1. Describe Technology

Justification of the topic + importance and the opportunities for society

Industrial robot is a robotic arm that is automated to perform specific tasks that are hard, dangerous, or too monotonous for humans.  There are four main components that make up the robotic arm. These components are manipulator, controller, end effector and teach pendant. Manipulator is the arm that moves and rotates on various axis. Controller is the computer system that connects to the robotic arm to control its movement, rotation, and effector functions. End-effector is the device that is attached to robot’s wrist which allows it to interact with the given task. These interactions include welding, handling, packaging, picking, placing, dispensing, and cutting. The Teach Pendant is the device used to program industrial robots’ movement, rotation, and end effector function.

Robots help increase productivity in the workplace. Once a robot has been automated in an industrial environment, it can speed up production by decreasing the completion times and creating more efficient manufacturing processes which convert into more profit. According to the information on International Trade Administration's website, adopting industrial robots has led to growth in productivity. Among all industries, a one percent increase in quantity correlated with an increase in productivity of 0.8 percent.  Within the United States, industrial robot installation increased at 10.28% compound annual growth rate in the past decade, from 15,170 in 2008 to 40,373 in 2018. According to economic research analyst Kara Mazachek, it was found that parts of the industry with easily automated labor and financial resources have the most robots. These industries include automotive, transportation, metal, and wood manufacturing industries. Largest productivity gains were seen in industries where companies were in early stages of adopting robots. These industries saw 5.1 increase in productivity with an increase in industrial robot density of one percent.

Industrial robots provide precise and quality work by reducing probability of human error and exhaustion. The automation increases the efficiency of production and helps ensure that the process of the function doesn’t alternate. Robots also provide efficiency while simultaneously lowering the production costs. BCG (Boston Consulting Group), an American global management consulting firm analysis found that using advanced robots can reduce conversion costs by up to 15%, and combining advanced robotics with other technologies, process enhancements, and structural layout changes can yield savings of up to 40%.

<https://www.youtube.com/watch?v=Cndodc3X50s>

<https://www.bcg.com/publications/2019/advanced-robotics-factory-future>

<https://blog.trade.gov/2020/12/22/robots-and-the-economy-the-role-of-automation-in-productivity-growth/>

As the number of industrial robot installations grow, the employment rate in industries with easily automated labour will likely begin to decline. The spread of robots has raised concerns about the future of employment. The tasks are performed much quicker and more precisely by robots than human workers.   In the article "Robots and Jobs: Evidence from U.S. Labour Markets", published by MIT professor Daron Acemoglu, the researchers found that for every robot added per 1,000 workers in the U.S., wages decline by 0.42% and the employment-to-population ratio goes down by 0.2 percentage points — to date, this means the loss of about 400,000 jobs.  Between 1990 and 2007, the increase in robots (about one per thousand workers) reduced the average employment-to-population ratio in a zone by 0.39 percentage points, and average wages by 0.77%, compared to commuting zones with no exposure to robots. This implies that adding one robot to an area reduces employment in that area by about six workers. BCG (Boston Consulting Group 2015) offers two scenarios for the next decade. In their aggressive scenario, the world stock of robots will quadruple by 2025. This corresponds to 5.25 more robots per thousand workers in the United States and with our estimates would lead to a 1 percentage point lower employment-to-population ratio and 2 percentage points lower wage growth between 2015 and 2025. The more conservative scenario involves a less than threefold increase in the stock of robots and would have a more modest impact (a 0.6 percentage point decline in the employment-to population ratio and 1% lower wage growth).

Chart, line chart

Description automatically generated

<https://mitsloan.mit.edu/ideas-made-to-matter/a-new-study-measures-actual-impact-robots-jobs-its-significant>

<https://economics.mit.edu/files/19696#:~:text=We%20study%20the%20effects%20of,and%20local%20indus%2D%20try%20employment>.

https://www.sciencedirect.com/science/article/pii/S0040162520310283#:~:text=The%20average%20unit%20labor%20cost,level%20in%20manufacturing%20(%2417.5).

Choices, currently available offerings for IR

* Where they’re used in industry
* What they do in that part of industry
* Discuss how they do it (production wise)

Industrial robots increase productivity in various industries that enable automated labour by increasing the speed and accuracy of the given operation. The applications of these robots can be generally categorised to welding, handling, packaging, picking, placing, dispensing, and cutting.

Automotive Industry

Automotive robotics is the area that generates the largest incorporation of industrial robots worldwide, currently covering 30% of total investments in the industry sector. Industrial robots are used in the automotive industry to increase process accuracy and annual production rates. The tasks are automated with limited human intervention which will significantly reduce the health risks for workers. An example of robot use in this industry is painting. Professional car painters are hard to find, and the job is unsafe because the paint is highly harmful to humans because of its volatile compounds that cause headaches and fatigue. The robots are striving in these areas because they reduce the health and safety risks for human workers by enabling them to work remotely and reduce the exposure to the paints’ harmful chemicals. Another application is welding. The welding cars is used in fuel tanks, vehicle’s body, suspension, and frame. The robots create more accurate welds in a shorter period while reducing any waste and health and safety risks. The other main use of robots in automotive industry is assembling. They assemble smaller components like pumps and motors and or windshield installation and wheel mounting at high speeds.

Today, the robot installations in automotive industries will likely continue to increase. As new materials and new technologies are constantly being used in automotive production, these projects created a demand for the supply of the latest generation robots capable of meeting high technical requirements. This trend will continue today and despite the 2020 pandemic, it is assumed that it is not going to have a huge effect even regarding the requirements of newly opened emerging markets. It is very likely that the application of robotics will become even more desirable. The pandemic also confirmed that one of the weakest links in the production chain is a human operator. Therefore, it would be appropriate to increase the robustness of the production system to such circumstances.

According to the latest figures, in 2019, there was a record of 2.7 million industrial robots operating in factories around the world – an increase of 12% in comparison with 2018.