

My deep fascination with electronics motivated me to pursue Electrical Engineering in my undergraduate studies, where I got the chance to participate in a line following robot competition during my first year. This was when I became familiar with embedded systems and this experience sparked a lifelong interest in me to learn more about their uses and incorporation in large devices. Eagerly looking for an outlet for my passion in this area, I joined the technical hobby club in my campus, Drishti, and represented my college at a national Robotics competition, Robocon 2017. This wasn't enough to satisfy my curiosity about the field and my unwavering pursuits led me to work with Professor Mukesh Zaveri on disaster management with the help of drones and undertake an internship at ThingsCloud Technologies Pvt Ltd. The knowledge I got from these two experiences helped me draft my final year project where I pursued the development of a differential drive robot. All these opportunities have given me immense hands-on experience with microcontroller programming, interfacing sensor modules with microcontrollers, and implementing basic control algorithms on microcontrollers. Now, having understood the widespread prevalence of embedded systems in almost every device around us, I wish to innovate using these systems and develop highly beneficial and out-of-the-box equipment for various industries. Hence, in order to acquire more knowledge about real time operating systems and their corresponding hardware drivers, I wish to pursue a postgraduate degree in Electrical Engineering with specialization in Embedded Systems.

Being fascinated with electronics and electrical appliances since childhood, I was deeply interested in the internal working of systems such as mobile phones and laptops. I also spent a lot of time wondering about how electricity was generated and how were motors controlled, and in an attempt to seek answers to these types of questions, I pursued my undergraduate studies in Electrical Engineering. During this period, my favourite subjects were Microcontrollers and Embedded Systems, and Sensors and Transducers. Both these courses gave me immense knowledge of the practical uses and applications of embedded systems and sensors, which greatly helped me in executing my undergraduate projects. My practical classes in Microcontrollers and Embedded Systems helped me acquire expertise in C programming, and I learned about assembly languages and circuit design through my courses on Microprocessors and Microcontrollers, and Digital Circuits respectively.

My intense interest in electronics and my desire to acquire practical skills in the subject motivated me to join my college team for participation in ABU Robocon 2017, where I wished to acquire a national-level exposure in my field and at the same time gain knowledge of the control of mechanical actuators using embedded circuits. I was specifically involved in designing a disc reloading mechanism for our robot which comprised of a disc stack that was to be fed into a disc throwing system. I used a pneumatic cylinder actuated with the help of a solenoid valve to raise the disc stack and a DC motor attached to a movable plate to dispense the discs. In order to ensure that the discs were fed into the mechanism one at a time, I used an IR proximity sensor fixed to the movable plate and aluminium strips to implement a linear encoding system. Using the Tiva C series microcontroller kit, I set up the control of the system, acquiring technical expertise in Code Composer Studio, control of solenoid valves and DC motors using microcontrollers, and interfacing of microcontrollers with rotary encoders.

During my undergraduate period, I had cultivated the habit of researching projects in my field of interest online, and I had come across several successful attempts at developing solar trackers for large solar panels. However, all these trackers were built on a single axis which made them inefficient for smaller solar panels which operated by tracking the sun's direction. Having taken an elective course in Sensors and Transducers around this time, I decided to develop a dual axis solar panel tracker that could help small solar panels align themselves in the direction of sunlight along with a GUI that would display the intensity of sunlight falling on the solar panel at any given time point. For this, I used a Light Dependent Resistor along with a voltage divider so that the voltage across the LDR would be proportional to the intensity of light falling on the device. Eight such LDRs were mounted on a circular platform fitted with a mechanism that would tilt the solar panel in the direction of sunlight with the maximum intensity. The Atmel ATmega microcontroller was used to control the DC motors that would rotate the circular platform and the rectangular plate on which the solar panel was mounted. A PID controller implemented on the microcontroller controlled the speed of rotation of the DC motors and a USART protocol and UART converter module was used to display the data on the system's GUI. This project was instrumental in helping me acquire in-depth knowledge of hardware components and mechanisms such as LDR sensors, microcontrollers, PID controllers, DC motors, GUI, Tkinter library, and Pyserial library for the development of a unique and useful solar panel tracker mounted on a dual axis.

When I came across the manual process of making pigments, I realized that this was a slow and unreliable process especially when different pigment colours needed to be dispensed at faster rates. Hence, I decided to develop a system for automating pigment dispensing of selected colours based on the given inputs. Using a centrifugal water pump, I set up a system to dispense three liquid pigments of colours red, blue, and yellow either individually or in combination to give colours such as purple, orange, and green. The user would indicate the desired colour by means of a potentiometer following which pumps controlled by motor driver ICs would be activated to dispense the desired pigment. An ultrasonic sensor for measuring distance was used to ascertain the volume of the pigment, and all sensors and pumps were interfaced with the ATmega microcontroller. Working on this project gave me advanced knowledge of the RISC architecture of the microcontroller and I specifically learned how to interface an LCD display with microcontrollers.

By this time, I had acquired a decent amount of knowledge of embedded systems and I was eager to work on a project that would help me expand my knowledge in this area. At this time, I got the opportunity to work with Dr. Mukesh Zaveri on the design of a sensor module for collecting environmental data and a clamp for carrying payloads for use in a hexacopter drone. The ultimate objective of this drone was to help in surveillance and disaster management activities using concepts of IoT. For the sensor module, I used Arduino nano along with gas sensors, temperature and humidity sensors, and ultrasonic sensors for measuring distance and object detection for collecting environmental data. With the help of a Bluetooth module and a LoRa module, the environmental data collected through these sensors was transferred to a ground base for further analysis. For the payload carrying clamp, I used a rack and pinion mechanism controlled by a DC motor that was further controlled by a microcontroller for taking payloads upto 1 kg. Apart from acquiring hands-on experience in using the Arduino environment for programming, and Bluetooth and LoRa modules for wireless communication, I

gained immense insights into the field by collaborating with PhD scholars working on various other projects.

One of the more disturbing statistics of Indian healthcare is that there are just 1.7 nurses and 0.7 doctors available for catering to every 1000 people in the country, and this makes it difficult for every physically disabled person to get premium healthcare services. So, for my undergraduate thesis project, I decided to develop a robot that could provide indoor assistance to patients and could further be scaled up to get converted into a self-driving wheelchair for these patients. To achieve this, I developed a two-wheeled differential drive robot using the SLAM technology to generate an accurate map of the environment. I also implemented a path planning algorithm on the ROS platform to enable the robot to determine the shortest path from its current position to the target position. The output of these algorithms would be sent to an Arduino controller via the MAVlink protocol and a unicycle model would be implemented to drive the motion of the robot. Through this project, I acquired an understanding of how to implement ROS packages on Ubuntu, use of MAVlink protocol to establish communication between ROS and MAVlink-enabled system, and the contribution of PID controllers in a robotic system.

Having covered several important concepts of my Power Electronics theory course, I had learned about various devices such as IGBTs and thyristors for designing various converter circuits. However, I was interested in learning about the development of control algorithms and the circuits that were used to control the converters that were not covered in my classes. Hence, in order to explore the field of power electronics in further detail, I undertook an internship at ThingsCloud Technologies Pvt Ltd where I designed control logic for generating trigger pulses for a 3-phase grid tied inverter. An ADC microcontroller was used to measure voltage and current of a grid connected to the inverter, and attenuation circuits were set up between the grid and the microcontroller. The measured voltage was passed through a low pass filter giving us line voltages and phase currents from which phase voltages were calculated. Clarke and Park transformation was applied to line phase voltages to obtain the grid angle and its corresponding frequency. The Clarke and Park transformation was then implemented on the phase currents and the resultant values were compared to a standard set of reference values. The difference between the values was noted and sent to a PID controller as an error signal so that the required amount of power could be transferred between the grid and the inverter. For this project, I used the microcontroller unit of Texas instruments and the Solar library to implement various components of the project giving me a good amount of knowledge of these concepts. I was also able to understand and appreciate the applications of Clarke and Park transformations in the field of power electronics.

After completing my undergraduate studies, I was interested in understanding the role of PLCs and embedded systems in the automation industry and the interfacing of various electrical systems, interfaces, and devices with embedded systems. As the newer industrial plants of the Hindalco Industries are popular for possessing exceptional automation infrastructure, I decided to take up a job here as a Graduate Engineer Trainee. In this position, I got the opportunity to visit various branches of the company including alumina plants, smelter plants, and flat rolling plants. I was able to understand all

the processes that took place in these plants in great depth thus getting an extensive overview of the entire aluminium manufacturing process. Apart from this, I got useful information on how PLCs were deployed on real time operating systems making the entire unit highly automated.

My work experience at Hindalco Industries has intensified my interest in embedded devices and I am deeply curious to learn about the design and development of various RTOSs and design of embedded system technologies for industrial automation, which I intend to achieve through a postgraduate education in Electrical Engineering. After completing my higher studies, I want to focus on bringing about automation in industries involved in the manufacturing of hazardous substances such as phosphene and naphthalene through the use of PLCs. Eventually, I would like to work as an Embedded Systems Engineer involved in the development of device drivers and RTOSs for implementing automation infrastructure at a large-scale industrial level.

In order to fulfill my goal of exploring the field of embedded system technologies, I wish to take up a postgraduate program in Electrical Engineering with specialization in Embedded Systems at _____ University. The numerous research projects that I have worked on and the internships I have attended during my undergraduate period have given me a strong command over the concepts. I now wish to deepen my understanding of the field and become up-to-date with the most recent trends in the field of embedded systems. I intend to acquire a strong technical skill set by pursuing several exciting and challenging projects at your state-of-the-art research facilities. Being guided by accomplished faculty such as _____ and _____ at your premises will help me take my projects to the next level and acquire a more comprehensive understanding of the field.

My experiences in using my knowledge and skills for research projects in my field of interest have given me a strong knowledge of my subjects, and I am confident that my aptitude and passion for the field will help me stand out at your campus.