Symbiosis Skills and Professional University

Village – Kiwale, Adjoining Pune Mumbai Expressway, Pune –412101, Maharashtra, India

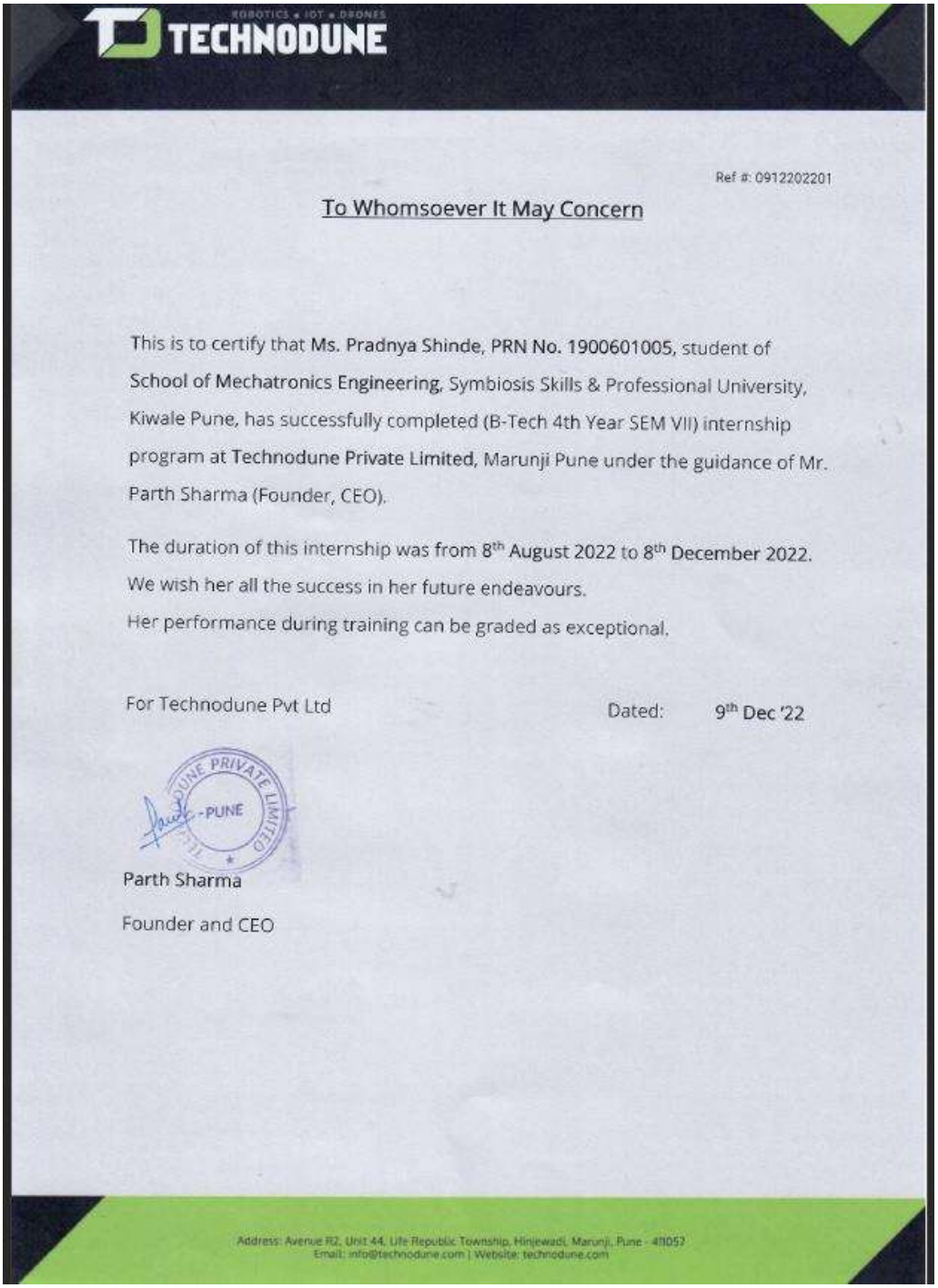
4-Months Internship Report
On
Industrial Training
At
Technodune Pvt. Ltd.

Submitted by:
Pradnya Shinde
PRN: {*1900601005*}
Final Year B.Tech Mechatronics {SEM VII}
A.Y. 2022-2023

Under the guidance of

Industry Mentor: *Mr. Parth Sharma*
Faculty Mentor: *Prof. Jahida Subedar*

CERTIFICATE



ROBOTICS • IOT • DRONES
TECHNODUNE

Ref #: 0912202201

To Whomsoever It May Concern

This is to certify that **Ms. Pradnya Shinde, PRN No. 1900601005**, student of **School of Mechatronics Engineering**, Symbiosis Skills & Professional University, Kiwale Pune, has successfully completed (B-Tech 4th Year SEM VII) internship program at **Technodune Private Limited**, Marunji Pune under the guidance of Mr. Parth Sharma (Founder, CEO).

The duration of this internship was from 8th August 2022 to 8th December 2022.
We wish her all the success in her future endeavours.
Her performance during training can be graded as exceptional.

For Technodune Pvt Ltd

Dated: 9th Dec '22

TECHNODUNE PRIVATE LIMITED - PUNE

Parth Sharma

Founder and CEO

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ACKNOWLEDGEMENT

I, Pradnya Shinde, the student of Symbiosis skills and professional University studying in B.Tech (SEM VI) Mechatronics engineering express my heartfelt thanks to **Technodune Private Limited** and Symbiosis Skills and Professional University for providing me the opportunity to undertake these 8 weeks internship. I am also thankful to my faculty mentor **Prof Jahida Subedar** without whose support I would not have been equipped with the sufficient knowledge to undertake this training. I also thank placement department to help me avail this opportunity.

I express deepest sense of gratitude to **Mr. Parth Sharma** for his careful and precious guidance which extremely valuable for my study both theoretically and practically.

I perceive this opportunity as a milestone in my career development. I will strive to use gained skills and knowledge in best possible way to attain desired career objectives. Hope to continue cooperation with all of you in the future.

(Signature)
Name of student: Pradnya Shinde
PRN: 1900601005

TECHNODUNE

Technodune is a young startup, started by Mr. Parth Sharma aimed at churning out next-gen technology through innovative products which shape the future. Channeling our passion through constant innovation and expertise, they help take you one step ahead into the future. Technodune paves the way for wide-ranging verticals and use-cases.

Technology has constantly been evolving and changing the lives of people around the world. Technodune Team was born from the need of providing an answer for common and underlying necessities. They make life simple one step at a time. They provide you with the best solutions for problems pertaining to the industrial and commercial environment.
They exist to bring about change, they exist to inspire, and they exist to create something that goes beyond the ordinary. Not a single product has been made for the sake of conventional existence, it is to introduce a new cutting-edge technology that leaves behind a legacy. By upgrading existing technology to a more efficient one, they ensure minimum wastage maximum operating ability.

They believe in empowering the masses- including both businesses and people. For mass empowerment, state-of-the-art technology is a prerequisite. An independent and tight-knit business focused headquartered in Pune, India; Technodune is a 100% founder-owned firm. We build communities, create solutions, and truly believe in collaborating, networking, and socializing.

ABSTRACT

This report consists of a brief explanation of everything that I learned during the internship period from 8th August, 2022 to 8th December 2022 as a **Robotic and IoT intern** at Technodune Private Limited.

For the 4 months of my internship, I worked on variety of concepts of Robotics Engineering – Robot Kinematics, Mechanical Design, Machine Learning Fundamentals, Sensor and Microcontroller Integration, Robot Sensing and Perception.

With regards to my long-term goal of specializing in Robotics and AI, Technodune has provided me with ample amount of theoretical as well practical knowledge related to the same. I was also introduced to IoT related applications, thereby providing me with knowledge of embedded systems.

PROJECT BIONIC ARM

{Project duration: June'22-July'22 & Oct'22-Nov'22}

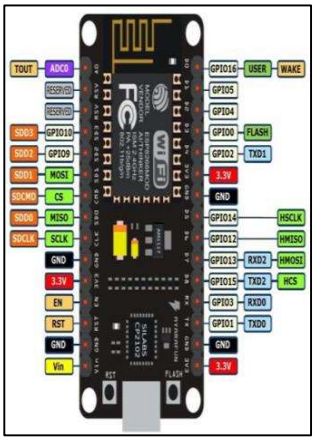
HARDWARE:

- The bionic arm consists mainly of two sections: The arm and the hand.
- The arm has three movements:

1. Roll (Wrist Joint)
2. Pitch (Wrist Joint)
3. Elbow Movement

- The hand has five finger joints.
- The bionic arm is printed using ***Ender-3*** 3D printer. Material used is ***PLA***.
- The design of the arm is inspired by Youbionic company and is modelled and assembled in ***Solidworks 2021***.
- Controller:

NodeMCU ESP8266



PINOUT

- The Bionic Arm is controlled using a Web interface.
- ***ESP 8266*** allows wirelss communication between the arm and the Web interface using WebSocket Protocol.
- The Web Interface is designed and developed using JavaScript and CSS in Virtual Studio IDE.
- ESP 8266 is programmed in Arduino IDE.

- Actuator:

TowerPro ***MG945*** Servo Motor 180 degrees (Fingers)

TowerPro ***MG995*** Metal Gear 180 degrees (Pitch and Roll)

Orange ***OT5325M*** Metal Gear 180 degrees (Elbow)

- Servo Motors move within the range of 0-180 degrees.
- They have three wire connections: 5V, GND, Signal.

SOFTWARE:

SETUP:

- The project is developed in ***C/C++*** language on Arduino IDE.
- While programming, safe mechanical limits of each joint were noted.
- Adhering by these limits, neutral and default servo position values were given.
- During startup and shutdown, the servos were programmed to reset to their neutral positions in order to ensure a safe mechanical position for the arm to rest in.
- Default servo positions were set with consideration to the actual servo limits.
- <***Servo.h***> is the primary library used for Servo operation.
- Data is received by the ***ESP8266*** from the Web Interface in form of an array string.
- The string consists of 8 desired servo positions separated by a delimiter(,).
- Then the string is parsed and individual joint positions are assigned.
- <***WebSocketsClient.h***> and <***WiFi.h***> are the two libraries used to execute WebSocket Protocol.
- ***ESP8266*** creates its own WiFi Hotspot with a specified SSID and password.
- Web Interface consists of image of the arm and its marked joints.
- Each of these joints have draggable sliders displayed on them.
- As each of the sliders is dragged, the selected joint moves accordingly.

CALIBRATION:

- Arm was calibrated to note down the upper and lower limits of each joint.
- A Keyboard test code was used.
- With the help of up and down arrows, each joint was moved to visualize the mechanical upper and lower limits.
- These limits were then noted down in order to map them on the sliders used on the Web Interface.

Once the initial setup and calibration was done, the arm was tested for operation.

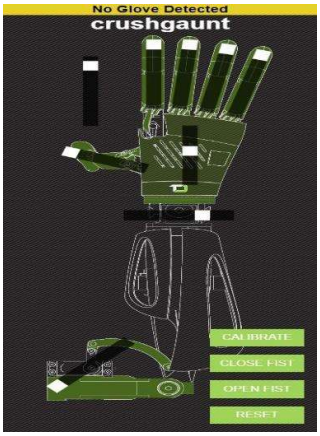
CONTROL:

GLOVE:

- A gesture-based glove operated using flex sensors.
- ESP8266 mounted on the glove is responsible for sending the analogue values of flex sensors over to the arm.
- The arm moves in accordance with the bend sensed in the glove.

WEB INTERFACE:

- The Bionic Arm was controlled wirelessly using a Web Interface.
- The Web Interface was designed and developed using CSS and JavaScript.



Reset: Resets the servos of the arm to neutral positions.

Close Fist: Fingers move in coordination to form a closed fist.

Open Fist: Fingers move in coordination to form an open fist.

Calibrate: Performs calibration of glove worn by the user

- Above mentioned operations are executed by the defined functions in the program.

HIGHLIGHTS:

- The ***first Bionic Arm*** {Version I} was developed and tested during ***June'22 – July'22*** internship period.
- Order for ***three Bionic Arms*** was received. They were developed and delivered during ***Oct'22 -***

Nov'22.

- The arms were featured in a tech-fest conducted by Symbiosis Institute of Technology and were also displayed at a Robotics Show in the UK.
- ***Version I*** had several design flaws which would be corrected in ***Version II***.
- One of the design flaws was to do with the grasping capacity of the fingers. Each of the fingers have a single degree of freedom and hence limited range of motion.
- In order to overcome this, a design solution of having a spring as the middle joint of fingers, was proposed.
- The first Bionic Arm makes use of Arduino Nano for servo operation. This was replaced by ESP8266 in other arms.