Welcome

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Career Episode 1

Introduction

CE1.1 Project Title: Applications of Flettner Rotors

Duration: month 20xx to month 20xx

Organization: ABC university

Position Title: Student (Mechanical Engineer)

The first career episode of my CDR is developed on my major project that I accomplished successfully when I was enrolled in an engineering course. I was a student of Bachelors of Mechanical Engineering in a reputed university of the nation, Manav Bharti University. The curriculum of this prestigious university is designed in such a way that itenhances technical expertise of the students by making live projects. In this project, I worked with two of teammates as fellow design engineers of the project. The location of all these project activities were

- CAD LAB (for solid works model)
- Field (for ground testing if any)
- Aerodynamics lab (for wind turbine test if available and required)

Background

CE1.2 The project consisted of effectual utilization of the renewable energy available at the disposal. Wind Energy is one of the most widely recognized and utilized form of renewable energy. The average wind speed is anywhere between 20-40 knots across major shipping routes and the carbon footprint of shipping industry being 4% of the total world population. So, keeping these factors in mind, I and my project team decided to conduct more exhaustive research to make the shipping industry more ecofriendly.

CE1.3 The proposed research was an extension to an already existing technology which harnesses the wind energy using Flettner Rotors. They are coupled with traditional propulsion system to not only make the shipping process more fuel efficient but also increase the overall efficiency of the ship. The above project included comprehensive technical investigation of the data and information linked with the designing of this proposed system. I decided to make this proposed project as simple to read as it can be and to make the topic more interesting to the fellow readers and colleagues.

CE1.4 Nature of my work in this technical work began with the phase of data research and data collection. It was imperative to understand the Magnus effect before getting into the

physical design details. I went to the college library to obtain some reference books based on similar technical concepts. I was also responsible to timeline the whole project tasks in a way to finish the project within deadline. Hence, I made use of project management tool and drew a PERT chart showing separate milestones.

CE1.5 This was a team project and I was appointed as a project team leader. I followed a vertical communication strategy by sharing work updates with my project guide and horizontal communication strategy by sharing ideas and work strategy with my project team. This chart is shown below:

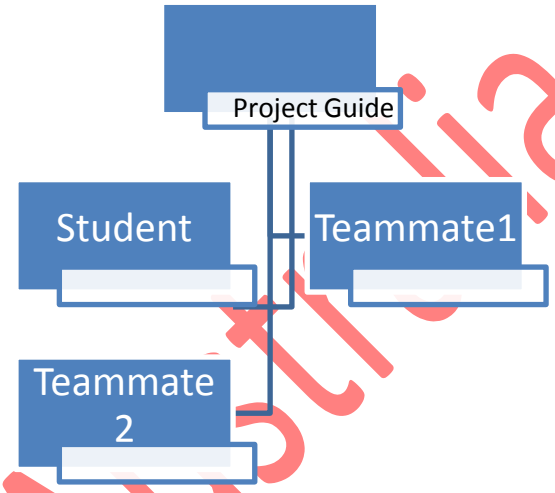


Figure 1: Project Positions

CE1.6 List of all the technical duties besides some project management responsibilities I had in this project is given below:

- Accumulated technical research details before finalizing the project idea into a prototype.
- Explored key terms and all prerequisite standards from the literature survey of all existing wind assisted propulsion systems.
- Investigated the factors affecting the thrust being produced and included their details in the present research work.
- Efficiently designed the Testing rig and also proposed a more efficient design of Flettner Rotors.
- Documented required technical project for the proposed system in MS-Word by noting all the technical activities.

Personal Engineering Activity

CE1.7 For this whole project, I worked on the project scope of the research process with a brief introduction of Magnus effect. In the first section of project development, I carried out a literature survey, from the reference books, journal articles, and online websites, based on Magnus effect. I got introduced with the principle of this core effect as it is just an extension to the Bernoulli's theorem. According to this, the pressure decreases where the velocity is fast or maximum and pressure increases where velocity of air is slow or minimum. This difference in pressure values results in exertion of force from high pressure area to low pressure area. This force can be used to propel the ship in the direction of low pressure zone as its moving direction, keeping in mind that the directions are same for both. I examined the principle in effect of Magnus from the textbook as below:

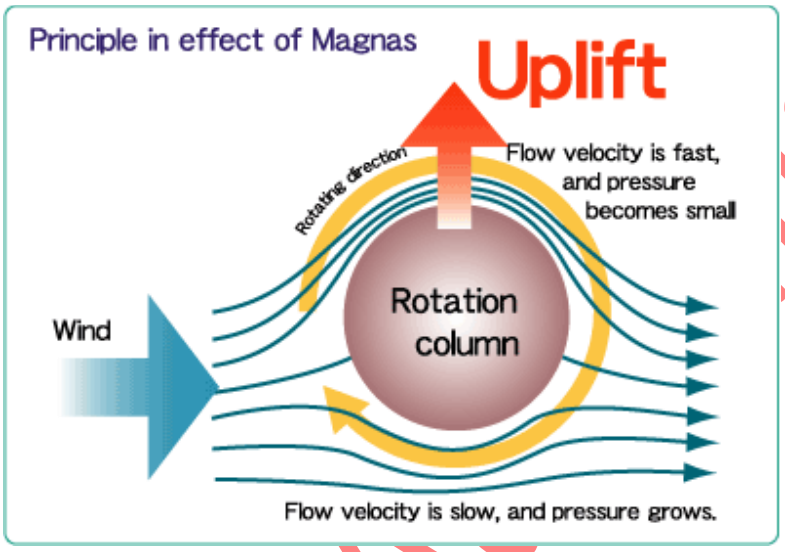


Figure 2: Principle in effect of Magnus

CE1.8 In the second section, I studied about wind assisted propulsion systems and found the technical details of different modes of its operations. Next, I conceptualized Flettner rotors as they are spinning cylinders, which produce fluid dynamic lift using the Magnus Effect. The Magnus force can be many times greater in magnitude than the wing lifting force, given the same projected area and dynamic air pressure. I examined the geometry of flettner rotors with the help of diagram shared below:

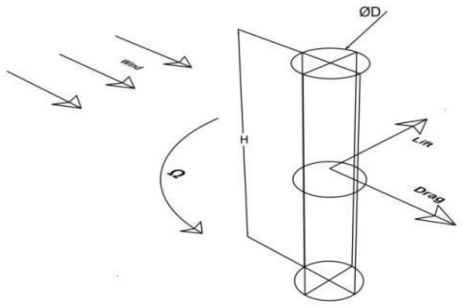


Figure 3: Geometry of Flettner Rotors

CE1.9 I engaged some important research papers as landmarks to base the research work on. The papers I consulted were:

- ❖ Simulations of Three-Dimensional Vertical-Axis Turbines for Communications Applications. By: B. D. Plourde, J. P. Abraham, G. S. Mowry and W.J. Minkowycz.
- ❖ Preliminary Analysis for Marine Application of Flettner Rotors by: A. De Marco*, S. Mancini*, C. Pensa*.
- ❖ A review of the Magnus effect in aeronautics by Jost Seifert.

I observed that these papers had the most influential points to the project. I gathered all the key terms related to the topic and also acquired the standard operating parameters to base the research upon. I carefully studied each and every aspect of the papers and used the commonalities in the three to set a guide-way for the research work.

CE1.10I understood the effect of the Magnus Effect on Flettner rotors of conventional cylindrical designs. I listed the key terms to the research project as:

- Reynolds's number
- End plates
- Aspect ratio
- Heel angle
- Strouhal Number
- Yawing

I utilized the concepts of advanced fluid dynamics in order to complete the design of proposed eco-friendly way of shipping.

CE1.11 I found that the thrust produced by the vertically erect rotating cylinders was important. Thus, I studied the factors affecting the thrust being produced by their careful analyses. I was guided in this process by my project guide and enlisted them as:

- Tip Geometry.

- Reynold's Number.
- Aspect Ratio.
- Wind Speed.
- Rotational Speed of the rotor.
- Strouhal number.
- Surface roughness.

CE1.12I made use of my mathematical learning and engineering skills to analyze each of these factors. I knew that each factor directly affected the value of thrust being produced. I found some key comparison terms and prerequisite standards in this phase. Thereafter, I followed below project methodology to get the final aims:

- Formulating a schematic diagram.
- Fabrication of a testing rig.
- Finalizing the standard test results to base our research upon.
- Performing tests on the testing rig:-
    - Fluid Flow test.
    - Balancing Test.
    - Thrust Calculation test.
    - CFD analysis.

CE1.13 At the same time, I made a list of parameters required for the comparison:

- Lift.
- Drag.
- Effect on center of gravity of gravity of ship.
- Material required.
- Weight of rotor.
- Yawing effect.
- Pressure leakage.
- Vortex formation

CE1.14 I and my project team fabricated three pairs of wooden cylinders of different shapes- Concave, Convex and Regular. I developed the prototype at 1/60th of model and studied the different shapes with the help of model analysis to control airflow around the rotors and to measure the best out of three. Now I engaged my software skills to carry out the CFD analysis using the ANSYS 15 software. I replicated the existing results from the referenced research papers to set a base for further CFD analysis of the proposed shapes. I kept in mind the specified initial conditions with a Hawk Eye view of the cylinder to get the final results. I examined all the contours obtained in the process very carefully.

CE1.15 I found that this 2D simulation of the data with the pre-requisites of the base paper agreed with theoretical calculations. I deduced that the Co-efficient of Lift(CL) increases with the increase in diameter and the End Plates played a major role in seizing the pressure leakage. Thereafter, I and my project team, decided to design a working model of the project. I had a brainstorming session of discussions with the project team on the designing specifications of the proposed working model of the system.

CE1.16 The working model was based on E ship 1 and the prototype was made with wooden deck and thermocol hull. I kept the hull light weight, but the prototype exhibited a lot of vibrations due to transient vibrations. I made the final prototype of plywood under the guidance of project supervisor.

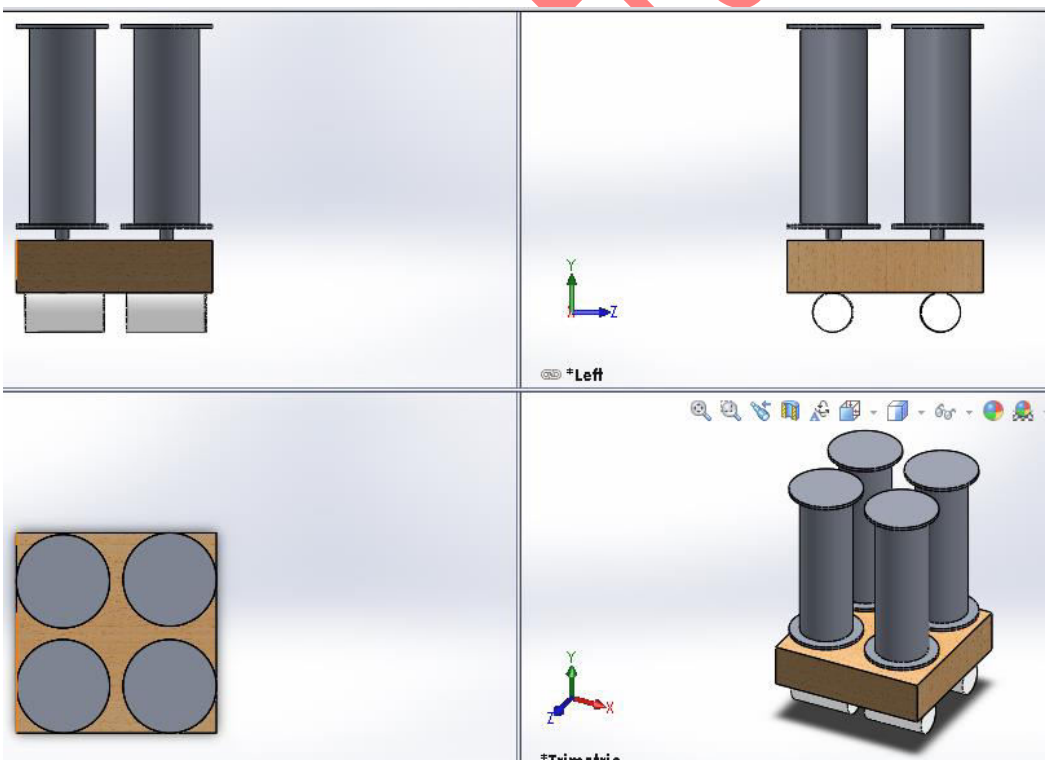


Figure 4: Experimental setup under construction

CE1.17 With the output of this 3D analysis, I found major gaps in the current research linked with the project. I found that there has been no analysis on the effect of magnus effect on the variable diameter type Flettner rotors. I also noticed that no concrete research has been done on the alignment or the positioning of the flettner rotors. I shared all these work details with my project supervisor for his approval. I had three different presentations in the duration of 6 months for regular assessment of the projects.I gave a seminar as well on the project in front of the Head of the Department and he was very much satisfied with the work efforts of my project team.

CE1.18 Problem Statement

In the development phase of the project, I faced some challenge while eliminating tapered shape and eliminating convexing cylinder. The conical shape has a minimum diameter of 1cm while the maximum diameter was proposed to be 5cm. Thus, the average aspect ratio turned out to 3. But according to the theory of vortex shedding, the vortex shedding would take place at an earlier stage if the diameter of the rotor is found to be too high.

As the fluid is dragged around the surface of the rotor of the rotor it loses Kinetic energy, now if the radius is too large the fluid will lose too much energy before it can reach the back of the cylinder to provide a proper pressure difference. Secondly, I found that the convexing cylinder's geometry was aiding the pressure leakage. This would have led to Irregular pressure shedding and also an undesirable output.

In order to resolve these issues, I conducted CFD analysis and computed the dimensions of different parameters of the structural layout.

Summary

CE1.19 I met the final aims of the project successfully with the application of my engineering competency, my mathematical skills, and my analytical abilities. This project had a complex construct but also helped me learn more about designing, rendering and modeling of an idea. I improved my team work abilities as well with several rounds of healthy discussions on project related issues. There were times of few conflicts; however I was able to resolve all of them successfully by effectual sharing of ideas.

Career Episode 2

Introduction

CE2.1 Project Title: Solar toy car

Duration: month 20xx to month 20xx

Organization: ABC University

Position Title: Student (Mechanical Engineer)

The second career episode of my CDR is written on my in-house project taken from my graduation. I submitted the project report as a part of curriculum of Bachelors of Mechanical Engineering to the University. I effectively applied my technical skillset of engineering while designing this solar car with my two other teammates as the fellow design engineers. The location of all these project activities was the mechanical lab of the university.

Background

CE2.2 This second project was again based on the effective use of the renewable energy at the disposal. However, this time I decided to design a project based on the opportunities of solar energy. The required amount of solar energy would be retrieved from the solar panels present on the surface of the car. In addition to this, there would be infrared transmitter and receiver on the surface for its smooth operations. I understand the importance of environment-friendly duties of an engineer, and hence I, and my project team, decided to conduct more exhaustive research to design this ecofriendly product this time.

CE2.3 The proposed solar car would be helpful in meeting the current energy crisis around the world by using a renewable source of energy. Moreover, solar energy is considered as the best source of renewable energy. The intended solar car would be designed by keeping in mind all technical aspects of combining solar power into electrical energy and then to the power source of a car. I decided to make this proposed project as simple to read as it can be and to make the topic more interesting to the fellow readers and colleagues.

CE2.4 I always follow a standard work methodology to complete a design task like this. Therefore, I commenced with the very first phase of data research and data collection linked with the structure and components of a car. I found some reference books in the college library based on designing of solar car and for some other important technical information I took some guidance from the internet sites. I made use of project management tool and drew a PERT chart showing separate milestones.

CE2.5 This was a team project and I was appointed as a project team leader. I followed a vertical communication strategy by sharing work updates with my project guide and horizontal communication strategy by sharing ideas and work strategy with my project team. This chart is shown below:

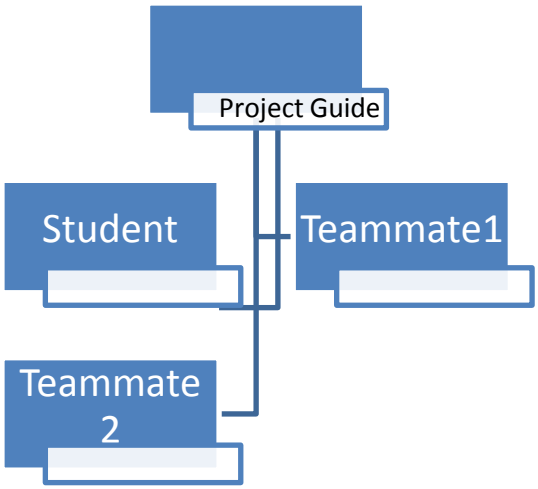


Figure 1: Project Positions

CE2.6 List of all the technical duties besides some project management responsibilities I had in this project is given below:

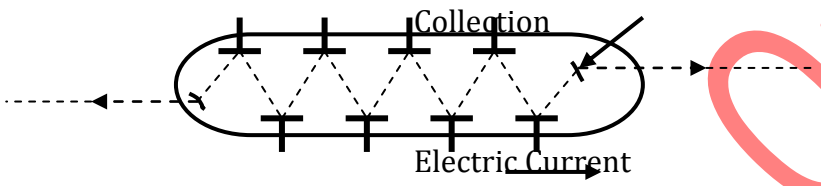
- Accumulated technical research details before finalizing the project idea into a prototype.
- Explored key terms and selected main components of solar car from the literature survey of prior journals and research papers on similar concepts.
- Interfaced selected components according to the block diagram to transform solar energy into electrical energy.
- Tested prototype of solar car in the lab environment setting to evaluate its parametric output and efficiency.
- Documented required technical project for the proposed system in MS-Word by noting all the technical activities.

Personal Engineering Activity

CE2.7 For this whole project, I worked on the project scope of the research process with a brief introduction of solar cell. In proposition of this, I tried to understand the principle of working of a solar cell. I got issues a number of reference books, journal articles, and online websites to collect relevant technical details about the solar cells. I found that this device can convert solar energy into required amount of electricity directly. These devices are made with the help of semiconductors like gallium and silicon. Hence, in the subsequent section, I decided to study about the semiconductors.

CE2.8 I found that semiconductors are the basic elements of solar cells and using these devices has increased the total efficiency of solar cell. In order to get the final aims, I

explored the principle of conversion of solar energy into electrical energy. I got to know that solar energy is transformed into electromagnetic radiations of different wavelength. These radiations are made up of visible light as well as invisible infrared light. Now, these radiations are transformed into electrical energy and it is further converted into mechanical energy. I read from the book that the conductivity of solar cells increases if certain kind of impurities like Arsenic and Boron are added to them. I explained this concept in the project report by making below diagram:



Solar Radiations

Flow of Electrons

Figure 2: Flow of solar radiation

CE2.9 I engaged some important research papers as landmarks to base the research work on. I observed that these papers had the most influential points to the project. I gathered all the key terms related to the topic and also acquired the standard operating parameters to base the research upon. I carefully studied each and every aspect of the papers and used the commonalities in the three to set a guide-way for the research work. I made a final list of selected components of the model as:

- Transistors
  - PNP BC548
  - NPN BC558
- Diodes
  - 1N4001 RECTIFIER DIODE
  - IN4148 SWITCHING DIODE
- LEDs
  - LED
  - Infrared LED
- Capacitors
- Resistors
- IC CD 4047

- RF Module (Transmitter and Receiver)
- HT 12E Encoder IC
- Infrared Detector
- Printed Circuit Board
- L293D

CE2.10 I designed the circuit diagrams of the sub-parts of the project including:

- Circuit diagram of RF Remote Control Transmitter Encoder
- Circuit diagram of RF Receiver Decoder Circuit for control of motor drives
- H-bridge motor drive circuit for two motors using IC L293D

By following the details in these circuit diagrams, I designed the working prototype of solar toy car using readymade sheet metal parts, geared motors, wheels, brass collars, axles, and brackets. In this mechanical assembly of the toy car, I made sure that all the components were according to the required dimensions.

CE2.11I placed a battery and mounted it on the PCB and then plugged the connectors from the battery, motors, and varied LEDs into the corresponding connectors on the PCB. I established all the connections as per the circuit diagram. I used a thermocole sheet on the flanged sheet to make sure that the battery sat over it by maintaining proper balance. I mounted the receiver PCB through its four corner holes and the screws secured the battery and the PCB in position. Thereafter, I inserted the connectors from the battery, LEDs and motors into their corresponding connectors on the receiver PCB. In this way, I completed the mechanical assembly of rover.

CE2.12 After completing both the sections, I combined both the design layouts to get the final prototype correctly. Thereafter, I and my project team, decided to design a working model of the project. I had a brainstorming session of discussions with the project team on the designing specifications of the proposed working model of the system. I shared all these work details with my project supervisor for his approval. I gave a seminar as well on the project in front of the Head of the Department and he was very much satisfied with the work efforts of my project team. I made project report in MS-Word to be shared with the project supervisor.

CE2.13 Problem Statement

In the development phase of the project, the problem I faced was of designing a voltage controller design. There were two batteries in the working model; where one battery gave supply to the motor and the second additional battery was to be charged by the solar panel as an additional source of power. I decided to use this voltage regulator for the main reason that it would be helpful in the selection of the two batteries. I shared this idea of mine with

my project supervisor and my teammates and they were delighted with this innovative approach.

Then, I and my project team explored some similar concepts from the internet and finally decided to complete this task with the help of a microcontroller. I devised the technical concept of battery selection using the microcontroller. In the end, I found that this additional device in the working model was helpful in increasing the battery life of the toy car.

Summary

CE2.14 This was my second successful project submission in a row where I demonstrated my mechanical engineering design abilities. I was able to meet the expected outcome of this in-house project perfectly and my working model was also presented in the college exhibition. I improved my team work abilities as well with several rounds of healthy discussions on project related issues. There were times of few conflicts; however I was able to resolve all of them successfully by effectual sharing of ideas. I got a chance to explore additional renewable source of energy in its practical way. I enhanced my problem resolving aptitude by applying my technical innovative approach.

Career Episode 3

Introduction

CE3.1 Project Title: Warp Knitting Modeling

Duration: Month 20xx to month 20xx

Organization: ABC

Position Title: Intern (Mechanical Engineer)

In the third career episode, I am sharing the details of my internship with ABC company. I submitted the project report as a part of curriculum of Bachelors of Mechanical Engineering to the University. I effectively applied my technical skillset of engineering in this project and coordinated with employees of the company. The location of all these project activities was work unit of the company only.

Background

CE3.2 ABC is a modern and advanced company of manufacturing and export of wide range of knitted fabrics. It caters the Shoe and Automobile(Seat Cover) industry and manufactures fabric which is made of polyester.The production at the unit beganin 2007 and since that time the company has been expanding its business operations over all parts

of India. With its premium quality of products, the company has been delivering high quality products in order to withstand existing high levels of competitiveness of the industry.

CE3.3 The proposed research was based on the technical study of machines of the company. I worked at the unit to analyze and learn the working methodology of the various machines installed at the company. During my time at the plant, I focused on understanding the technical aspects of the complete process the yarn undergoes to be turned into the fabric of desired design. The research was based on the operations and components involved and detailed analysis of the function of each. In addition, I closely studied working conditions with the way each parameter affects the proper functioning of the machines.

CE3.4 Nature of my work in this technical institutionbegan with getting deep understanding of the work operations of this machine. I went to the college library to obtain some reference books based on similar technical concepts. I was also responsible to timeline the whole project tasks in a way to finish the project within deadline. Hence, I made use of project management tool and drew a PERT chart showing separate milestones. It was my proficiency in English that was helpful in making a technical project form me by covering all technical points.

CE3.5 It was my individual work and I followed a vertical communication strategy by sharing work updates with my project guide. This chart is shown below:

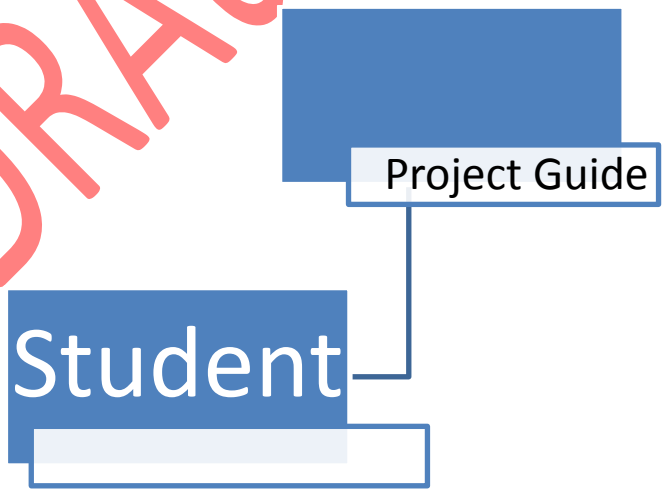


Figure 1: Project Positions

CE3.6 List of all the technical duties besides some project management responsibilities I had in this project is given below:

- ❖ Accumulated technical research details before finalizing the project idea into a research paper on the machines of the unit.
- ❖ Explored key terms and selected main components of warp knitting machine from the literature survey of prior journals and research papers on similar concepts.
- ❖ Investigated the steps followed to complete the work and included their details in the present research work.
- ❖ Documented required technical project for the proposed system in MS-Word by noting all the technical activities.
- ❖ Streamlined the activities to meet the final delivery date of the internship report.

Personal Engineering Activity

CE3.7 The scope of the project was to explore the details of the work operations in the process of Warp knitting. For this, I took guidance from the reference books, journal articles, and online websites. I also discussed some points with the workmen of the company as they had enormous experience on the machine and thus know all the positive and negative points related with the machine. I found that the machine was very important for the knitting operations of the company and the company was very much apprehensive about its regular maintenance.

CE3.8 I made a list of major components of the machine before going deep into their details:

- Compound needle
- Needle bar
- Guide bar
- Sinker bar
- Sliding latch bar
- Needle
- Guide
- Sinker
- Sliding latch
- Comb

- Cloth roller
- Link
- Rocker shaft
- Pattern drum
- Pattern chain
- Main shaft
- Intermediate shaft
- Let-off mechanism
- Take-up mechanism
- Machine AC
- Timing belt
- Warp beam
- Bottom beam

CE3.9 I engaged some important research papers as landmarks to base the research work on. I observed that these papers had the most influential points to the project. I gathered all the key terms related to thecomponents of the machine and also acquired the standard operating parameters to base the research upon. I carefully studied each and every aspect of the component as they were used in the machine and used the commonalities in the three to set a guide-way for the research work.

CE3.10 I noticed that the metal hooked needle was the basic principle knitting element of the warp knitting machine. Before the yarn feeding, the needle was pulled upwards to clear the old loop from the hook and to employ the next loop above it on the needle stem. The sinker was a slim plate present in the machine that was made up of metal with an individual or else a collective action working just about at right angles from the hook side of the needle bed. Most often it was in between adjacent needles. Guide was a metal element made up of metal having holed at the end.Through these holes the individual thread was passed which distinguished each thread.The combined action of the needle and the guide was responsible for each knit

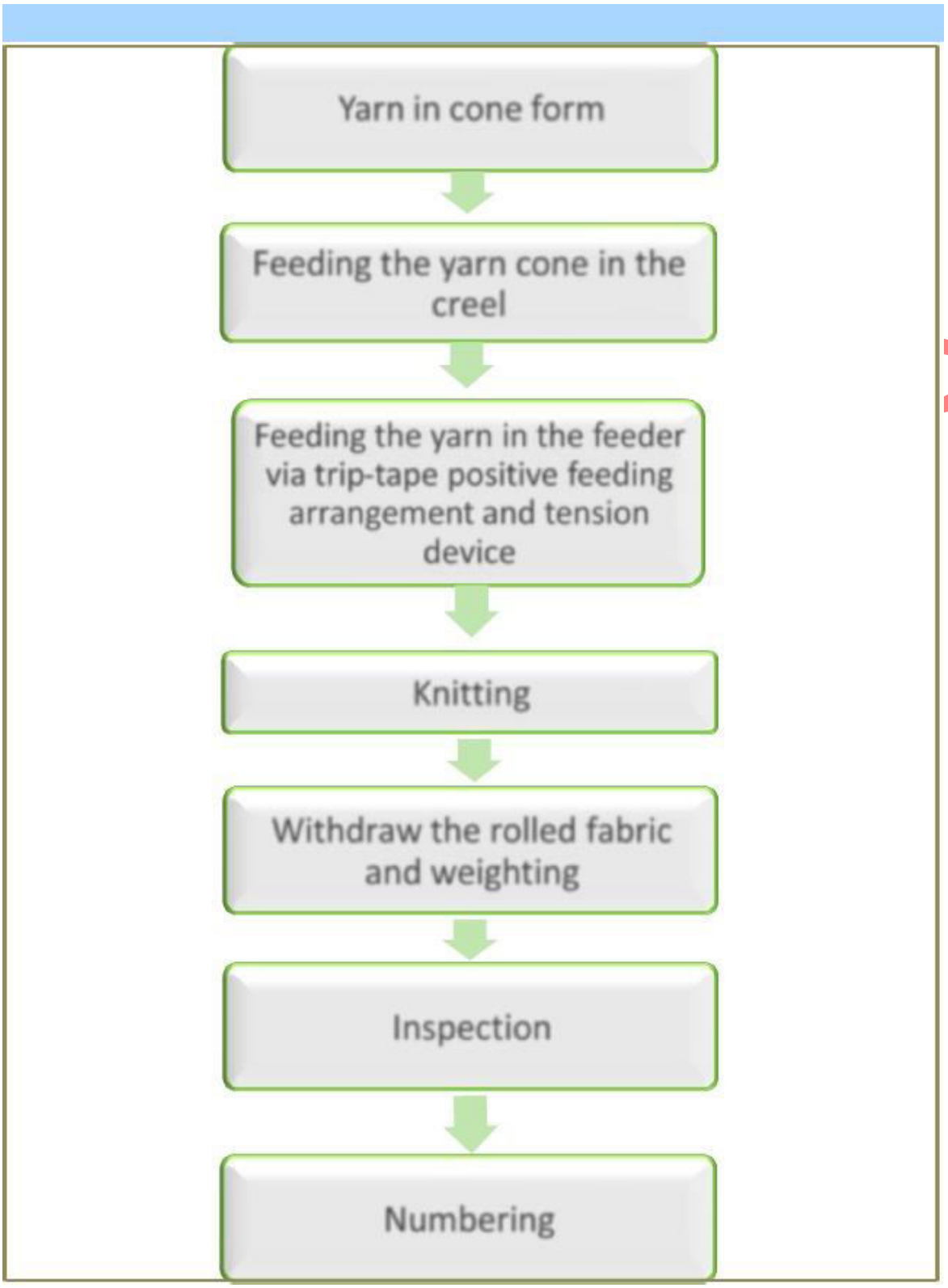
CE3.11 I found that the three bars, sinker bar, needle bar, and guide bar were placed in between the components to complete the knitting operation. There were design wheels to

carry out knitting according to a particular design. Motors were employed to achieve the necessary amount of rotary motion. The rotations of beam shaft to the rotations of the roller shaft were linked. To achieve the timing and the sync gears and belts were required.Using these mechanical applications the timings and sync was achieved in the machine.

CE3.12 As soon as I understood the details of every component of the machine, I studied the working condition. I found that the required conditions for the machines were a room temperature of 20 degrees and a dust free environment. However, nowadays air conditioners were employed for controlling the temperature. This was necessary because of the high speed of the machine and the heat generation. Heat generation in the machines may lead to breakage of needles. And the needles were expensive and also changing needles wasted time and labor. And during winters heaters were used to maintain the temperature.

CE3.13I made a process flowchart of the machine to demonstrate all activities included in the operation. I made this process flowchart in MS-Word and noted down all the steps correctly.

Figure 2: Process flowchart



I shared all these work details with my project supervisor for his approval.I gave a seminar as well on the project in front of the Head of the Department and he was very much satisfied with the work efforts of my project team.

CE3.14 I evaluated different parameters in knitting section as:

- Machine diameter
- Machine rpm
- Number of feed or feeder in use
- Machine gauge
- Count of yarn

I determined the relationship between knitting parameter:

- Stitch length increase with decrease of GSM
- If stitch length increase then fabric width increase
- If machine gauge then fabric decreases
- If yarn count increase then fabric width increases
- For finer gauge, finer count than should use

CE3.15 Problem Statement

As a part of my internship, I was told to perform product quality check on the machine. It was entirely a new activity and therefore I found it somewhat challenging. However, with the constant support and guidelines of my project supervisor, I was able to perform all the steps as below:

- Checkedthe value of yarn input tension to be 4-5 gm/tex
- Checkedthe length of the stitch in 5 different feeder to assure they were same as per the required
- Examinedgrey GSM
- Checked wales/3 cm or course/3 cm if required
- Checked for any knitting faults in the fabric
- Checked R.P.M

When I had performed all these steps, I found that the results were satisfactorily and up to the set industrial limits.

Summary

CE3.16 Industrial training is an important and essential part of education as through this training I learnt all the implementations of the processes studied theoretically. It gave me an opportunity to compare the theoretical knowledge with practical facts and thus developed my knowledge and skills. This industrial training also gave me an opportunity to enlarge my knowledge of administration, procurement activities, production planning, and machineries and taught me to adjust with the industrial life.I realized that this industrial training enhanced my practical knowledge and made me confident.

Summary Statement

Competency Element	A brief summary of how you have applied the element	Paragraph in the career episode(s) where the element is addressed
PE1 KNOWLEDGE AND SKILL BASE		
PE1.1 Comprehensive, theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	My mechanical engineering concepts and my other skills attributed to the successful outcomes of the results in all the three career episodes as clearly illustrated in the files.	CE1.4, CE1.6-CE1.7, CE1.8, CE2.4, CE2.6-CE2.7, CE2.8, CE3.4, CE3.6-CE3.7, CE3.8
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics and computer and information sciences which underpin the engineering discipline	In all the projects, I made effective use of my knowledge, mathematical expertise, and planning and execution abilities to complete the specific sub-activities of the projects professionally.	CE1.7, CE1.10, CE2.7, CE2.10, CE3.7, CE3.10
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	As required, I kept written records of all the tasks and showed design calculations and tests performed in the files for assessment and reference.	CE1.6, CE1.7, CE1.8, CE2.6, CE2.7, CE2.8, CE3.6, CE3.7, CE3.8
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	Always assured for the project quality, I kept in mind all the applicable work standards honestly	CE1.7, CE1.10, CE2.7, CE2.10, CE3.7, CE3.10

	without affecting too much to the total project budget.	
PE1.5 Knowledge of contextual factors impacting the engineering discipline	Specifications and documentation of the work activities were shared with the teammates and subordinates lawfully and this demonstrated my successful handling of the projects	CE1.9, CE2.12, CE2.13, CE3.9, CE3.12
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline	I observed and followed compliance to relevantrulesandregulationspertainingtotheprojects, which indicates my understanding of norms and accountabilities.	CE1.6, CE1.7, CE1.8, CE2.6, CE2.7, CE2.8, CE3.6, CE3.7, CE3.8
PE2.1 Application of established engineering methods to complex engineering problem solving	At all times, I evolved creative and feasible technical solutions to the problems by using my problem solving skills and engineering know-how.	CE1.9, CE2.8- CE2.10, CE3.7,CE3.9-CE3.10
PE2.2 Fluent application of engineering techniques, tools and resources	Performed different calculations and testing as well as evaluations in the projects whenever required prior to their final implementation.	CE1.4, CE1.6-CE1.7, CE1.8, CE2.4, CE2.6-CE2.7, CE2.8, CE3.4, CE3.6-CE3.7, CE3.8
PE2.3 Application of systematic engineering synthesis and design processes	Followed scheduled project plan to meet the project milestones was my first priority. I also discussed project details with all the team personnel.	CE1.4, CE1.6-CE1.7, CE1.8, CE2.4, CE2.6-CE2.7, CE2.8, CE3.4, CE3.6-CE3.7, CE3.8
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	Throughout these projects' experiences, I demonstrated management techniques through the experimental process and applied them effectively to achieve a result.	CE1.6, CE1.7, CE1.8, CE2.6, CE2.7, CE2.8, CE3.6, CE3.7, CE3.8
PE3.1 Ethical conduct and professional accountability	I am fluent in current word-processing programs to produce professional reports. I choose to organise paper-based documents alphabetically and name electronic resources through a brief of the content, demonstrating my organisational skills.	CE1.2-CE1.4, CE1.7, CE2.4-CE2.6. CE2.7-CE2.12, CE3.1-3.2, CE3.9-3.15

E3.2 Effective oral and written communication in professional and lay domains	Regular participation in project meetings to discuss project chores with seniors and fellow project members was always practiced by me.	CE1.4- CE1.10, CE1.14, CE2.4-CE2.10, CE2.14, CE3.4- CE3.10, CE3.14
PE3.3 Creative innovative and proactive demeanour	Realized the limitations of my knowledge when faced with a problem, I controlled my personal learning development and consciously strive to improve my work, benchmarking it against other work and standards.	CE1.13, CE1.14, CE2.13, CE2.14, CE3.13, CE3.15
PE3.4 Professional use and management of information	Gathered substantial engineering knowledge and leadership expertise in my projects and grew in professional confidence.	CE1.4, CE1.6, CE1.7, CE1.8- CE1.10, CE2.4, CE2.6, CE2.7, CE2.8-CE2.10, CE3.4, CE3.6, CE3.7, CE3.8- CE3.10
PE3.5 Orderly management of self, and professional conduct	I manage my time effectively and use schedule of work to manage the timely execution of projects.	CE1.7- CE1.9, CE1.14, CE2.7-CE2.9, CE2.14, CE3.6
PE3.6 Effective team membership and team leadership	Teamwork was my major concern in all the projects without disturbing the rights and decisions of my teammates.	CE1.12, CE2.12, CE3.6, CE3.16