



Senior Project Proposal

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I. Title of Project:

The Next Mechanical Revolution: What are the key technologies shaping the future of automation?

II. Statement of Purpose:

Every product starts as a single thought that harnesses humanity's inherent creativity and imagination to transform an idea into reality. As society has progressed, there has been a growing demand for more complex products that require a more sophisticated design and construction process. This has led me to question the construction processes behind products that have revolutionized modern life and how the evolution of labor to assemble these commodities has shifted from entirely human to human with specialized tools, and now to fully robotic assembly lines that require little human oversight. The production industry is constantly developing new ways to make goods cheaper by utilizing cost-efficient strategies, making the market for automotive services centered on the most recent technological breakthroughs and the newest ideas that exploit different approaches to create better solutions to the same problem. Through an engineering internship, I aim to answer the following question: What new components of modern-day technology must be utilized to prepare the automation industry for the future?

This senior project has given me the opportunity to explore this passion further by questioning what possibilities remain to be explored in advancing the automotive industry into the next era of engineering techniques. As I begin my journey with Bent River Machine, I aspire to shed light on my curiosity about what the next significant step will be for the future of mechanization in society.

III. Background:

From atoms to large skyscrapers, everything in life consists of two things: structure and scalability. I learned this lesson at a young age while playing with my electronic snap circuits. The ability of the metal strips acting as conductors to carry current through them to provide electrical energy to LED lights fascinated me to understand the math behind these principles and uncover all the ways electricity can function in granting us easier lives. These early memories of building intricate electrical systems have made me realize

all of the technological achievements and triumphs society has had to overcome to create working automobiles and functioning factories that manage to mass-produce common necessities. My life as a teenager has been fortunate enough to travel to many different countries, getting the privilege to experience many ways different communities utilize their natural resources to incorporate modern amenities in their average citizens' lives through the use of advanced machinery.

I followed this passion throughout my high school years, as I decided to pursue the most academically rigorous math and physics courses to strengthen my knowledge in STEM subjects. I would also constantly update myself through various news sources on the latest and greatest innovations that will revolutionize society, including the progression of robotic technologies and the introduction of AR hardware into mainstream devices. For my senior project, I wanted to obtain hands-on experience with engineering firms that are constantly changing to adapt to the increasing standards of the future of automation.

IV. Prior Research:

The very first steps to achieving global innovation through automation systems occurred in 1913, when Ford Motor Company introduced a car production assembly line incorporating basic electrical components that "reduced the car assembly time from 12 hours per car to about one and a half hours per car" (Boisset, 2018). This small change, leading to a more efficient process for manufacturing cars, eventually blossomed into a worldwide movement to maximize the efficiency of creating products using complex machinery with many moving components. As I explore deep into the various techniques and equipment utilized today, I find that "emerging trends in industry are focusing on human-robot collaboration, AI-driven predictive maintenance, and sustainable manufacturing processes" (Waseem, 2025). This reflects the ideology that automation is becoming an increasingly interdisciplinary field, where various engineering disciplines must collaborate with designers to create systems that can meet the requirements of modern factory production.

Present society is constantly expanding the boundaries of technological capabilities by giving each piece of equipment within automation greater abilities to collaborate with one another. The Internet of Things (IoT) is a prime example of a recent innovation that is revolutionizing the industry. The IoT technology enables "real-time tracking and monitoring of shipments, inventory, and equipment" (Turvo, 2025), creating a vital communication line between different mechanisms. This allows machinery to not only achieve its own goals but also assist others. The only downside of this innovation is the cybersecurity risk it imposes, as IoT requires a local network, meaning it can be accessed by anyone who knows its vulnerabilities. This calls for innovations in security protocols and

threat detection to grow alongside the increasing use of complex networks in automation.

In order to maximize efficiency in the transportation field of automation, a common solution has been found in implementing software called TMS (Transportation Management System), which helps to “reduce transportation costs by identifying inefficiencies, consolidating shipments, and optimizing routes ” (Turvo, 2025). This innovation provides data analytics, which can reduce errors and improve sustainability methods. This type of software, in combination with machine learning, will create industrial systems that continually optimize performance in the creation of new products by adapting to changing conditions.

Another massive issue that can plague fully robotic automation systems is latency (communication delay), which can postpone fast decision-making. This problem still has limited solutions, but many different techniques are designed to get technology as close as possible to taking instant actions. A temporary outcome for this challenge is edge computing, which “presupposes data processing in the location of its generation and does not imply transfer of all the data to a central cloud” (Plant Automation Technology, 2025). This essentially signifies that the data is computed in local networks instead of using centralized servers, which increases the proximity of the traveled data. This also works together with 5-G networks to make nearly instantaneous connections between devices.

Looking towards the future of AI in automation, some companies are utilizing agentic AI to perform various autonomous tasks, where the AI has the freedom to devise solutions to generic problems with the machinery. It is different than traditional AI in the fact that it will “focus more on goal-oriented behavior and adaptive decision-making, using a range of techniques like machine learning to achieve these outcomes” (SS&C Blue Prism, 2024). This extension of AI usage involves giving the AI a prompt that includes completing ongoing projects where context and background must be known, instead of having it solve a specific issue. These natural language processing models can collaborate with people to ensure quality optimization in the automotive industry, as well as faster task execution.

With all of these innovations in software and hardware automation creating a more complex network than ever before, it is essential that I take the initiative in understanding all of these modern advancements to help in the effort of standardizing all of these techniques to set up our society for the best possible future. These recent changes in automation are just being implemented in the beginning stages and need many different companies to take the leap in testing them out. I believe this topic will present me with all the tools necessary to create a groundbreaking senior project and will be a heavily present theme in my future. This research will educate me on what the next steps the automation industry must take to maximize its resource development and design products at record speeds.

V. Significance:

The field of automation has seen explosive growth in the last couple of years and “is poised to redefine the future of work by altering how tasks are performed, reshaping job roles, and influencing the overall work environment” (Admin, 2025). The future of the industry looks promising, but real change can only be achieved by taking action and implementing the latest technologies to make automation shine through these turbulent times. This is the exact reason I am dedicating my effort toward pursuing this field for my senior project. This movement will transform job markets by giving workers the chance “to focus on more complex, creative, and decision-making tasks that require emotional intelligence, critical thinking, and problem-solving skills” (Admin, 2025), instead of having many job positions taken up by repetitive, mundane tasks.

The senior project committee should allow me to research this topic because it will shed light on many recent inventions that will change many aspects of not only automation but also everyday life. Researching this will give me the opportunity to provide a blueprint of what things must be incorporated into modern machines to create an automation system that utilizes all of today's new technologies. I will also analyze what ramifications could arise from these new techniques and how they can possibly affect other industries.

I believe this experience will broaden my knowledge of what to expect when looking forward into my adult life. I hope this knowledge will establish a solid foundation for my future career and will give me a jumpstart in pursuing a bachelor's degree in engineering. I also wish that in the future that I can pass down the knowledge I gain from this experience to the next generation to continue the legacy of changing society for the better.

VI. Description:

The execution of my senior project will consist of hands-on experience where I will physically aid in constructing parts that are utilized in many common automation systems. I will create 3D CAD (Computer-Aided Design) models for blueprints using Autodesk Fusion 360 and recognize the GD&T (geometric dimensioning and tolerances) for any part I am manufacturing. I will go through multiple drafts of designs for automation parts until I can fully optimize the functionality of the part. I will physically create the components utilizing the HAAS VF-3 they have on site and aid in the development of G-code using the Solidworks CAM (Computer-Aided Manufacturing) software. This process of making a part from start to finish will be shown through a presentation showing what I have learned and how I applied it.

VII. Methodology:

To find out what modern components will be utilized in the future of the automation industry, I will spend 2 days out of my designated senior project weeks working at the Bent River Machine facility and 1 day per week dedicated to independent research and computer work. I will spend this time creating automation parts for private companies through Bent River and researching what modern techniques can be implemented to increase the efficiency of their equipment and software. I am not yet familiar with the specific company I am working with to develop a manufactured part, but I will be familiarized with this company during my initiation week in early February and will do extensive research on what specifically my role will be in manufacturing the product.

Throughout the creation of the automation parts, I will attend weekly meetings where product optimization will be discussed. This will build up my communication skills as I talk with various engineers about what potential improvements can be made to make a greater fit for what the outside company is requesting. I will analyze every step that is incorporated into turning a paper blueprint into a working collection of mechanisms that will help an organization create the final good that is then sold to consumers or used for their own purposes.

This internship will serve as my first meaningful step into the engineering field. I seek to develop practical experience with industrial automation workflows, including the operation of HAAS machinery and control systems. By observing and participating in the production line, I want to understand how automation firms optimize precision, efficiency, and quality control to deliver technically flawless final products. All of this work experience will allow me to fully conceptualize what is necessary to create modern automation systems.

VIII. Problems:

One problem I could face in pursuing this automation internship opportunity is the hour-long commute to Clarkdale, Arizona. If there are snowy or icy conditions on the road, it will be challenging to drive to this location. I hope to solve this problem by having many resources at home, where I will be able to continue my research and have the tools on my computer to continue the potential design of certain automation components or anything that will be needed to answer my scientific question. Another problem I could face in carrying out my senior project is my limited knowledge of what specific role I can play in the machine-making process. Since the firm had a government audit throughout the month of November, I was not able to tour their facilities until early December, which may give me a later start than most in beginning the production



phase of the project. But, I believe that with time, I will be able to obtain a firm grasp on all of the specifics that my research will include.

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