Internship Report Cover Sheet

Last name, first name: Chowdhury, Priontu
Class: 2023
Major: Electrical and Computer Engineering
Internship Institution: Bosch Engineering GmbH **(Motorsport Department)**
Internship Position: Embedded Software Engineering
Internship Duration: From: 01/06/2022 **(DD/MM/YYYY) To:** 31/08/2022 **(DD/MM/YYYY)**
Type of Internship: (selectable) Company
('Research Institute,' 'Company,' 'Governmental Organization,' 'Non-Profit Organization,' 'Other')

Brief Description of Hosting Institution/Company:

Bosch Engineering offers comprehensive engineering services for an efficient, safe, and connected mobility. They develop tailor-made solutions from the initial phase right up to series production independent of the actual production numbers needed.
The service portfolio includes the development of systems, functions, and software for powertrain, safety, vehicle dynamics and infotainment systems – as well as their electrical and electronic integration.

Brief Description of Department at Hosting Institution/Company:

As a partner, supplier, and sponsor, Bosch Motorsport supports crews and racing teams worldwide with customer-specific consulting services and high-quality motorsports technology. Bosch Motorsport develops and distributes both complete electronic systems and individual components for the world's most prestigious racing series, such as F1, Formula E, WEC, WRC, DTM, and NASCAR. Bosch Motorsport customers receive tailored solutions with all the benefits of the Bosch Group's tried-and-tested volume-production technology, quality standards, tools, and work processes.

Sector: (selectable) Automotive, Electronic Industry, Sports, Engineering, IT, Telecommunications
(Advertising / Aerospace/ Associations/ Automotive/Banking, Insurance, Finance, Law/Chemical Industry/ Consulting/ Consumer Goods/ Culture, Arts, Sports/ Electronic Industry/ Energy, Utility/ Engineering and Construction/ Environment/ Foundations/ Government, Politics/ Health/ IT, Telecommunication/ Logistics/ Media/ Medicine/ Nutrition, Food Industry/ Real Estate/ Textile Industry/ Tourism/ Trade)

City: Abstatt, Baden-Wuttemberg **Country:** Germany
Supervisor's name: Mr. Joerg Eesmann
Supervisor's position: Software Engineer, Motorsport Engineering

Final Evaluation:
In this section, please evaluate the following aspects of your internship (make a cross in the relevant box):
(1 = not important / not good at all / not relevant at all,…., 5 = very important / very good / very relevant)

	1	2	3	4	5
The relevance of this internship to your major					x
The relevance of this internship to your personal career goals				x	
The quality of supervision at your internship					x
The quality of the work environment at your internship				x	
Your **overall satisfaction** with your internship experience				x	

We would like to make this Internship Report available to your peers (accessible only by Jacobs University account holders) to support their internship and job search. Please indicate if you agree to this or not:
_x_ Yes
__ No, because: _____

Internship Report

Application Steps:

The pressure for finding an internship started building up from the beginning of the second year – it was an absolute necessity for my timely graduation. At the onset, it was not something of great importance – I still had time, of course. However, by the middle of the third semester, I realized that the pressure from my courses had built up beyond my capabilities – and after consulting with my struggling classmates I wondered if it was indeed beyond human capabilities as well. However, one thing was certain – it would be impossible to even think about internships anymore. This meant, when fourth semester started, my life was toppled over by a flurry of emergency job applications. I responded to every relevant job posting and took all the help I could muster. I consulted seniors who had experience with this and tried to come up with the best excuse I could find for a CV as fast as possible, and then I consulted the CSC to add the finishing touches with some professional help. All of this took about a month, and all this time I kept applying to jobs knowing the results won't be very satisfying – but I felt like it would be better to keep applying while I improved my profile. By the time I came to a good standing with my profile, it was time for the career fair. I had attended the fair the year before, during which time I was clueless and did everything wrong, but I learned a lot from the experience – and it helped me do better this time. I signed up for 1:1 sessions with most of the companies attending the career fair, including FHR, Vector Foiltec, Evonik, Microsoft, TNG, Hubspot, Berata, Rentschler Biopharma SE, Fricke Holding GmbH, d-fine GmbH, Huawei, KPMG, Makersite GmbH, UsmanRamay.ORG, Acronis, HANSA-FLEX AG, ATLAS ELECTRONIK GmbH, and so on. Only the first 6 accepted, and it was a busy day spent with just them. It seemed like I had a good chance with Evonik and TNG, and I only needed to apply. In the meantime, I was working on what seemed like the hundredth application on LinkedIn, which included companies like Bosch Motorsport, QT, Baxter, Teamviewer, BMW, Luxoft, statworx and many others I can't remember the names of. Before I could complete my Career Fair applications, I was contacted by QT, FHR, Baxter, Bosch, and Hubspot. I didn't do very well in most of my interviews, but by the end, I had offers from Bosch Motorsport

and FHR, which went fairly well. Bosch provided me work in the Motorsport Data Acquisition Team as an Embedded Software Engineer, and FHR provided me the opportunity to work as an FPGA Programmer. I found the former position to be more interesting and chose to work at Bosch, because it was more relevant to my studies. It allowed me to work on the Bosch LTE Telemetry system, and it required understanding of electronics, communications, signals, systems, and C and C++ -- all of which were topics we dealt with regularly in ECE. This gave me a very wholesome view of the electronic product development cycle in Motorsport, and also gave me some hands-on experience on framework development for these devices.

The Organization:

Bosch is one of the largest suppliers of automotive parts and systems in the world, and it's also a very well-known provider of Home Appliance products. Its products range from motor vehicle parts and security and microelectromechanical systems to household appliances and power tools. It is a multinational engineering and technology company known for its excellent electronic products and solutions. Here, I saw an opportunity to truly apply myself and make full use of my knowledge in electronics, signals, systems, computer programming (C and C++), FPGA Programming (Digital Design), algorithms, data structures and especially communications. I also found myself resonating with the company objectives and values, and that convinced me to accept this offer.

The Bosch Group is a leading global supplier of technology and services. It employs roughly 402,600 associates worldwide. Its operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. As a leading IoT provider, Bosch offers innovative solutions for smart homes, Industry 4.0, and connected mobility. Bosch is pursuing a vision of mobility that is sustainable, safe, and exciting. It uses its expertise in sensor technology, software, and services, as well as its own IoT cloud, to offer its customers connected, cross-domain solutions from a single source. The Bosch Group's strategic objective is to facilitate connected living with products and solutions that either contain artificial intelligence (AI) or have been developed or manufactured with its help. Bosch improves quality of life

worldwide with products and services that are innovative and spark enthusiasm. In short, Bosch creates technology that is “Invented for life.”

Bosch’s mission statement involves the aim to secure the company’s future by ensuring strong and meaningful development and preserving its financial independence. Culture, innovation, quality, and global presence are the core strengths of Bosch. This company values responsibility, sustainability, initiative, determination, openness, trust, fairness, reliability, credibility, legality and diversity.

Bosch’s competitors include companies such as DENSO, Panasonic, Continental, Siemens, Valeo, Whirlpool and so on, and competitively it is at a very good position. The company generated total revenue of around 78.8 billion euros in 2021. Despite having a large international presence, Europe remains Bosch’s main market, contributing more than 50 percent to the company’s total revenue in 2021.

The Internship Position:

I was hired by the Motorsport Department at Bosch Engineering GmbH (Bosch Motorsport). As an Embedded Software Engineer for the Motorsport Data Acquisition Team, I was tasked with developing a framework for the log data analysis of the system log data of different electronic devices that were used in the race cars. All these devices communicate with each other through the Bosch LTE Telemetry system, and the devices themselves are made on FPGA and programmed with C. Bosch required someone with a background in electronics, FPGA, signals, systems and communications, who also understood C, C++, Python, algorithms and data structures – so that the candidate could recognize how the electronic devices and the telemetry system worked and use that to develop a framework for this system. Considering all of this, I was the perfect candidate because by then I had taken courses like Electronics, Signals and Systems, Communications, Programming in C and C++, Algorithms and Data Structures, Digital Signal Processing, Digital Design, General Electrical Engineering and Numerical Methods – which were mandatory courses for my ECE Major. These courses gave me exposure to all the required knowledge for this position.

I mostly worked in the Motorsport department, and my daily tasks involved developing the framework and obtaining further understanding of how the devices and the LTE system worked. My goal was to provide them

with a fully functioning framework by the end of my term at Bosch. The framework would be able to obtain the log data from the devices, parse them and extract the meaningful chunks of data, and provide reports in desired formats (html, pdf, txt etc.). It would also be able to perform analysis by looking for important clues within the data.

I had meetings with my supervisor every day, during which time he would provide me feedback on my work and assign me new tasks. The feedback was very useful considering I was developing the framework based on his design plans. This specific project was named the Syslog Analysis Framework, and this was my core focus during my term at Bosch Motorsport.

Difficulties and Problems:

One of the most important things I realized during my internship is that industry is very different from academia. At work, I was required to know everything I learned throughout my major and more, but having knowledge of things well enough to obtain a good grade was not sufficient. I required enough dexterity to understand them like the back of my hand.

From time to time, I struggled to understand when my supervisor would talk about the structure and design of electronic devices, the programming that went behind them, the communications structure and how everything was linked, and the design of the framework. I wouldn't understand parts of the information and some knowledge gaps were apparent, which made it difficult to retain most of it. But at the end of the day my supervisor was my main source of information and contact because he was in charge of this project and I was mostly handling this project alone under his supervision. Therefore, I would ask as many questions from him as possible and let him know directly if I didn't understand something. I was lucky that he wouldn't get annoyed and made every effort to help me through any difficulties I faced.

Language and culture were not issues in my work, but they did create some shortcomings in my overall experience. I would feel left out when my colleagues talked in German during lunch or other times we were hanging out, and most times it was difficult to communicate with other colleagues because I wasn't sure about

the right approach. However, there aren't any memorable misunderstandings that might have occurred because of this.

Work Environment:

Bosch campus in Abstatt is very beautiful. The campus is very large and nicely designed, and it's placed in an area that is very scenic. It was also an exciting time because I came across some of my favorite cars at the Bosch campus. My supervisor was very nice, and he was very helpful to me through every roadblock I faced. However, it was somewhat hard for me to communicate or network with other colleagues from the department. Bosch has a very healthy work environment, and I found everyone to be very friendly with me and each other. However, I believe I wasn't sufficiently well equipped to carry myself in a German workplace. I found myself falling short when it came to understanding numerous social norms and cues that were common knowledge for others. I feel like this is predominantly an effect of being a bookworm for the last two years, which has created a gap in my social development. Additionally, very few people would come to office in my department, which was an after-effect of COVID, so there were few opportunities for interaction.

However, everyone around me was very caring towards me the whole time. I had every support I required from my superiors and my colleagues whenever I required it. My relationships with my colleagues and my supervisor developed very well, and I still keep contact with them all the way from America.

Evaluation:

At Bosch, I learned a lot about how electronic devices and appliances are developed, with a large focus on embedded software engineering. I obtained exposure on hardware and software side development of electronic devices, and developed a framework for log data analysis for these devices. An embedded software engineer is a cross between a software engineer and an electrical engineer, which made this knowledge a requirement. Having this background allowed me to tie together all my academic and technical knowledge that I received throughout my ECE major and learn how to use them to develop useful and meaningful products that people can use in their daily lives. I became more confident in my work and found myself becoming passionate about

Embedded Software Engineering – realizing in the process that this is something I am prepared for and would like to pursue as a career.

The internship also helped me realize that gaps in my personal and professional development. I learned that I need to develop better communication skills and sharpen my technical skills and knowledge. As a result, I feel like I should become more outgoing, so that I can develop more social skills and learn how to interact with others. Moreover, in order to develop my technical skills, I'm thinking about pursuing a Master's in Embedded Software Engineering or similar fields. Furthermore, I feel like I should also pursue more jobs in this field to earn more professional experience.

For the future, I see myself working hard to fill any shortcomings and do my best to become a skillful engineer. This internship has been a great experience and an excellent learning opportunity, and I recommend anyone interested in Embedded Systems and Communications to pursue similar opportunities.