospect of being able to explain course fundamentals well to others and to be able to simultaneously do research in the domain of design, made me consider becoming an academician as a suitable career option.

I strongly believe that an unconstrained environment is important for a student to pursue research with the broader aim of becoming an independent researcher. Having heard about the multicultural environment of MIT and the prospect of a holistic development with the best and the brightest peers gives me a strong encouragement to apply to this prestigious university. The ESD course work on product design and development, systems architecture, systems dynamics for engineers and real options for product and systems design will help me refine my approach towards product development and systems engineering. I believe these courses will help me nurture the skill to develop methodologies to seamlessly incorporate large scale systems in everyday lives and help me better visualize my own ideas in the field of product development.

I am particularly intrigued by the work of Prof. Maria C Yang and her research group on understanding design team behaviour in complex systems. I would like to research about the impact of product customization on the behaviour of design teams. I am also interested in the work of Prof. Warren Seering on risk management while developing products.

I believe I have the right attitude and aptitude to pursue research. I have always been sincere as a student and my current academic record reflects this well. I am currently ranked 4^{th} in class of 83 students with a GPA of 9.12 on a scale of 10. I have always aimed towards a holistic development by maintaining a balance between the creativity of a designer and the problem solving capability of an engineer. Therefore, I sincerely believe that I am ready to accept the challenges and responsibilities associated with graduate studies at MIT as I am wholly motivated to learn from every experience linked with both the campus and its people. I am looking forward to gaining admission to the SM plus PhD program at MIT with full financial assistance and I reflect that this education might transform the way I think and feel about teaching, learning and most importantly, myself.

Thank you for considering my application.

Murtuza Shergadwala