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CAREER EPISODE 1

The low intensity LASER treatment development for healing of fracture

a) Introduction:

Dates: November 2016

Duration: 2016 (7th and 8th semester)

Location: Kathmandu, Nepal

Name of the organization: College of Biomedical Engineering and Applied Sciences

Position Title: Student

b) Background:

[CE1.2]

Most of my study is focused on how laser therapy can be used to treat broken bones. It is important for bones to heal through their own normal processes. Based on what we know, the time it takes to heal from a fracture is much longer. I have tried various methods for helping my broken bone heal faster and more comfortably. In recent years, there has been a lot of interest in using LASER therapy to treat broken bones. There are many different things that affect how long it takes for a broken bone to heal. Even in the most cutting-edge medical practices of the modern age, plaster casts are still an important part of treating broken bones. Also, injuries are often treated with screw plates these days. Using these ways to treat a broken bone takes a longer amount of time. Recent studies, on the other hand, have

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shown that laser treatment is the best way to fix broken bones.

[CE1.3]

Furthermore, the goal of the project also involves the effect of fibroblast, osteoblast and other major cells of the body on fracture treatment. The experiment of the project has been executed using 15 guinea pigs. A guinea pig is a species of rodent having biological properties similar to that of a human being. The guinea pigs are used for various experimental purposes, especially in the field of medical sciences. The guinea pigs, in this project, were divided into different groups, and laser treatment was applied to them. Finally, all the observations were noted and a difference in the healing rate was noted for the groups.

[CE1.4]

The work that was performed in this project belongs to the field of biomedical engineering. A greater precision rate has been noted while using laser treatment in the field of biomedical engineering. The laser treatment increases the chances of the doctors to effectively treat the fracture in the early stage itself. Furthermore, laser treatment is also being used in angioplasty, dermatology, cancer treatment, and so on. A basic laser system design consists of two mirrors that are placed parallel to each other for the purpose of oscillating the light back and forth between the mirrors.

[CE1.5]

Supervisor
(Assoc. Prof. Sekhar Khanal & Prof. Rajani Shrestha)



Assistant Supervisor
(Lect. Neela Prajapati)



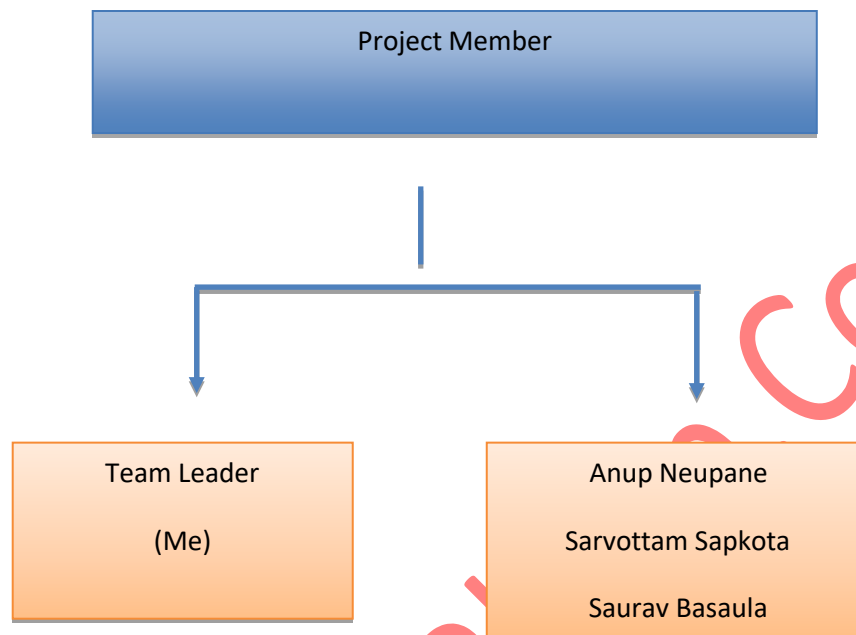


Figure 1.5.1: Organizational Chart

[CE1.6]

I have been instructed by my supervisor to perform various duties while executing the project. I have been asked to design the laser circuit by initially forming a block diagram. After this, I was asked to perform the experiment of healing the bone fracture by surgery using guinea pigs. After the surgery had been done, I was asked to collect the samples of laser irradiation on the guinea pig. After this, the guinea pigs were euthanized and the radiographic images were collected. **Furthermore, bone extraction had been done with the help of a vet surgeon after collecting radiography images with the help of an Xray.**

c) Personal Workplace Activity

CE1.7

The fracture healing procedure is one of the most vital processes within a body. However, the

healing procedure is primarily influenced by different factors such as nutritional diet, and fracture intensity. Besides the overall healing procedure initially requires a much longer time. In this concern, I developed a low-intensity laser treatment for the process of fractured healing. The traditional procedure for fracture healing is mainly done by utilizing plaster. It assists in immobilizing the fracture-healing it does not properly prevent an adequate time for healing the fracture. I have developed a laser treatment device that would emit light by a specific procedure of optical amplification. The amplification was based on the stimulated emission regarding the electromagnetic radiation. The technical devices that were used in this project are an AC power supply, full wave rectifier, transformer, laser diode, variable resistor, voltage regulator, and capacitor.

CE1.8

The laser had few characteristics of collimation, and monochromaticity alongside coherence which initially led the laser light to penetrate the surface of the skin non-invasively. Laser light works in certain processes in which the photons discharged through laser adequately reach towards the mitochondria beside in the lying cell's cell membrane such as endothelial or fibroblasts. In this laser treatment, the photon energy was primarily get absorbed through the chromosphere. On the other hand, this energy turns within chemical kinetic energy among the cells. This procedure adequately improves the overall cell signaling among the cytosol, nucleus, and mitochondria. It formed the nitric oxide beside it enhanced the oxidative metabolism. The metabolism leads to more production of the ATP.

CE1.9

I have designed a circuit for a laser driver which was properly simulated within the proteus software for measuring the highest output regarding the circuit. After that, this device was completed through soldering within a "printed circuit board". Next, I integrated the laser with the driver circuit. However, the device involves a transformer that stands down 220v towards 7.5v and a full wave rectifier that rectifies through AC to DC. The AC noises were then filtered through a continual voltage input and a capacitor from the voltage regulators. Then I provided the voltage regulator to the laser diode.

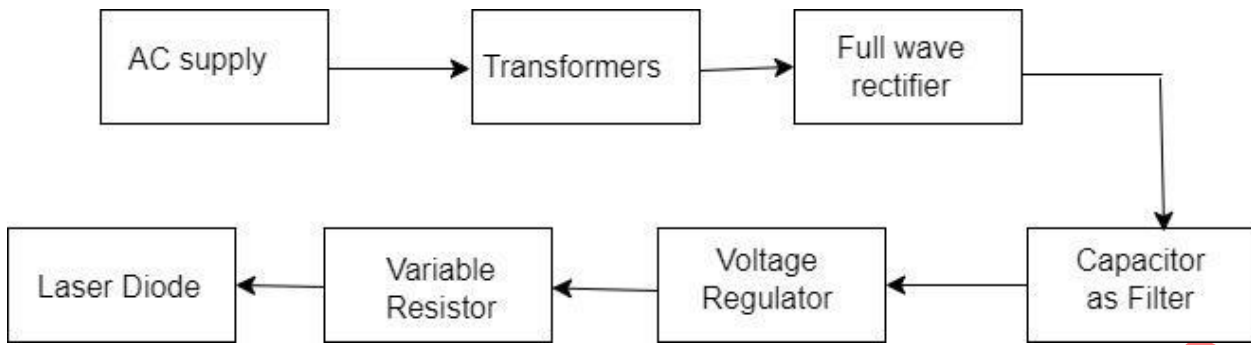


Figure 2: Circuit block diagram of the laser driver

CE1.10

In order to generate low-intensity laser light, I had associated with a multi and single-wavelength output, and an adjustable output power was proposed with this device. Besides the device involves numerous numbers of units which have been properly elaborated in a given table. Additionally, for designing the low-intensity laser light, I utilized a power supply unit for providing a “5 and 12 VDC voltage” in order to properly run the system. However, within the control unit, I used an Arduino MICRO A000053 for the development of the MCU board. Within the design and development of the low-intensity laser light device, 3 laser modules escorted by various wavelength has been used. In this concern, blue laser at 480 nm, green laser at 520 nm, and “low-power 0.3 W industrial laser beam” associated with red laser at 635 nm had been utilized within the overall system design.

D8-MOTOR80 Mini Linear Stepper Motor	
Rated voltage	4-9 VDC
Number of Phase	2
Current	500 mA
Coil DC Resistance	15 Ω
Insulated Resistance	> 50 M (500V)
Response Frequency	1600 PPS
Stride Angle	18°
Screw Length	90 mm
Effective Stroke	80 mm
Screw Pitch	0.5 mm
Screw Diameter	3 mm

Figure 3: Specification of each factor

CE1.11

In this system, I implemented and designed a mechatronic system for combining the produced laser beams. However, three produced laser beams can be aligned and combined together within a linear optical track in order to generate multi and single-wavelength laser beams. However, among this whole mechanism, I utilized a 3-step alignment procedure. Two small half-silvered and right-angle mirrors had been further implemented for aligning those three laser beams.

CE1.12

During the period of my project implementation, I had properly assembled various kinds of tools and techniques that were required regarding my project implementation. I had adequately consulted with my project supervisor in every phase of this project. Besides, I have also cooperated and maintained effective communication with my other team members.

d) Summary

CE1.13

The project is effectively suitable for fracture healing in the body compared to the traditional methods. I have designed the device with a numerous number of tools and techniques.

CE1.14

The aim of this project was to develop a low-intensity laser treatment for fracture healing. However, at the end of this project, the development of this device was completed successfully. Hence, it can be asserted that the project's aim is successfully met.

CE1.15

This project was one of the vital developments in my professional career. During the project implementation, I learned various kinds of things related to laser beam light and the importance of leadership and effective communication within a group.

CAREER EPISODE 2

ROTARY LEFT VENTRICULAR ASSIST DEVICE(LVAD)

A) Introduction

[CE 2.1]

Dates: March 2015

Duration: 2015 (5th September)

Location: Kathmandu, Nepal

Name of the organization: College of Biomedical Engineering and Applied Sciences

Position Title: Student

B) Background

[CE 2.2]

LVAD, or the Left Ventricular Assist Device, is a mechanism that helps to enhance the heart performance. It is comprised primarily of rotary pumps that are lighter, smaller, and quieter as compared to the pulsatile pumps. The development of an appropriate feedback helps in controlling the speed of pump and is required to meet the crucial challenges. In this study, I have performed the practical issues that are connected to the controller development. The controller performance helps in noise measurement to investigate the flow of pump signal.

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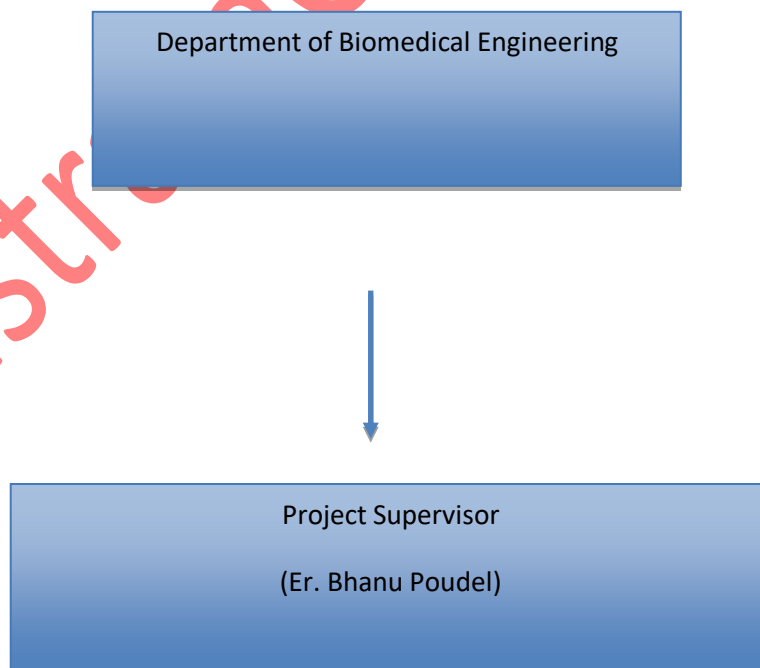
[CE 2.3]

The primary objective of the project is to design an LVAD mechanism that will help in assisting heart ailing performance and is comprised primarily of rotary pumps that are smaller in size. I have also simulated the results by using feedback controllers that are present in two different scenarios of the patient activities. The controller performance has also been investigated for measuring pump flow signals and has been represented by a difference in pressure across the pumps.

[CE 2.4]

In this project, I was primarily responsible for gathering the initial data and information regarding the design and development of the Rotary left ventricular assist device (LVAD). At first, I had properly discussed with my peers and supervisor the design of the LVAD device. This device is considered a long-term implantation and it could flow approximately 10 litres in each minute. The internal surface of this device primarily involves an inlet stator, outlet stator, rotor, and a thin wallet duct. I was responsible for designing the overall device in a proper way; thus, it could work precisely.

[CE 2.5]



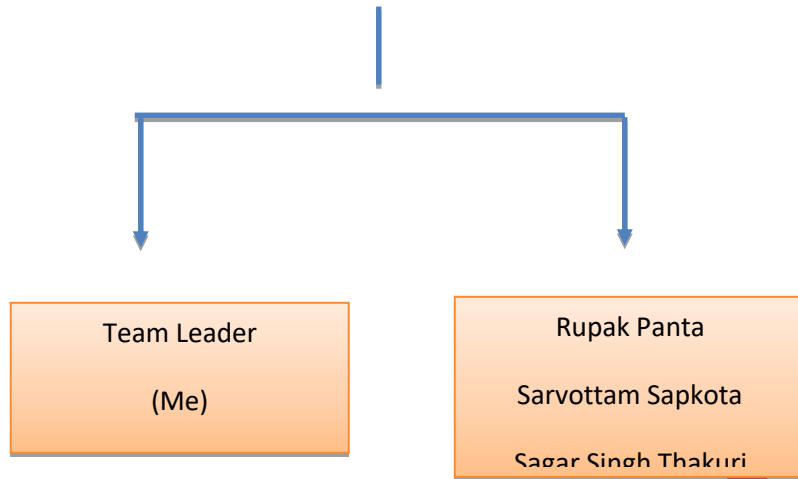


Figure 2.5.1: Organizational Chart

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[CE 2.6]

During the project implementation, I completed some crucial responsibilities which are properly given below

- To gather initial and vital information related to the microcontroller, flow sensor, and power source through different articles, books, and journals
- I had drafted a particular methodology for my project supervisor regarding the nature of the overall design
- I had properly collected the required materials and methods for designing and developing the LVAD device.
- I had properly communicated with my other teammates and with my project supervisor as well.
- I had adequately updated the project progress report with my project supervisor and discussed every aspect regarding the LVAD device.

C) Personal Workspace Activity

[CE 2.7]

Heart transplantation in the present time has been recognized as a better therapy for the patients who are suffering from end-stage heart failure. In the present time, medical community have presented an emphasis on the mechanical circulatory usage for enhancing natural heart function. The “left ventricular assist device” is a vital system that is utilized for keeping patients alive. However, it further assists the patients who initially could not have a heart transplant. An important engineering challenge is to increase the LVAD usage and then use it as a controller for adjusting rotor speed. When the pump speed is low, blood from the aorta to the left ventricle results in a backflow, resulting in a phenomenon known as suction.

[CE 2.8]

During the project implementation, vital components were utilized which were elaborated on below

- A liquid crystal for displaying the information that would be taken through the sensors.
- A transformer that I had utilized as a main power supply for the both pump and Arduino.

- A container that would indicate the left ventricular, an elastic pipe, and a small breadboard
- Regarding the microcontroller, in this device, I utilized the Arduino Uno programmable controller. The programming was done through a computer I also ran the custom instruction by implementing the Arduino IDE which controls both liquid crystal and sensors
- I had used a flow sensor that was used for sensing the flow rate
- A motor pump had been used to push the blood through the left ventricular. Besides, instead of blood, I used water to complete the design of the LVAD device.

The motor would pump the given fluid through the left ventricular, while the power source would supply the pump alongside the microcontroller. The tubes in this system would move the fluid out of blood vessels and the heart while the LCD would display the flow rate.

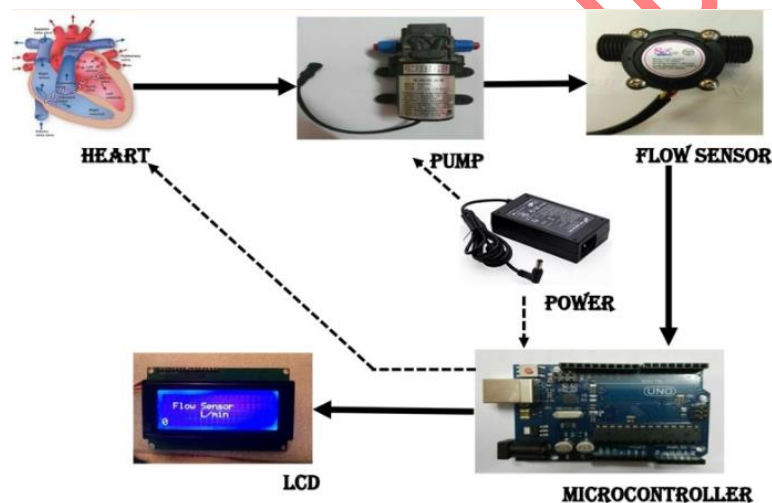


Figure 2.8.1: Block diagram of LVAD device

[CE 2.9]

I placed the flow sensors within the water line by utilizing the pinwheel sensors to a particular degree. I had developed the proper sensors beside ran a specific digital pulse when the water volume was coming by the pipe. The sensor flow was controlled through the microcontroller and hence, the output could simply link regarding the examination of used water amounts. The utilized microcontroller had been constructed among the “ATmega328”. It had 14 digital output/input pins. I used the Arduino Uno microcontroller for its numerous benefits. It could be adequately supplied with the electric power without having the high voltage for activating. In the below figure, the overall11

connection between the flow sensors, LCD display, and the Arduino Uno is properly represented.

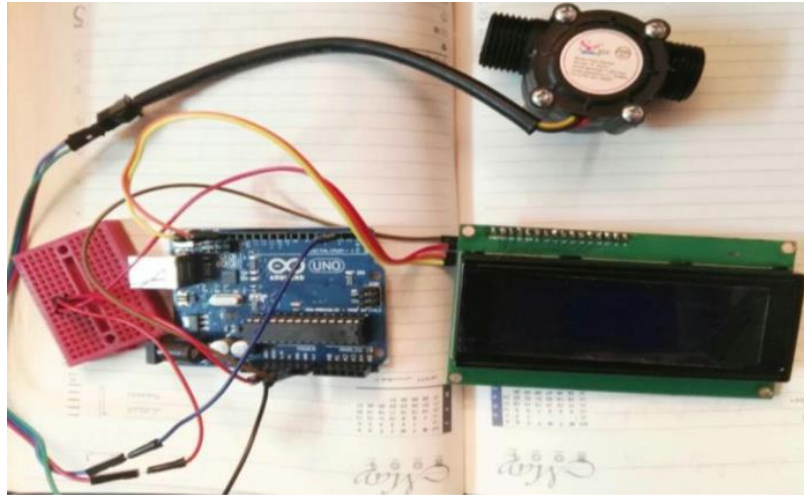


Figure 2.9.1: The connection of each component

[CE 2.10]

While performing this experiment, I have encountered specific technical difficulties that have limited my research work to move further. I have encountered a discrepancy between the availability of donor hearts that has led to the increase of LVAD devices. One of the primary complications is inheriting the LVAD therapy in the right ventricular failure. The patients who are suffering from the ventricular dysfunctions have developed certain conditions that are associated with the support of right ventricles. The previous studies have helped in predicting those patients that have a higher chance of RV failure. It could be identified as the abnormal biochemical parameters for predicting risk factors of RV dysfunction.

[CE 2.11]

I have collaborated with my fellow team members in this project to design and develop the LVAD device. During this study, I have faced specific technical difficulties during which my team members have helped me to solve the problems in an efficient method. I utilized the motor pump for designing the device which did not have a particular requirement for the water outlet size. Whenever the hole of the water outlet was blocked or too small, the motor pump stopped pumping. However, as the pump should be utilized in a dry situation, besides, I did not submerge it in the water. The elastic pipe used within this LVAD design has a approx. 2.5 meters in length. The tube was mainly considered as an overall blood cycle length of the human body. The container in this device indicates the left ventricle of the

human body which has the capacity of around 200ml. The final implementation and the design of the LVAD system are given below

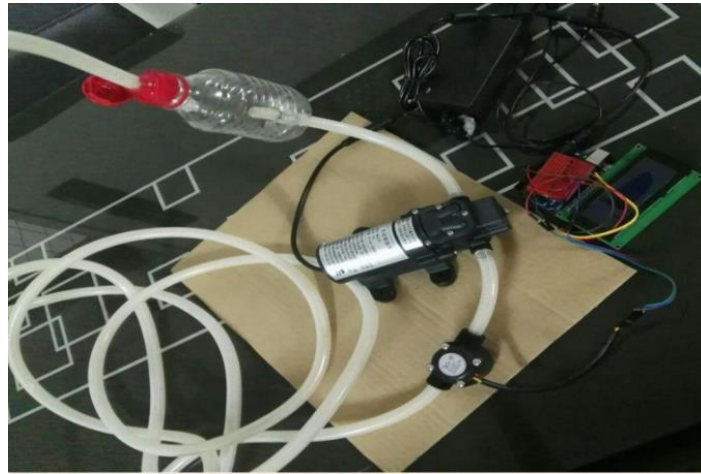


Figure 2.11.1: Final design of the LVAD system

Summary

[CE 2.12]

It can be concluded from this study that the Rotary Left Ventricular Assist Device has been used for ailing the performance of heart functions. These pumps have been controlled by the difference in rotor speeds and could be adjusted to meet the blood needs of the patients. I, along with my teammates, have developed an appropriate feedback controller for adapting daily activities of the patients so that excessive pumping could be prevented, which can cause the ventricle to collapse. The model associated with this study is a six-dimensional vector model that has been used for representing the ejection and contradicting the left ventricle.

CAREER EPISODE 3

INSTALLATION OF 0.3T PERMANENT MAGNET MRI SYSTEM

A) Introduction

[CE 3.1]

Dates: January 2018

Duration: January to March 2018

Location: Butwal, Lumbini Province, Nepal

Name of the organization: Butwal CT and Imaging Private Limited

Position Title: Team Leader

B) Background

[CE3.2] **Nature of the project**

The nature of this project was developing clear images regarding the structure inside of a body by utilizing massive radio waves and a large magnet alongside a computer. MRI system is to properly implemented, monitor, and diagnose numerous medical criteria. However, the MRI system does not utilize radiation techniques or X-rays rather it utilizes a massive magnet and radio waves to develop a clear image of structures and organs inside a human's body. The scanner of the MRI system primarily utilizes powerful radio waves and magnetic fields in order to produce signals through the body. Those signals are then picked up through the radio antenna beside processed through a computer for developing a detailed image.

[CE3.3] **Objective**

The objective of this project was to adequately install the 0.3T permanent magnet MRI system.

At the beginning of this project, the gantry units and related accessories had been offloaded for the further installation process. After that, I positioned that gantry unit by the guidance of

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Hitachi Medical technical team. A proper wiring of both the MR unit to the filter box and the gantry unit to the filter box done has been done after this.

[CE3.4] Nature of particular work area

In this project, I had to work on the complete installation of a 0.3T permanent magnet MRI system. During the installation period, at first all-related accessories boxes has been off-loaded.

Those boxes had been opened systematically according to the installation chart.

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[CE3.5] Organizational Chart

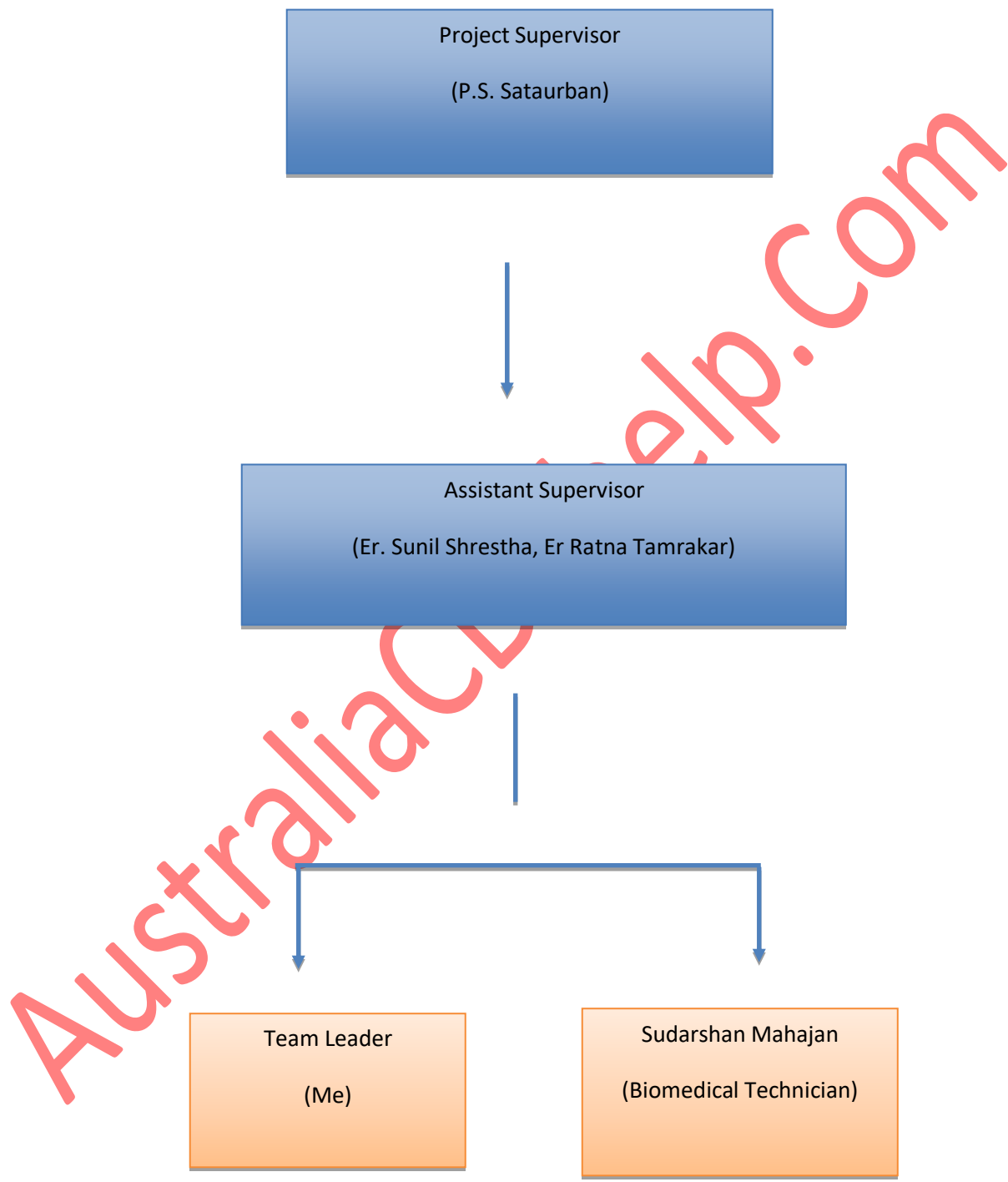


Figure 3.5.1: Organizational Chart

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[CE3.6] Statement of duties

In this project, I had to work on the installation of a 0.3T permanent magnet MRI system. I performed different kinds of responsibilities regarding fieldwork support.

My main responsibilities in this project have been properly elaborated below

- I assisted in the precise installation of upgraded MRI systems, besides delivering different comprehensive applications for ensuring smooth operation.
- I had to provide support for rectifying and identifying fails in the MRI system
- I had to properly maintain all the documentation in the all-on service that is provided to the customers, for ensuring a perfect record.

C) Personal Workspace Activity

[CE3.7] Technical details of work

During the installation steps of MRI, the overall positioning of all gantry unit was done and followed by wiring towards the noise filter box and from filter box to MR unit. At the same time, 15KVA UPS for the power backup had been installed for properly maintaining the electricity flow in order to prevent a sudden shut down of the system. Then, all the covering concerning the main gantry unit and MR unit was done. After that, the system is powered up and I waited for the heater to reach up approximately 32 degree which is an operable temperature for the system that took 2 days. After properly preparing the console system it was turned on.

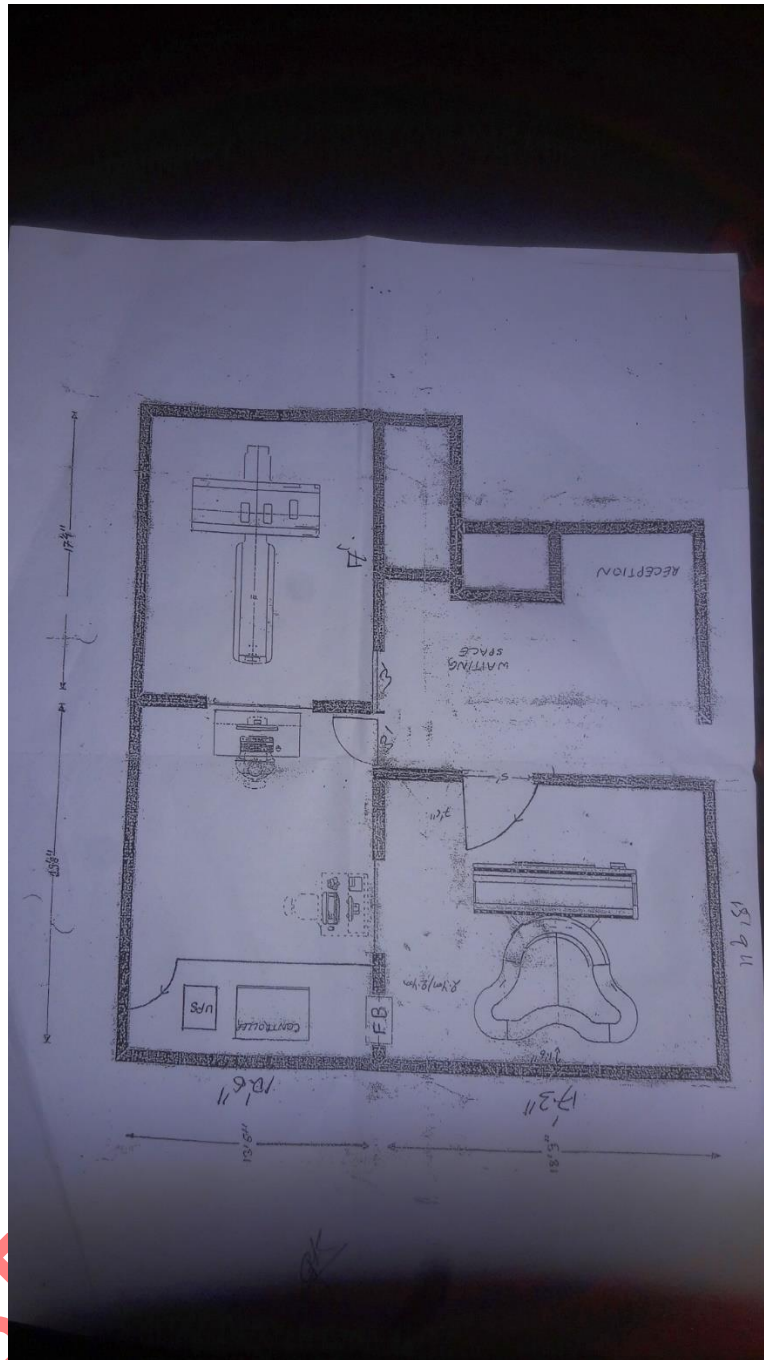


Figure 3.7.1: Schematic diagram of MRI Installation

However, a PSC board error had been occurred that adequately resolved though resetting all the all-cable connection to and from the DGBZ pcb board. Moreover, all the essential calibration and final system preparation was done. System is ready for scanning the patient.

[CE3.8] Applied engineering knowledge

I had successfully done the Phantom scanning which was followed through the test patient scan. Yet the artifacts were seen within the scanned image. After then, I had collected the error logs and sent it to the technical team from Hitachi for the decoding. The result from the process of decoding showed fault in the transfer module. The issue was confirmed through checking the waveforms from the same faulty module by utilizing an oscilloscope. I had replaced the faulty module with an upgraded one and then signal to noise ratio measurements (SNR) of all the receiver coils such as knee coil, body coil and head coil. I had further checked and adjusted the central frequency to the optimum level.



Figure 3.8.1: MRI System Installation

[CE3.9] Tasks assigned to me

In this study, I was responsible for performing essential maintenance with the assistance from Hitachi technical team in order to ensure optimal functionality and seamless operations of the MRI system.

I have played a vital role in the successful installation of the MRI system.

I have opened the wooden box of gantry covers and have shifted it to the gantry rooms.

MRI heater have been powered, and the heater temperature has reached to over 32 degrees Celsius.

The PSC board error has been reported to the technical support team by providing specific team instructions.

[CE3.10] Technical difficulties faced

During the installation period, the patient table error has been occurred and it was solved by 20

replacing the wire connection board within the patient table. A proper training towards the radiology technician had been done with the assistance from the Hitachi team.

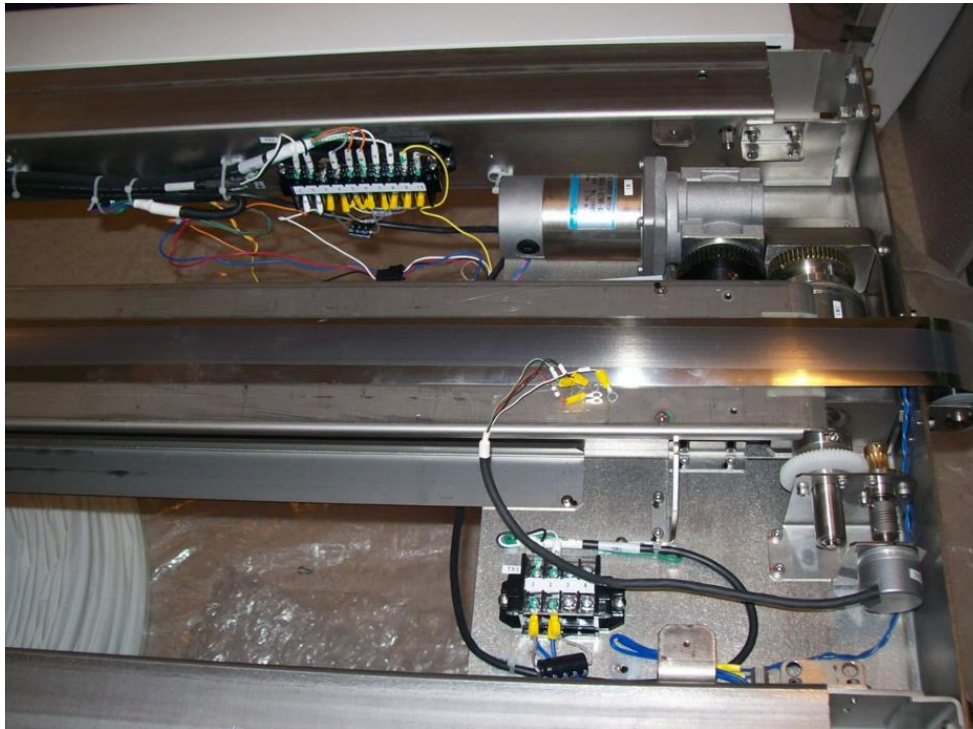


Figure 3.10.1: MRI installation procedures

Furthermore, end user was instructed for maintaining the room temperature. The basic application training has been provided to the operators, and advanced training has been provided for overcoming the difficulties that have been faced.

[CE3.11] Strategies devised in this project

In the next phase, a film printer for printing the patients scanned images was installed. I had properly done the remote connection that helps for examining the general status of system from another location without having the service team on site. I have implemented my skills in the installation of MRI systems and have collaborated with my team members to overcome any technical difficulties that may arise during installation. I have implemented some necessary settings after replacing the DGBZ pcb board.

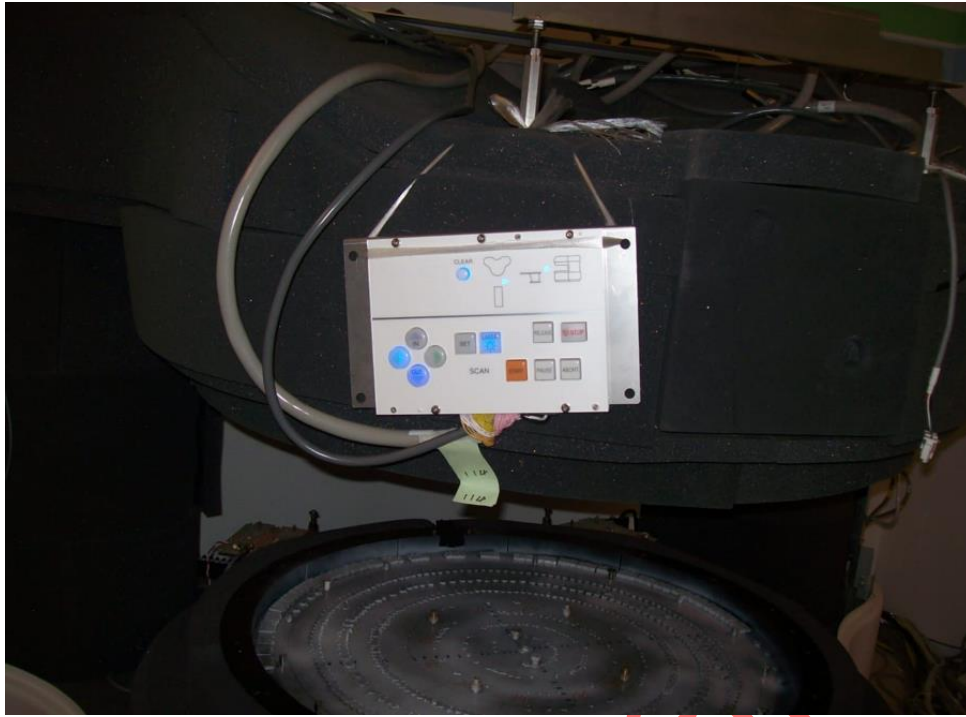


Figure 3.11.1: MRI Gantry Unit

The entire system has worked normally after these procedures have been maintained. My team members were responsible for performing PCB checking functions, and the SNR ratio for the replacing the transfer module.



Figure 3.11.2: Final installation of a MRI

System

In the above image, I have developed and set-up the final installation of the MRI system and have tested all the necessary tests required to operate the machine.

Servicing for different systems has been done accurately and monitored during the scanning of patients. Images obtained have been reported to Singapore to the technical team.

D) Summary

[CE3.12] Personal contribution to this project

In this study, I was responsible for the installation of a 0.3T permanent magnet MRI system as a Bio-Medical Service Engineer. I have developed a compact and economical magnet for wider access configurations in the horizontal directions. These skills have helped in the development of MRI system installation. I have faced several problems during the installation of this system, our supervisor has helped us in solving the technical difficulties that I have faced so that we can install the MRI system effectively. The objective of this project was properly installing of MRI system, hence, in the end it could be said that, the objective of this project had met successfully.

SUMMARY STATEMENT

<ul style="list-style-type: none"> Competency factors 	<ul style="list-style-type: none"> A brief explanation of the all factors regarding the overall evaluation procedure 	<ul style="list-style-type: none"> Single paragraph number in each career episode
<ul style="list-style-type: none"> PE1 SKILL AND KNOWLEDGE BASE 		

<ul style="list-style-type: none"> PE 1.1 Theory based implementation and understanding of the Biomedical Engineering's fundamental implementations. 	<ul style="list-style-type: none"> I implemented three project assignment bases on the Biomedical Engineering's field which are <ul style="list-style-type: none"> Developing low-intensity laser treatment regarding the fracture healing. Rotary left ventricular assist device(lvad). Installation of 0.3t permanent magnet MRI system. 	<ul style="list-style-type: none"> CE 1.1, 2.1, 3.1
<ul style="list-style-type: none"> PE 1.2 Theoretical acknowledgements of the both Information and numerical inspection regarding the Biomedical Engineering's practice and discipline. 	<ul style="list-style-type: none"> A vital and theoretical practice had been adequately explained during the all-project implementation, especially for the scrutinization of Biomedical Engineering's discipline and its engineering practice. 	<ul style="list-style-type: none"> CE 1.3, 2.2, 3.2
<ul style="list-style-type: none"> PE 1.3 Core inside of the conceptual theory and disciplines for the Biomedical Engineering's discipline. 	<ul style="list-style-type: none"> All the relevant and particular research had been done by following the Biomedical Engineering's fundamental practices and disciplines. 	<ul style="list-style-type: none"> CE 1.4, 2.3, 3.3

<ul style="list-style-type: none"> PE 1.4 Research knowledge and direction discernment among the Biomedical Engineering's discipline and practice has been adequately maintained. 	<ul style="list-style-type: none"> The project's primary and crucial practices are evaluated beside properly examined according to the main fundamental skills of Biomedical Engineering's field. 	<ul style="list-style-type: none"> CE 1.7, 2.4, 3.4
<ul style="list-style-type: none"> PE 1.5 Comprehension of the main contextual aspects, practice beside the fundamental disciplines. 	<ul style="list-style-type: none"> I have properly gathered the definite practices and principles besides implementing the Biomedical Engineering's factors for gaining an adequate outcome. 	<ul style="list-style-type: none"> CE 1.8, 2.7, 3.7
<ul style="list-style-type: none"> PE 1.6 Acknowledgements of the Biomedical Engineering's discipline, vital norms, practice and, principles. 	<ul style="list-style-type: none"> I recognize the crucial principles and primary norms of accountability aspects that are significantly examined and analyzed for obtaining the desired result and fulfilling the given assignment. 	<ul style="list-style-type: none"> CE 1.9, 2.8, 3.8
<ul style="list-style-type: none"> PE2 ABILITY OF ENGINEERING APPLICATION 		

ACU

<ul style="list-style-type: none"> • PE 2.1 Employing of the accomplished Biomedical Engineering's principles and procedure alongside resolving a complex engineering problem. 	<ul style="list-style-type: none"> • Different types of complex Biomedical Engineering's issues and activities have been properly resolved by implementing the main fundamental skills of Biomedical Engineering's domain. 	<ul style="list-style-type: none"> • CE 1.10, 2.9, 3.9
<ul style="list-style-type: none"> • PE 2.2 Relevant evaluation of the different sorts of Biomedical Engineering's strategies and disciplines. 	<ul style="list-style-type: none"> • I have made a relevant implementation of the Biomedical Engineering's disciplines with various types of fundamental skills and abilities for obtaining a particular result among the elaborated tenure. 	<ul style="list-style-type: none"> • CE 1.11, 2.10, 3.10
<ul style="list-style-type: none"> • PE 2.3 Evaluation of the systematic engineering synthesis and design. 	<ul style="list-style-type: none"> • In the above-mentioned all projects, a proper implementation process had been created and developed regarding the systematic design in order to consider the outcome. 	<ul style="list-style-type: none"> • CE 1.12, 2.11, 3.11
<ul style="list-style-type: none"> • PE 2.4 Evaluation of the different types of Biomedical Engineering's discipline and approaches. 	<ul style="list-style-type: none"> • I have implemented a constant and systematic design approach which has been employed. 	<ul style="list-style-type: none"> • CE 1.10, 2.11, 3.11

<ul style="list-style-type: none"> PE 3 PERSONAL AND PROFESSIONAL ATTRIBUTES 		
<ul style="list-style-type: none"> PE 3.1 Professional Accountability alongside the Ethical conduct. 	<ul style="list-style-type: none"> Professional ethics and factors have been properly examined and scrutinized along with implemented for obtaining required outcomes through the all three projects. 	<ul style="list-style-type: none"> CE 1.6, 2.12, 3.6
<ul style="list-style-type: none"> PE 3.2 Effective and written oral communication among professional domain has been properly continued. 	<ul style="list-style-type: none"> Effective communication ability alongside the soft skills has been significantly continued on my all-field work projects. However, my all-team member has adequately finished the project along with engineering skills. 	<ul style="list-style-type: none"> CE 1.6, 2.6, 3.6
<ul style="list-style-type: none"> PE 3.3 Creative and Proactive demeanor. 	<ul style="list-style-type: none"> I adequately preserved a proactive and creative demeanor in the period of every project with the evaluation of the innovative plan for securing the desired solution regarding the all-above-mentioned projects. 	<ul style="list-style-type: none"> CE 1.13, 2.6, 3.12

<ul style="list-style-type: none"> • PE 3.4 Information management beside the implementation of professional Biomedical Engineering's activity. 	<ul style="list-style-type: none"> • I established all Biomedical Engineering's activities and tasks that include the professional implementation of different types of technical skills, abilities and acknowledgment in order to obtaining a satisfy outcome. 	<ul style="list-style-type: none"> • CE1.14, 2.12, 3.6
<ul style="list-style-type: none"> • PE 3.5 Competent conduct and self-orderly management. 	<ul style="list-style-type: none"> • I continuously handled and managed various types of practical and technical skills in the all projects regarding my Biomedical Engineering's fields. 	<ul style="list-style-type: none"> • CE 1.15, 2.12, 3.12
<ul style="list-style-type: none"> • PE 3.6 Team leadership and effective communication besides team membership 	<ul style="list-style-type: none"> • I was properly guided by my other team members for responsibilities in all projects. 	<ul style="list-style-type: none"> • CE 1.15, 2.12, 3.12

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