**Individual Report**

Project Title: **Portable Water Quality Monitoring Device**

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**My Role in the Project**

I played a key role in organising and managing our team’s Water Quality Monitoring System. My primary responsibility was to set up and continuously update our Trello board, ensuring that tasks were properly assigned, tracked, and completed on time. This allowed our team to work efficiently and maintain a clear understanding of our individual responsibilities. Additionally, I actively participated in every class and group meeting, contributing to discussions and decision-making processes to drive the project forward.

A major part of my contribution was compiling and structuring our Team Report. I ensured that all required sections were included, and I was responsible for researching and writing the “Links to Any Data Gathered or Data Analysis Planned” and “Outline of the Problem, Supported by Research” sections. This required in-depth analysis of academic papers, including:

* **Lakshmikantha, V., et al. (2021).** *IoT-based smart water quality monitoring system.*
* **Sankhla, M.S.,** **et al. (2016).** *Heavy metals contamination in water and their hazardous effect on human health-a review.*
* **WHO (2017).** *Guidelines for Drinking-water Quality.*
* **Koditala et al. (2018).** *Water quality monitoring system using IoT and machine learning.*

I also contributed to the technical development of our Arduino-based project. Along with my teammates, I was involved in coding and troubleshooting the integration of the turbidity sensor and water temperature sensor with the Arduino UNO R4 Wi-Fi and sending real-time data to the Blynk application for remote monitoring.

**Technical Learnings**

Through this project, I have developed new technical skills and strengthened existing ones, including:

* **Project Management with Trello**: I took responsibility for managing and updating our Trello board, ensuring that tasks were effectively assigned, tracked, and completed within deadlines.
* **Arduino and IoT Development**: I gained practical experience working with Arduino UNO R4 Wi-Fi, programming in **C++**, troubleshooting circuits, and integrating sensors.
* **Sensor Integration Challenges**: I encountered issues with the turbidity sensor, which either arrived broken or became defective during our connection attempts. The sensor produced the same readings in air, clean water, and coffee, leading us to order a replacement and troubleshoot extensively.
* **Hardware Compatibility Awareness**: One of our first challenges was that the initial Arduino board we ordered was not compatible with the turbidity sensor due to a voltage mismatch (3.3V vs. the required 5V). This taught me the importance of verifying hardware compatibility before purchasing components.
* **Electrical Circuitry**: I learned that the temperature sensor required additional components, such as specific resistors, and could not be directly connected as initially assumed. This improved my understanding of electrical components and circuit design.
* **IoT Integration & Data Transmission**: By working with Blynk, I gained practical insights into sending real-time data from our sensors to a mobile application, enabling remote water quality monitoring.
* **Debugging & Problem-Solving**: The project required constant troubleshooting, from debugging our Arduino code to fixing hardware issues. I improved my ability to analyse problems systematically and find practical solutions.

**Challenges and Overcoming Them**

Our team faced numerous challenges throughout the project, and overcoming them required patience, creativity, and teamwork. Some key challenges included:

* **Faulty and Incompatible Components**: Our first turbidity sensor was not working properly, possibly due to an initial defect or improper connections. It kept providing the same reading regardless of the water quality, leading us to order a replacement.
* **Voltage Compatibility Issues**: We initially purchased an Arduino board that only supported 3.3V when our turbidity sensor required 5V, leading to additional delays and adjustments.
* **Sensor Connectivity Issues**: We discovered that our temperature sensor could not be directly connected to the Arduino and required additional configuration, including resistors, to function properly.
* **Learning New Technologies**: None of us had previous experience integrating IoT (Internet of Things) and Blynk, so we had to invest time in learning and troubleshooting the connection between Arduino and Blynk to ensure real-time data transfer.
* **Coordination & Time Management**: With multiple moving parts and different responsibilities, keeping track of our progress was challenging. To mitigate this, I actively managed our Trello board, making sure tasks were clearly assigned and everyone was on track.
* **Asking for Help**: There were times when we felt stuck due to technical difficulties, but I learned the importance of asking for assistance. We sought help from experienced peers and resources available online, which ultimately helped us resolve many of our challenges.

**Final Thoughts**

This project has been an enriching experience that has significantly contributed to my personal and technical development. I have learned the importance of meticulous planning, thorough hardware compatibility checks, and effective project management. Additionally, working with a team has strengthened my communication, problem-solving, and collaboration skills. I have learned to be patient and persistent, understanding that encountering obstacles is part of the learning process. While there is still much to improve in our project, our team has made significant progress, and I am proud of our commitment and teamwork. Despite the challenges we faced, we continued to work hard and find solutions, which has been an invaluable learning experience. And despite the fact that there are still a lot of things to work on, this project has further solidified my interest in software development and IoT applications, and I look forward to applying these learnings in my future projects.

**What I Learned from the Project**

From a technical perspective, working on this project allowed me to deepen my understanding of embedded systems and IoT applications. I gained hands-on experience with hardware components such as the Arduino UNO R4 Wi-Fi, which provided me with insights into microcontroller programming. Through integrating the Jopto TSW-30 & SEN0189 Turbidity Sensor and DS18B20 Waterproof Temperature Sensor, I learned about sensor calibration, data collection, and interpreting sensor readings.

Additionally, troubleshooting hardware and software issues proved to be a valuable learning experience. We encountered multiple compatibility issues, such as finding out that our initially chosen Arduino was incompatible with our turbidity sensor and that our temperature sensor required additional components like resistors for proper functioning. Debugging the Arduino code was a team effort, and I was actively involved in testing and refining it to ensure that data from the sensors was accurately transmitted to the Blynk application for real-time monitoring.

Aside from technical learning, I gained valuable skills in team collaboration, communication, and project documentation. Managing the team report, ensuring tasks were completed on time, and keeping everything organised on Trello required clear communication and teamwork. I learned the importance of being adaptabl**e** and overcoming challenges, as we encountered multiple setbacks, such as compatibility issues with different components (e.g., the initial Arduino board incompatibility with our turbidity sensor) and the realisation that our temperature sensor required additional resistors for proper functionality. Each challenge provided an opportunity to improve problem-solving skills and resilience in the face of technical difficulties.

**Conclusion**

Through this project, I have developed practical skills in Arduino programming, sensor integration, and IoT-based data transmission. I have also improved my ability to troubleshoot technical issues and work collaboratively in a team environment. This project has reinforced the importance of clear communication, adaptability, and patience in real-world problem-solving.

Beyond technical skills, our Water Quality Monitoring System contributes to global efforts in achieving United Nations Sustainable Development Goal 6: Clean Water and Sanitation. The ability to monitor water quality in real time can help prevent waterborne diseases and empower individuals to take proactive steps in ensuring the safety of their drinking water. By addressing compatibility issues, troubleshooting hardware failures, and improving our design iteratively, we have made meaningful progress toward developing a reliable and accessible solution for monitoring water quality.

This project has been an invaluable experience in understanding the intersection of software development, IoT, and environmental sustainability. It has reinforced the importance of teamwork, problem-solving, and continuous learning when working on real-world technological challenges. While we encountered multiple obstacles, overcoming them has taught me resilience, adaptability, and the importance of effective communication in a team setting. I believe this project has provided a solid foundation for my future studies and career in software development and embedded systems.