

INTERNSHIP REPORT

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Submitted to: Mr. Hiron Bose

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# Acknowledgment:

I would like to express my sincere gratitude to CDAC, Thiruvananthapuram for providing me with the opportunity to undertake my internship at their esteemed institution. This internship has been an invaluable experience, and I am thankful for the support and guidance I received throughout my time here.

I extend my heartfelt thanks to Mr. Hiron Bose for their mentorship, patience, and valuable insights during my internship. Their guidance has played a pivotal role in enhancing my skills and knowledge in the field of IoT and embedded Technology. I am truly appreciative of their dedication and willingness to share their expertise.

I also want to thank the entire team at STDC, CDAC for their warm welcome, cooperation, and willingness to include me in various projects and activities. The collaborative environment at CDAC has been instrumental in my professional growth, and I am thankful for the opportunity to work alongside such talented individuals.

Lastly, I want to express my gratitude to my academic institution, VIT, Vellore, for facilitating and encouraging this internship. The knowledge and skills I have gained during this period will undoubtedly benefit me in my future endeavours.

In conclusion, this internship has been a valuable stepping stone in my career, and I am grateful to everyone who has contributed to my growth and learning. I look forward to applying the knowledge and experiences gained here to my future endeavours.

Thank you all for your unwavering support and encouragement.

Sincerely,

Mahadevan Syam

Vellore Institute of Technology, Vellore Campus

30th September 2023

# Information about the company:

The Centre for Development of Advanced Computing (C-DAC) Thiruvananthapuram is a research and development (R&D) institute located in Thiruvananthapuram, Kerala, India. It is one of the 16 regional centres of C-DAC, which is a premier R&D organization under the Ministry of Electronics and Information Technology (MeitY), Government of India.

C-DAC Thiruvananthapuram was established in 1988 and has been working in the areas of advanced computing, networking, VLSI design, embedded systems, software development, and IT education. The centre has a strong team of experienced researchers and engineers who are working on cutting-edge technologies.

Some of the key areas of research at C-DAC Thiruvananthapuram include:

* High performance computing
* Grid and cloud computing
* Multilingual computing
* Cyber security
* Power electronics
* ASIC design
* Underwater electronics
* Intelligent transportation systems

The centre has developed several innovative products and solutions in these areas. Some of its notable products include:

* PARAM Padmavathi, a supercomputer
* Mitra, a cyber security product
* Power++, a power electronics product
* SeaShell, an underwater electronics product
* ITS++, an intelligent transportation system product

C-DAC Thiruvananthapuram also offers a number of training programs in the areas of advanced computing, networking, VLSI design, embedded systems, and software development. These programs are aimed at students, professionals, and entrepreneurs.

The centre has received several awards and recognitions for its work. In 2020, it was awarded the National Award for Excellence in IT by the Ministry of Electronics and Information Technology.

Overall, C-DAC Thiruvananthapuram is a leading R&D institute in the field of advanced computing. It is playing a significant role in the development of advanced technologies in India.

# Information about the internship position:

While doing internship at CDAC, Thiruvananthapuram, I had the role of a project intern. I was first asked do familiarise myself with the concepts and protocols implemented in IoT. The reference textbook used was **Practical Python Programming for IoT** by **Gary Smart.** The topics for familiarisation included:

* Linux interface and terminal commands
* Raspberry pi 4 pin configuration
* Interfacing sensors and actuators with the different port pins available in the raspberry pi
* Understanding and implementing the concepts of RESTful API and Web Sockets using FLASK
* Implementing IoT Communication protocol MQTT and understanding the functioning of Mosquito MQTT broker
* Interfacing various analog electronics components with raspberry pi such as ADC, relay, optocoupler and many more
* Advanced IoT concepts such as Threads, AsyncIO and Event loops
* Get an understanding about IoT visualization using platforms such as IFTTT, ThingsBoard many more.

During my internship, all the above mentioned topics were covered and many mini projects were also implemented. Further, I was asked to make project on IoT based health automation where data would be collected using the sensors integrated to a Raspberry pi 4, stored in MySQL database, transferred over the web for remote access using the communication protocols and visualisation of the data using a web client. The project was made and submitted in the stipulated time.

# Description of internship experience:

In the first couple of days of the internship, I was asked to study all the major Linux commands, understand the concepts of raspberry pi OS, have a good understanding of python programming and how to write python code in Raspbian OS. All the programs were written in a virtual environment using pip as interpreter. Next, I went on to study pin configuration and pin programming.

After these, I started integrating sensors and actuators with Raspberry Pi. Basic circuits were made at first which were then simulated using python code written in the terminal window of Raspbian OS. Once I got to understand the basic coding syntaxes, I went on to learn about the service known as dweet**.**io**.** This service is based upon RESTful API and works by sending requests to the receiver device. Using this service, I made programs where the actuators integrated with the raspberry pi can be controlled using a device anywhere around the world by sending dweet requests. Here I started learning how to integrate web services and https requests to python programs. Further, I also understood how to program the raspberry pi using two packages for the pin configuration, that is the PiGPIO and GPIOZero packages leveraging on their respective strengths.

After these, I went on to understand the concepts of flask microservice framework, how to create RESTful API using flask, how to make a RESTful API client webpage, how to create a Web Socket service with Flask-SocketIO and how to make a WebSocket client web page. Hence, I learnt how to initialize the flask framework, how http requests need to be handled, displaying the website using HTML, JavaScript and jQuery and implementing the Web Socket service. After this, I went on to understand the concepts of MQTT, how to use Paho MQTT client library using python and their implementation in real world devices. Thus, through these, I went on to understand how IoT devices can be connected to servers etc.

After understanding all these important concepts, I started on working on the project assigned to me. The details of the project are given in the coming pages of the report. The project was done in the given time and submitted.

Overall, this internship helped me gain real world knowledge of IoT devices and protocols, their implementation and visualization in devices and many more. This internship helped me get a basic a basic understanding of the concepts such as FLASK Framework, REST API and WebSocket, MQTT Communication protocol, MySQL database, Integrating PHP script in HTML codes, Linux commands and user interface and advanced python programming.

# Description of Project:

As a part of being a project intern at CDAC, I was asked to make a IoT based healthcare monitoring system for remote access of patient health data by the health care professionals. During the project, I had to:

* Reference multiple research paper for clear understanding of the project
* Integrate multiple sensors to a Raspberry pi 4.
* Use python script to collect sensor data and store them into MySQL database.
* Establish a local server.
* Create a website using HTML, CSS, and PHP to display the values in the MySQL database.

The Hardware devices used include:

* Raspberry Pi 4
* Sensors which included DHT 11, Ultrasonic sensor and MAX30100 Pulse Oximeter and heart rate Sensor.

The Software technologies used included:

* Python for collecting data.
* MySQL using MariaDB for storing the collected data.
* Apache server for hosting a local server
* HTML, CSS and PHP script for displaying the data inside the MySQL database.

# Conclusion:

In conclusion, my one-month internship at CDAC Thiruvananthapuram, under the mentorship of Dr. Hiron Bose, has been an invaluable learning experience. During this time, I had the privilege of working as a project intern on the development of an IoT-based health monitor using a combination of cutting-edge technologies such as Raspberry Pi, Python, MySQL, Apache, HTML, CSS, and PHP.

Throughout this internship, I was exposed to a dynamic and collaborative work environment where I had the opportunity to apply and enhance my technical skills. I was actively involved in various aspects of the project, from designing the user interface to implementing the backend functionalities, and I was able to witness the entire project lifecycle firsthand.

One of the most significant takeaways from this internship was the exposure to real-world applications of IoT technology in the healthcare sector. It allowed me to gain a deeper understanding of how technology can be leveraged to address critical healthcare challenges and improve patient well-being.

Working closely with Dr. Hiron Bose and the CDAC Thiruvananthapuram team was a privilege, as their guidance and mentorship played a pivotal role in my professional development. Their expertise and willingness to share knowledge greatly contributed to my growth during this internship.

Furthermore, this experience enhanced my problem-solving skills, teamwork, and communication abilities. It also reinforced the importance of adaptability and continuous learning in the rapidly evolving field of technology.

In conclusion, my internship at CDAC Thiruvananthapuram has been a transformative experience, and I am immensely grateful for the opportunity. I look forward to applying the knowledge and skills I have acquired here in my future endeavors and am excited about the possibilities that lie ahead in the world of IoT and healthcare technology. I extend my heartfelt thanks to Dr. Hiron Bose and the entire CDAC Thiruvananthapuram team for their support and guidance throughout this enriching internship journey.