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Career Episode 1

Introduction

CE 1.1

<mark>Aforementioned career episode is the detailed narrative of my graduation project Intelligent Driving System. The project was started in Month/ year and completed in Month/ Year. During the time, I was the student of Electronic and Electrical Engineering in the University.</mark>

Background

CE 1.2

This project was my 6th semester project and was aimed to develop such a system that helped in domestic routine of the humans. The objectives of the project were to make the following modules work with the robot: Object manipulation, Simultaneous Localization and Mapping

(SLAM), Robot Navigation, Facial Recognition, Object recognition and speech recognition. The project aimed to carry out a detailed study on the different Intelligent Driving System models and performing literature review.
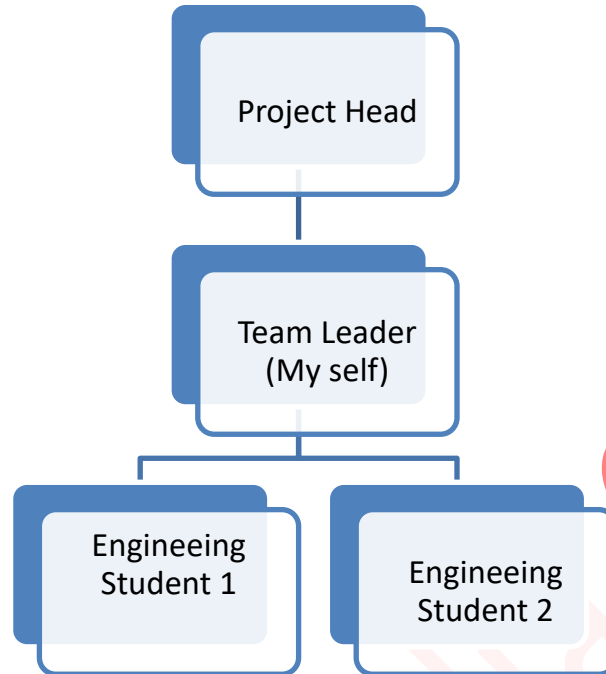
CE 1.3

During the project, I have undertaken the following responsibilities;

- Conducted research and understand the scope of the project
- Worked on SLAM and robot navigation system
- Maintained the robot base and developed understanding with the ROS which was the software that I used to use to develop all the modules
- Coordinated with my teammates and also taught them about using this software
- Helped the team with any technical issues they face in their modules
- Developed an overall structure of the robot system to help integrate all the modules easily
- Compiled a final report by gathering all the related data

CE 1.4

Project Hierarchy

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            ┌─────────────────┐
            │   Project Head  │
            └─────────────────┘
                     │
            ┌─────────────────┐
            │   Team Leader   │
            │    (My self)    │
            └─────────────────┘
              │            │
     ┌──────────────┐  ┌──────────────┐
     │  Engineeing  │  │  Engineeing  │
     │  Student 1   │  │  Student 2   │
     └──────────────┘  └──────────────┘
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Personal Engineering Activity

CE 1.5

Before, I initiated with the technical tasks of the project, my first milestone to achieve was to carry out a detailed study on the system. Based on it I developed my understanding. I prepared a project charter in which I distributed the project tasks and I myself lead the project activities. I firstly prepared a 2D design of the robot with the help of the AutoCAD Software. I developed the complete design and hold a meeting for discussing it with the project head and my teammates. I then decided for the type of material required and calculated the rigidity and strength of the system structure.I developed different modules for the system.

CE 1.6

Next, for the design, I decided the overall flow of the robot and its code since it had to include all the modules. The design that I made was that the robot would first make the map of the room in which it had to perform. I used the software SLAM and robot Navigation modules to make this map. Then I coordinated with my teammates in programming the robot. The robot was allowed to wait for a user to give it some commands to work. The robot recognized the speech and would consider which other modules were needed for it to perform the task. I developed a flow chart that showed the robot movement by incorporating the differential principle. For example if a person were to ask the robot to pick a can and bring it to him the robot would first handle the speech and recognize the task and then ask the object recognition module to check for a can when a can is found the information will be processed by the object manipulation module which would attempt to pick up the object with the robot arm.Here for the object manipulation module,

I used the Inverse kinematics to determine the angle at which the robot arm was moved to grab an object.Then the robot navigation module would use the map of the room generated by SLAM to go back to the user and the manipulation module would give the instructions to handover the can to the user.

CE 1.7

My second design task was to decide on an algorithm for SLAM with the help of the resources available. SLAM stands for Simultaneous Localization and Mapping and it is a very interesting and complex problem in the field of robotics. There was still no perfect solution for it but there were a few methods available, which I studied through the research papers available online and each would require different hardware. So I had to find an algorithm that would be ideal for our situation. The one that I found and used is called RGBD SLAM. In this, I used a RGBD camera which was available in the form of Xbox Kinect. This algorithm was ideal for the project because it worked by detecting features of different objects in the room and since our project was specifically based in an inside home environment so the algorithm would have many features available for it like chairs table or other furniture in the house.

CE 1.8

While the design of the intelligence system, the first problem that I faced was the structure of the robot which was very unstable and created issues like difficulty in moving the robot. The camera which, I mounted on the top experienced many jerks while the robot was moving so the map that I was trying to make was always bugged.To resolve this issue I decided to make a new stable structure for the robot. To make it more stable and to make it so that it can hold all the things that we needed to put on it. Also the previous structure did not have enough places to support some hardware that we needed to place on the robot. I decided that the new structure would have three circular plates each one held to support a laptop, a camera, and the robot arm. I then supported these circular plates using some aluminum rods. I determined the weight and thickness of the plates and accordingly, I selected the rods. Each plate had five rods attached to it. This structure was better and more stable than the previous one by a large degree.

CE 1.9

The second design problemthat I faced was during integration of modules. All of the modules were made on ROS which was the central software that was being used for the project except for the voice recognition module. I made this voice recognition module using a web app and it transmitted all of its data to an online database which was called firebase. I had to find a way to get that data from firebase and link it to ROS. To solve this problem I devised a strategy. I knew that I could get the data from firebase by using JavaScript so I looked around for a library that could link JavaScript with ROS and I found one. Then all I had to do was to write a script that

would get the data from firebase whenever it was available and immediately send it to ROS. This successfully resolved the issue.

CE 1.10

As this was the University Project and we have fewer budgets so, I tried to manage all the equipment required for this Intelligence System design within the provided budget. While buying a robot arm, I tried to select the cheapest ones that could effectively perform the tasks and could bare the required loads.

CE 1.11

The special techniques, which I used in thisproject, were the RGBD SLAM algorithm and the firebase database that was used to transfer the data from the speech recognition module to the main code base of the robot in real time.

CE 1.12

I used different software in this project that provided me with accurate design and calculations. To handle all the code for the project, I used the Robot Operating System (ROS) and Pro-e was used for the designing and analysis of the structure. I also used MS office for preparing the project report and performing the project calculations.

CE 1.13

I well managed my team. I cooperated with them at all the stages of the project. I distributed the responsibilities to each member, by integrating all the modules together and by helping all other members with any technical difficulties they faced while developing their modules. I regularly took the updates on the provided tasks and arranged the meetings with the supervisors and the team once every week in which the goals for the week and the current progress were discussed. Also, if I faced any issue that was not able to handle alone, I discussed it in the meeting and took suggestions from all the team and put forward it to supervisor for his further reviews. I prepared several reports discussing the objectives, software, hardware and the conclusion of the project. I also gave a final presentation. I also mentioned the engineering codes and standards that I used in this project. Most importantly I followed the IEEE standard. Also I followed the ES standard of Environmental Safety that was my main concern. I specially focused on the safety issues and followed the rules and procedures.

CE 1.14

Throughout the project period, my main aim was to improve my electronic and communication studies. Therefore, I browsed for different research papers and articles. I also read different books and often visited the University Library with my teammates. I attended different seminars and conferences that further I enhanced my knowledge on new developments.

Summary

CE 1.15

The overall progress of the project was very good. I was able to successfully accomplish all the tasks. All the tasks were executed within the time frame. All the issues were resolved by brainstorming and through research. Me and my team got appreciation from the Head of the project. This project was a real time challenge for me as I gained a lot of technical knowledge from this project from many fields related to robotics. I also enhanced my team leading and communication skills.

Career Episode 2

Introduction

CE 2.1

My first career episode is based on my graduation project "Designing a Testing Tools (CAN)". The project was started in Month/ year and completed in Month/ Year. During the time, I was the student of Electronics and Communications at Jawaharlal Nehru Technological University, Hyderabad.

Background

CE 2.2

I completed this project along with my team of two more engineering students. This project was about the design of a CAN bus for the connection and data transmission. A simulator was used to perform the simulation test. The main objective of this project was to design software and hardware, which was controlled by using a microcontroller as an alternative of connecting with PC. Resistive touch screen and a display of 7 inches were used for operating the production line conveniently.

CE 2.3

During the project, I have performed the following tasks;

- Conducted detailed research on the CAN and developed my strong understanding with its features and design
- Coordinated with the team members and carried out literature review and studied the previous research on the design of CAN

- Developed a schematic diagram and PCB layout
- Developed an embedded software for the microcontroller
- Carried out necessary simulations and finally developed a report

CE 2.4

Following is the project Hierarchy
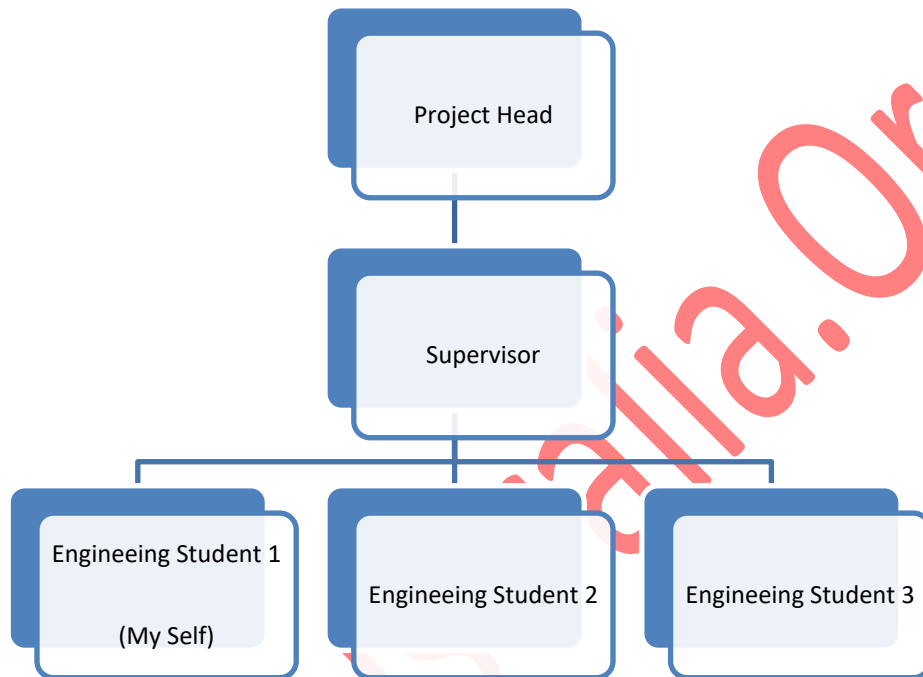
Personal Engineering Activity

CE 2.5

I started the project by performing some research at the beginning. I developed a project plan and detailed the different tasks that needed to be carried out. I then arranged a small meeting with my team and discussed the objective and scope of this project. We then performed the literature review of the project and studied about different CAN Models. I also arranged an initial meeting with the supervisor and discussed with him the complexities of the project.

CE 2.6

I first developed the Hardware. I started by listing down the entire function module and designed a system chart by combining the requirements and production line functions. I then prepared a schematic accordingly as per the requirements of the system chart. After this, I designed the size and layout of the PCB. My design was based on astm32microcontroller and v850 microcontroller. I used stm32 for controlling the GUI Display and the interface of thetouch screen. It was also a node of CAN at the same time. The other part v850 was responsible to send,

receive, and judge the data of CAN; meanwhile, it was another node of CAN. Both nodes formed a minimum CAN Network. I connected the test machine with the network of CAN for developing a communication and testing directly in harmony with the equipment node address which has been appointed already. I used two networks having different speed including with and without fault tolerant CAN network. Also, on each microcontroller, there were two CAN controller lines. Finally, I matched the different CAN transceivers to establish two different CAN controller lines

CE 2.7

After finalizing the design of the hardware, I developed the software using C language. I developed a user interface including the output part (7" TFT displayer) and input part (touch panel);

- Realization the SD function, need SD card to store information,

- Realization the CAN message send and receive function,

- Realization the communication between two MCU via UART

I further hold a discussion with the tam for finalizing the control logic. I designed the TFT and touch panel driver by developing the tasks for two of the hardware resources in real time operating system. Then I designed the SD card driver and make the software to get data from SD card by creating atask for SD card. Next task was the design of the software of UART driver for both MCUs, making them can communicate with each other. Finally, I designed the CAN controlling driver in such a way that it can send and receive amassage by following the UIC (user interface commands).

CE 2.8

This task was real learning for me regarding the CAN message standard from "BOSCH CAN Specification Version2.0", CAN controller works on data link layer so I have to understand the meaning of standard CAN frame. I also learned the uCGUI application programming interface and then designed the user interface by creating labels, buttons, and sliders. I also understand the meaning of function's input and output. I make research onthe internet and by visiting the University Library. I also took help from my senior engineers and teacher whose ultimate guidance enhanced my technical skills and I was able to complete the tasks on time.

CE 2.9

During the project, I faced an issue of interrupt phenomenon in sending the packet appears in the process of sending some CAN signals. In response to this question, the first step that I carried was to confirm that whether the driver itself had a problem. On my further analysis, I found that the there was a matching problem between the operating system and the driver. This further

suspended the task when a data frame has been interrupted by other tasks with high-priority and not sent in time. The minimum unit of data frame should be coherent, otherwise, the data can't be identified and the CRC check can also go wrong, which is the cause of the problem. I discussed this issue with the supervisor and decided to increase the priority, but this will damage the performance of the system. I shared my views of processing the data before sending it. So another solution that I suggested was the optimization of the process of sending the CAN data, split it into multiple steps, and set each step as a distinct task for running the operating system. Only the priority of the task which is sent eventually has been improved and another task, such as data parsing, can be interrupted which is still in the low priority of thetask. So the system performance and the stability of sending CAN data have both been taken into account

CE 2.10

One of the issues that I faced was that the touch screen had some instability phenomenon in the process of using and an offset was faced. This happened because some invalid data has been taken into the algorithm to calculate the position in the process of dealing with actual code when there was too much discrete data. Instead of this, I must use the sample on raw data in multiple groups in the process of calculating the coordinate of thetouch point. I employed the filter operation to discard the interferential and useless part from these data and got the relatively accurate data. Then I used the data to calculate the coordinate point. The improvement measure that I used was to carry out data filtering when getting the original data newly. I then gave this task to my teammate to enlist all of the sampling points according to the size and take the median to get the initial data which is relatively accurate. At last the data was used in the algorithm of calculating the touch point coordinate. The probability of offset has been greatly reduced after the optimization.

CE 2.11

To improve the touch panel sensitivity and accuracy, when sampling the raw data, most of thetime I got 20 samples for each touch. After that, I compared all data and used the middle values, then comparing the middle data with the threshold which generated at the touch panel calibration stage to limit the discrete points. This operation was very important because the resistor touch panel has so many discrete points when it working. This helped in reducing some mis-operation. By using this method I was able to increase the accuracy of the touch panel.

CE 2.12

During the project, I made sure that none of the team members were got effected in any way by any of the project activities. Therefore, I implemented safety and health procedures. I made sure that all the members must use the personal protective equipment. Apart from this, I made sure that no activity imparted pollution in the environment. I followed the engineering standard OSHA of health and safety. I also followed the IEEE and ISO standard while carrying out the

design activities. I cooperated with the team and managed all the activities. We mutually discuss on various issues and I took theopinion of each member. The developed a more friendly relation among all.

CE 2.13

CE 2.14

I managed all the phases of the project. At the end of this project, I showed my effective communication skills by developing a final report. In this report, I narrated all the design part of the project and mentioned the detailed methodology. I also gave the final presentation in the University and receive appreciation from the Supervisor and other teachers.

Summary

CE 2.15

The project was completed on time and I was able to achieve all the project objectives. This project was a real time opportunity for me as it helped me a lot in improving my electronic and communication knowledge. I enhanced my interpersonal skills by communicating well with the team and supervisor by arranging meetings. My performance in this project was dominant as I got a chance to lead this project. Also, it was an opportunity for me to implement my knowledge.

Career Episode 3

Introduction

CE 3.1

This episode was based on my final year project that I carried during the project. The project was about designing a surveillance camera for analysing the baby movement. The project was started in Month/ year and completed in Month/ Year. During the time, I was the student of Electronics and Communications at Jawaharlal Nehru Technological University, Hyderabad.

Background

CE 3.2

The products of camera and image analysis are very popular in the market in recent years. The project is also a multifunctional product of camera. In the aspect of function, this project is a product of surveillance camera developed for the babyThis project was aimed to develop a baby

camera that would be able to make the video and took the pictures in the night with Ultra High Definition. This camera used for analyzing the movement of the baby and send the messages on mobile that was logged in with the camera. The camera is very useful in recording the all the movements of the baby in the absence of the parents. In this project, I used the SOC of AMBARILA as core solution. In this project a special video processor was used in the SOC. The video processor was able to decode and analyzed the video. Also, an audio processor was used around it to work together with the image sensor and transfer the image via high-speed differential bus.

CE 3.3

During the project, I have performed the following tasks;

- I first choose the suitable components, then complete the schematic diagram according to the design principle
- I designed the PCB after completing the schematic diagram and use the design tool of the PCB and the corresponding specification to finish the layout of the PCB
- I connected all the mainboards together and check whether they can communicate normally and whether all the physical signals can meet the design requirement after completing the design
- I took the corresponding solution for different problem in the process of development and testing
- Finally I completed the test list and developed a final report
- I coordinated with my team and arranged meetings

CE 3.4

Following is the project Hierarchy
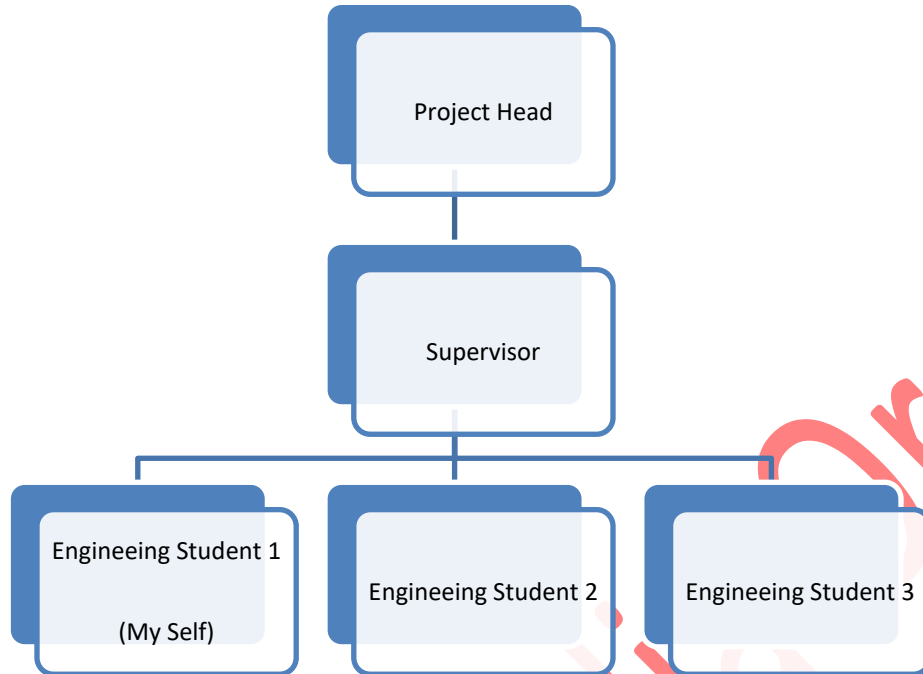
Personal Engineering Activity

CE 3.5

At the start, I prepared a project plan in which I mentioned all the major tasks that needed to be carried out during the project. I based on this plan distributed the tasks among the team. I took regular updates from them. I then carried out the detailed literature review to read the previous studies on the same design. After developing my complete understanding I started developing the design.

CE 3.6

I developed the design of the image sensor. I used two kinds of image sensor in this project. I developed the schematic diagram according to the data of the sensor. After completing the schematic I developed the design of the PCB using the AutoCAD. In my design I used the temperature sensor, image sensor chip, EEPROM, and infrared filter driver on the mainboard of image sensor. In my design, the MIPI bus has been used by the image sensor and the temperature sensor has been used for temperature monitoring. I used the software that was managed accordingly when the temperature becomes too high or too low. I used the EEPROM to store the calibration data and the infrared filter driver is used to switch the filter for the day or night on the lens. All the components mentioned above have been centralized on a PCB with 8 or 6 layers. I paid attention to the differential impedance of high-speed bus when designing the image sensor.

CE 3.7

The image sensor can't capture the image fully because of the insufficient light when the ambient light turns dark in the design of the infrared LED. So I used the light in infrared wavelength for aided imaging. I also added a sole board of infrared LED in the project which can be installed on the shell and connected to the driver on the DSP mainboard to work conveniently. I completed the schematic diagram first in the development process. Then I designed the PCB according to the schematic diagram with the help of AutoCAD software. On the image board, there was one high speed bus which was the image sensor data bus. It was based on differential LVDS. I used the PCB parameters to generate the trace width and gap using the Z difference equation. As there were two kind of image board with different layer stack, so I calculated twice by using different model.

CE 3.8

Because there were many power supplies such as the core power supply and the IO interface power supply used in the image sensor, so the distribution of different layer according to the different power supply line was necessary in the layout of the image sensor mainboard. I provided different voltages on different layer of the power supply to make them travel from the power supply chip to the image sensor chip in the shortest path to ensure the stability of the power supply. I implemented the separate optimization on account of different image sensor chip at the same time. I designed the two pieces of image sensor for different image sensor chip which needed different stacked structure of the PCB. I then designed a different power supply layer in corresponding to the two kinds of image sensor chip.

CE 3.9

All the LED lights have been connected in series in the initial design of the schematic diagram, which results in the lack of driving voltage for the infrared LED. There is a driver of the infrared LED light on the DSP mainboard, which is a buck-mode switching power supply and its driving voltage was not enough to drive all the infrared LED when 12 infrared LEDs have been connected in series. So I connected all the infrared LEDs in parallel and combine the serial and parallel to test. A balance has been reached not only in the driving voltage and the driving current but also on the linearity of the adjustment for the infrared driving current.

CE 3.10

I was prepared for all kinds of difficulties faced at the initial stages of design and I have paid great attention in developing the progress, time distribution risk, and the layout phase. I maintained communication with my teammates and ensured a high-quality design. While debugging phase, I conducted different tests for solving the problems and improved the product design. I conducted weekly meetings where we discussed the issues faced and suggested the technical solutions. I finally prepared the project report detailing all the major activities carried

during the project. I also entailed the detailed research and literature review that I carried at the start of the project along with my team.

CE 3.11

I also collaborated with my teacher and asked their help at various stages of the project. I used to arrange shot discussion with him where I explained him my design methodology. I showed him the initial design and took his suggestions. His guidance was very important for me as I learned new things. I also continued to my lifelong learning by making detailed research and browsing through the internet. I studied various journals and research papers. I also used the online forums and websites and understand on latest developments. I also attended training and seminars that were also beneficial for my technical grooming.

CE 3.12

One of the main factors of the project, which I focused mainly, was the safety. I made sure that none of the project tasks were resulted in any hazardous injury or losses. I strictly followed the safety rules and also advised my teammates to follow the same. Apart from this environmental safety was also important for me. I followed the OSHA standard that was based on safety and health. By implementing the basic safety procedures, I successfully created a safe environment.

CE 3.13

In this project, I used different software that helped me in better design. I used AutoCAD for various design activities. For report writing and calculation tasks I worked on MS office. In this project, I also followed the Engineering Accountabilities. I followed the IEEE standard and ISO standards.

CE 3.14

Being a social person, I always stayed healthy by taking part in different social activities. I joined my teammates in weekend dinners and also played sports in the near ground. I was also involved in charity activities that were take place in my society. These activities also made me close to my friends.

Summary

CE 3.15

This project was my final year project and it gave me room for the development of my technical skills. I completed all the activities on time and achieved the project objective by solving different technical issues that I have faced. I learned a lot from this project. I got help and guidance from teachers and my senior engineers which really helpful for completion of this

project. I was able to achieve all the targets which I set in the start. I got appreciation from the project supervisor for my dedicative and quality efforts.

PROFESSIONAL ENGINEER

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	I applied comprehensive knowledge and fundamentals of engineering performing the design tasks and solving technical issues	CE 1.6, CE 1.7, CE 1.8, CE 1.9, CE 2.6, CE 2.7, CE 2.8, CE 2.9, CE 2.10, CE 2.11, CE 3.6, CE 3.7, CE 3.8, CE 3.9
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics and computer and information sciences which underpin the engineering discipline	I performed diverse arithmetical calculations as per the project needs and requirements	CE 1.5, CE 1.6, CE 1.7, CE 1.8, CE 2.10, CE 3.7
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	I used different professional software for more enhanced performance in the project	CE 1.6, CE 1.7, CE 1.11, CE 2.7, CE 3.13
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	I explored on the new procedures and logical advancements and furthermore actualized the same in the task execution	CE 1.7, CE 1.14, CE 2.5, CE 2.8, CE 3.11
PE1.5 Knowledge of contextual factors impacting the engineering discipline	I applied engineering standards while carrying out different activities	CE 1.13, CE 2.12, CE 3.13
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline	I effectively handled all the technical issues faced in the project by devising sound solutions	CE 1.8, CE 1.9, CE 2.9, CE 2.10, CE 3.7, CE 3.7, CE 3.8, CE 3.9
	Being well aware with the engineering accountabilities I tried	CE 1.13, CE 2.12, CE 3.13

	to follow them while executing the technical tasks	
	I implemented a safe working place by following the safety norms and procedures	CE 1.13, CE 2.12, CE 3.12
PE2 ENGINEERING APPLICATION ABILITY		
PE2.1 Application of established engineering methods to complex engineering problem solving	I followed the engineering methods for solving the technical issues underpinned during the project	CE 1.13, CE 2.12, CE 3.13
PE2.2 Fluent application of engineering techniques, tools and resources	During the project, I worked on SLAM, AutoCAD and MS office for design and calculation tasks	CE 1.6, CE 1.7, CE 1.11, CE 2.7, CE 3.13
PE2.3 Application of systematic engineering synthesis and design processes	I developed the best engineering designs following the sound engineering principles	CE 1.6, CE 1.7, CE 1.8, CE 2.6, CE 2.7, CE 2.8, CE 3.6, CE 3.7, CE 3.8, CE 3.9
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	I developed the project charter and plan for the smooth completion of all the tasks	CE 1.5, CE 2.5, CE 3.5
PE3 PROFESSIONAL AND PERSONAL ATTRIBUTES		
PE3.1 Ethical conduct and professional accountability	While carrying out design tasks and other engineering activities I followed the engineering codes and standards relevant to my project	CE 1.13, CE 2.12, CE 3.13
	I followed the safety rules and also advised my other teammates to follow thus a safe work place was maintained	CE 1.13, CE 2.12, CE 3.12
PE3.2 Effective oral and written communication in professional and lay domains	I prepared final project reports and presentation	CE 1.13, CE 2.14, CE 3.13, CE 3.10

	I also participated in project meetings and well communicated with the team	CE 1.5, CE 1.13, CE 2.5, CE 3.10
PE3.3 Creative innovative and proactive demeanour	I collaborated with my supervisor and teachers to take their help on different issues	CE 1.13, CE 2.5, CE 2.9, CE 3.11
PE3.4 Professional use and management of information	I prepared project reports that showed my high written skills	CE 1.13, CE 2.14, CE 3.13, CE 3.10
	I managed the project effectively and successfully completed it on time	CE 1.5, CE 2.5, CE 3.5
PE3.5 Orderly management of self, and professional conduct	I regularly research for the latest updates and technologies that helped me in building my knowledge	CE 1.7, CE 1.14, CE 2.5, CE 2.8, CE 3.11
PE3.6 Effective team membership and team leadership	I managed my team, guided them, allocated them tasks and cooperated with on all the project stages	CE 1.5, CE 1.6, CE 1.13, CE 1.14, CE 2.10, CE 2.12, CE 3.11, CE 3.12, CE 3.14

**Reach to our executive for your report to be done at below
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