**Key Learnings and Takeaways:**

Working on the autonomous vehicle gave us valuable insight into how complex it can be to design a functional system in real life. Some of the major takeaways we had include;

**Understanding Autonomous Systems**

* Gained practical insight into how autonomous vehicles perceive their environment using sensors like ultrasonic, Infrared and color sensors.
* Learned how decision making is handled through state machines and sensor inputs.

**Sensor Integration Challenges**

* Realized that real world sensor data is noisy and can be affected by environmental conditions (e.g., lighting, surface reflectivity).

**PID Control in Real Life**

* Learned how a PID controller is used to achieve smooth line following.
* Understood the role of tuning kp, ki and kd for optimal movement balancing responsiveness and stability.

**System Thinking**

* Understood the importance of combining hardware, software and control logic into a cohesive system.
* Experienced how small issues in one component (e.g., a sensor) can impact overall system behavior.

**Programming and Logic Development**

* Improved skills in C/C++ programming using Arduino IDE.
* Learned to design modular code with functions, state machines and helper routines.
* Developed debugging skills by using serial output for troubleshooting sensor behavior.

**Project Planning and Iteration**

* Learned the value of testing in stages – first the motors, then sensors and then integration.
* Iteratively refined the system through testing, debugging and improvements.