Technical Design Report: Toothless V1.0 (TechSpectra 2.0: Project Showcasing)

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1. Introduction

1.1 Background:

Toothless, the Scout Bot V1.0, takes its name from a real-life experience during its creation. One of the team members faced a severe tooth problem, inspiring the name "Toothless" as a testament to resilience and determination.

1.2 Project Objectives:

Toothless, a symbol of innovation, addresses the unique challenges faced by communities in Bangladesh. Its objectives include:

- **Scout and Navigate:** Toothless is designed to navigate and explore challenging terrains, providing access to areas difficult for humans to reach.

- **Data Collection for Disaster Response:** Toothless aims to collect crucial data on temperature, water levels, heat, fires, harmful gases, and pathway structures, contributing to disaster response efforts.

- **Infrastructure Assessment:** Post-disaster, Toothless's ability to assess structural damage is crucial for quick and efficient rebuilding efforts.

1.3 Significance for Bangladesh (Impact):

Toothless directly tackles the urgent issue of disaster resilience, providing a tailored solution for Bangladesh's unique environmental challenges. By offering a sophisticated means to navigate difficult terrains and gather critical data, Toothless significantly advances disaster preparedness and recovery efforts, setting a new standard for innovative, impactful disaster response strategies.

2. Hardware Overview

2.1 Chassis:

The robot features a sturdy chassis made from wood, designed to withstand rough terrains. This choice of material balances weight, durability, and flexibility.
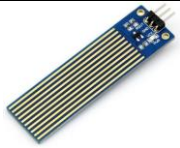
2.2 Arduino Uno #1

Bluetooth and Motor Control: Arduino Uno #1 is dedicated to controlling the Bluetooth module (HC-06) for communication, motor control for the wheels, and an IBT2 motor driver.
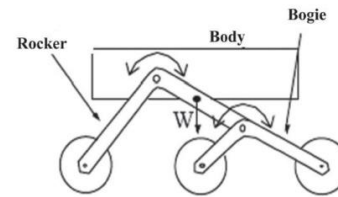

2.3 Arduino Uno #2

Sensor Control: Arduino Uno #2 manages various sensors:

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• Ultrasonic Sensor (HC-SR04) for distance measurement.	
• Liquid Level Sensor for water level detection.	
• Gas Sensor (MQ2) for detecting harmful gases.	
• 5-way Flame Sensor for fire detection.	

2.4 Rocker Bogie Mechanism:

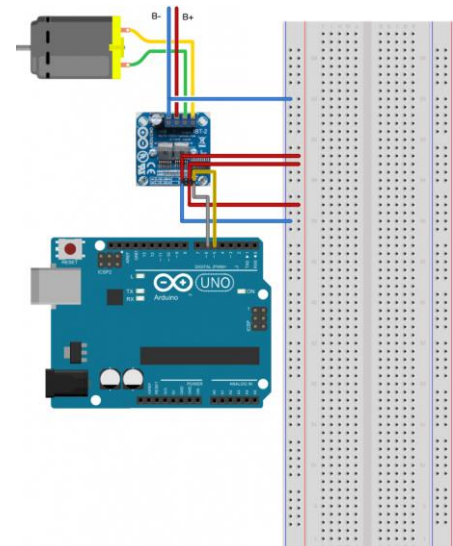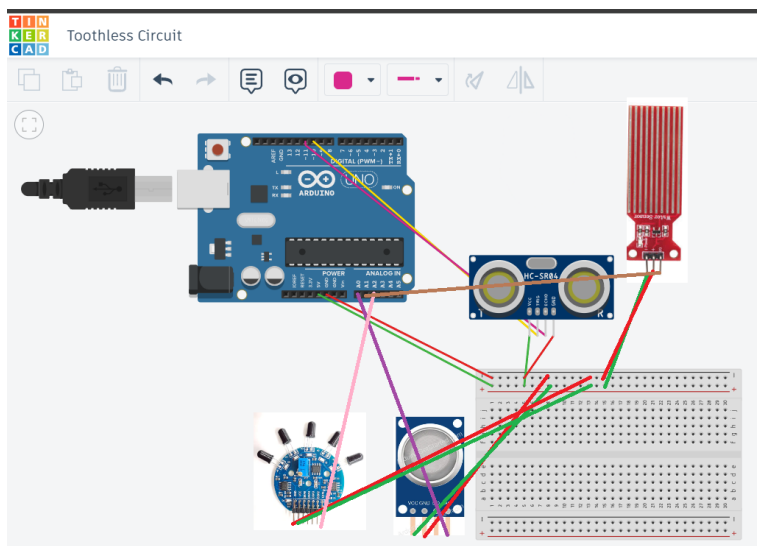| The rocker bogie suspension system, crucial for enhanced mobility on challenging terrains, is also crafted from wood.	D Line diagram of Rocker-bogie suspension system and its motile joints.

2.5 Tinkercad Design:
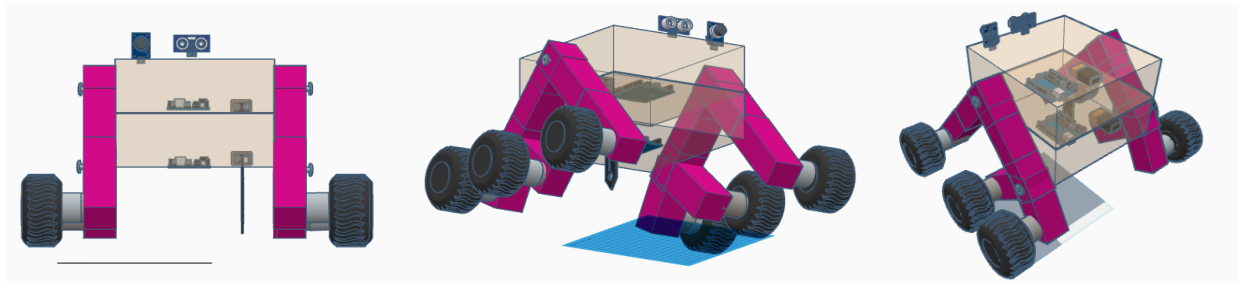
2.6 Circuit Diagram:

2.7 Power System:

The motors of Toothless are getting powered by 11.1v lipo batteries and a power bank powers the Arduino's providing a portable and compact power source.

2.8 Future Integrations:

- An ESP32 will be integrated to provide autonomy and will enhance the robot's vision capabilities.

- The addition of a GPS tracker to Toothless can significantly enhance its navigation accuracy and reliability

2.9 Financial Details:

Component	Price (Taka)
1) Arduino Uno	700X2=1400
2) Liquid Level Sensor	450
3) Ultrasonic Sensor (HC-SR04)	93
4) Gas Sensor (MQ2)	150
5) 5-way Flame Sensor	290
6) Chassis (wood)	2600
7) Bluetooth module (HC-06)	290
8) Wheels	450X6=2700
9) IBT2 motor driver	670X2=1340
10) Motor	2000X6=12000
11) Lipo battery	2100
12) Jumper wires (Female to Male)	140

Total:	**23553**

3. Conclusion

Toothless, with its wooden chassis and integrated systems, symbolizes resilience and innovation in robotics. The project's future upgrades, including autonomous capabilities and camera integration, aim to enhance its performance and contribute more effectively to disaster management. Toothless is not just a robot; it is a technological asset that holds great importance for the people of Bangladesh, addressing specific challenges faced by the nation in disaster-prone areas. As technology meets resilience, Toothless signifies a promising.