Application: Robotics and Automation

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Description of the Lab activity

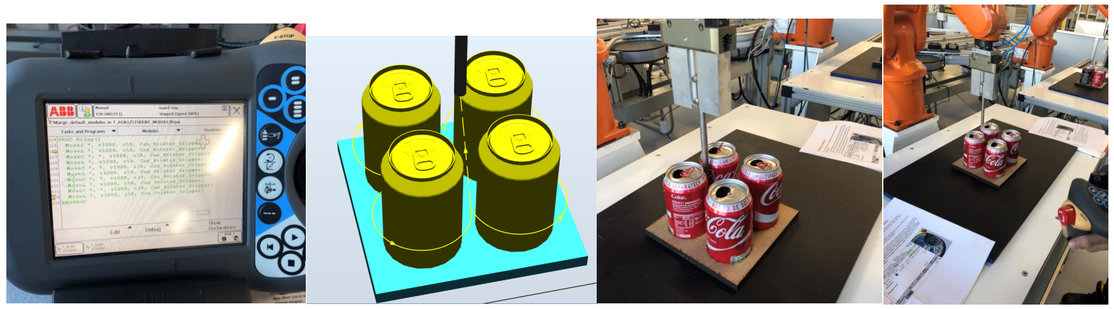
- Brief description of the lab activity and task given to you

  The task was to learn design methodologies and operations in offline RobotStudio software which simulates ABB's IRB120 control. Also, to program IRB120 to create a path program to move the Robot Gripper tool holding a pointer to move around 4 cans. **Robot Studio Software** was used to design Robot cells in offline mode. Paths were defined on a predefined station using targets and movement from targets with job to move linear and curve command, defining mid and end to follow an arc.

- The exercise output

  The Offline Robot studio helped learning programming by using ABB Virtual Robot technology with IRB120 Robot and made me familiar with the robotics, gave me an insight of the risks without risking the physical robot. Using this programming knowledge, a program was created to operate the can pointer gripper to move along the programmed path around the can without colliding or damaging the can.

  Operating IRB120 was used for controlling the robot with instructions made on the Software Robot studio. Program was programmed using the dead man's grip. Instructions were followed before operating such as making sure that the gripper tool was selected, Operation speed was set to 10% so that the program would run at a slow speed when played, without damaging the cans therefore it could be paused in time if the program was not right. Single cycle/Loop was selected for initial programming and worked in a group. Instruction to move was added as Move*, V1000 with TCP moved to the starting point, move linear instruction was added to move the pointer and set to the end position and * symbol was selected and modified to the coordinates required. This step was repeated until the TCP covers the programmed path around the remaining 3 cans. Testing was done by selecting debug, PP to routine and start.



- Challenges

  Most difficult challenge faced was when moving the gripper holding a pointer in dead man's grip, around the can in a specific path/motion without colliding with the cans. It took several tries to overcome this challenge, several times single step operations were performed to move the pointer in the programmed path with reduction and single cycle operation to make it follow and make the program end. This helped in slowly tracking of the program and helped to get used to the programming aspect of the software.

The product/production life cycle

- Where in life cycle and how can it be integrated with the previous and following step in the life cycle

  The product life cycle (PLC) is a standard model of the performance of a product from the time that it is first introduced in the marketplace until the time that it is discontinued. They are: Product concept → Design Engineering → Drafting → Process Planning → Order New Equipment & Tolling or Production Scheduling → Production → Quality Control → Customer & Market. (vask82, 2015)

  Manufacturers can improve their return on investment by adapting the **production processes to the PLC**. They are introductory Stage, Growth Stage, Maturity Stage and Decline stage. Therefore, the whole revised would look like: Product concept → Design Engineering → Drafting → Process Planning → Order New Equipment & Tolling or Production Scheduling → Production → Introductory Stage → Quality Control → Customer & Market → Growth Stage → Maturity Stage → Decline stage. (Patrick F.Muir, n.d.)

- The common characteristic that describe the application
  - The process requires access to multiple systems: One of RPA's (Robotic process automation) strengths is its ability to work across systems using the presentation layer. Automation was only possible within a single program. RPA can now jump between desktop windows without any human assistance.
  - The process is prone to human error: Humans make mistakes however, robots do not. Especially with repetitive processes like cutting-and-pasting where attention can, Robotics and Automation works well together.
  - The process can be broken into unambiguous rules: Robots performed instructions exactly how you want, but they must be well-defined rules. If these rules are done correctly, robotics and automation can greatly reduce time and errors.
  - The process, once started, needs limited human intervention: Process can be run solely by Robotics and automation without requiring little human intervention. There are plenty of decision-heavy processes that could really benefit from even Robotics and Automation. (Behrens, 2014)

- Identify important attributes which affect the application, for example format of information sharing
  - Initial Investment Costs - This is typically the biggest attribute which affects Robotic and Automation. Companies will decide whether a company will invest in robotic automation, or wait until a later stage because comprehensive business case must be built when considering the implementation of this technology. The cash flow must be sustainable in the meantime and later when the robots will need maintenance, which will add extra costs to the businesses.
  - Hiring Skilled Staff - Manufacturers have found it harder to source skilled staff members to fill the specialised roles in their factories. The introduction of automation adds another layer to that conundrum as the robots require programming and a knowledge of how to operate them. (Granta, 2017)
  - The cost to replace robots after its life cycle – It will be expensive to buy new robots when the older ones exceeds its life cycles and stops working. New robot pricing would likely be like the robot bought originally, with a minor adjustment for inflation costs. Additional engineering cost could be involved depending on how much change has occurred in the replacement robot design compared to the robot being replaced. (Motion Controls Robotics, n.d.)

Benefits to industry

- Identify the issue this application could improve

  Robotics and Automation have had major impacts on different industries:
  - In Food Industry – Robotics and Automation is helping to achieve **Quality control**. Quality is a big selling point for both food producers and consumers. When processing and packaging are automated, defects can be noticed and isolated more easily. This helps to ensure faulty products do not enter the marketplace and underlying manufacturing faults are corrected. **Improved Safety** - Automation and machine vision can work together to provide a more granular view of every step-in food processing. Leaders can adapt more quickly to changes in safety standards because a change in one process will not introduce unexpected consequences in other areas. End to End **Traceability** - Traceability is a growing concern in many industries. When products are traceable, companies can capture better quality, safety, and profitability at once. By streamlining traceability, food producers can cut down on regulatory compliance costs and continuously improve key processes. **Brand Protection** - Food producers rely upon their brand reputation to maintain a good relationship with the end consumer. A single product recall or disease outbreak can be enough to shutter a business – and it can throw customers' lives into chaos. In the end, automation means brand protection. (Team, 2016)
  - Electronics Manufacturing – **Increased productivity and efficiency** – Human labour comes with an inherent margin or errors, machines are less prone to mistakes. Machines do not get tired or get distracted by emotions or problems. Machine can get more done in less time and more precisely than human labour. Therefore, increasing productivity and efficiency and efficiency. **Improved quality** – With tasks completed faster than human labour, automation will have more time to focus on other details such as the finishing touches which will result in higher quality products. **More opportunities for Customization** – Customers are now edging towards personalised and customised products and its increasing, making it difficult for companies to match the market demand. Manufacturers need to be able to meet these demands without losing money while still sticking to strict quality and safety standards. **New Products** – because of automation, manufacturers are able to create new stream of new products through development and manufacture of an expansive systems. (Mayes, 2016)

- How it will impact on the product/production life cycle

  Implementation of the production process to the product/product life cycle will significantly increases production efficiency in product/production life cycle. The **introductory stage** is characterized by slow sales growth. This will help manufacturer decides which product should be produced more and sales growth is booming against the product which is growing at a slow rate. The **growth stage** is a time of rapidly increasing sales. It is a signal that the product has been accepted in the marketplace. The increased sales volume allows the exploitation of economies of scale and provides the revenues for the purchase of new, more efficient, production equipment. As a result, the costs of production is lower in per product terms. Prices can be dropped which further increases sales by opening new markets from lower-income customers. A relatively **constant sales** volume characterizes the maturity stage. Once all markets for this product have been saturated, sales tend to approach a constant level. Prices, profits, and production costs are stabilized also. This will let manufacturers know that the current product has reached **Maturity Stage** and it might be a time for a new product production or changes to the production of the current product to reach the growth stage again. When the sales volume begins to continually reduce, the product has entered the **decline stage**. Regular aesthetic changes can no longer maintain sales levels and it will help manufacturers know that the product can has peaked its product cycle and can be discontinued from the production cycle. (Patrick F.Muir, n.d.)

Reflection and conclusion

- Reflection on how the application can impact on industry 4.0 and the digital engineering environment

  The industrial revolution we're experiencing now, Industry 4.0, is powered by advancements that include smart manufacturing, robotics, artificial intelligence and the Internet of Things (IoT). In addition to prompting manufacturers to invest $267 billion in the IoT by 2020, Industry 4.0 is revolutionizing manufacturing along by the help of Robotics and Automation.
  - **Advanced Manufacturing -** Automation is a vital aspect of the industry's future. Approximately 50% of Flex's manufacturing processes are already fully automated. Automation enables a level of accuracy and productivity beyond human ability—even in environments that would be considered unsafe for humans. The new generation of robotics is not only much easier to program, but easier to use, with capabilities like voice and image recognition to re-create complex human tasks. Another advantage of robots is that they do precisely what you ask them to do - nothing more, nothing less. And while automation eliminates some of the most tedious manufacturing jobs, it is also creating new jobs for a re-trained workforce.
  - **Building intelligent factories** – with the help of robotics factories environments are also driving advancements in cloud computing and smart sensors. Smart sensors can perform tasks such as converting data into different units of measurement, communicating with other machines, recording statistics and feedback and shutting off devices if a safety or performance issue arises. IoT functionality can track and analyse production quotas, consolidate control rooms and create models of predictive maintenance. (Barbier, 2017)

  In conclusion, Robotics and Automation is making big impacts for manufacturers in industry 4.0, it is helping manufacturers achieve shorter lead times, on demand-production, mass customization and opening new opportunities for manufactures to compete on a global stage. This is an opportunity for every manufacturer in industry 4.0 to invest in Robotics and Automation and they would reap significant rewards from investing time and money to rapidly transform themselves in the industry 4.0.

- Implementation requirement hardware

  Determine the technical skill required to support the robot: The technical expertise of staff force should be taken into consideration when purchasing an automated robotic system.

  Implement the most efficient technology: Sales staff, engineers and technicians should have experience developing effective automation plans. They should be well-versed in automated robot models, controllers and software. They should be able to walk through the entire process to ensure the best return on the investment. (RobotWorx, n.d.)

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