**CERTIFICATE**

This is to certify that the thesis entitled “Self-Driving Car” is being submitted by Rudranarayan Sahu (Roll No.: 15830V23028), Prabin Kumar Sahoo (Roll No.: 15830V23024) and Soumya Ranjan Panda (Roll No.: 15830V23032) to the Department of Computer Science and Applications, Utkal University, Vani Vihar, Bhubaneswar, for the award of the degree of Master of Computer Applications. It is an original research work carried out by them under my supervision and guidance. In my opinion, the thesis has fulfilled all the requirements as per the regulations of this University and has reached the standard needed for submission. The results embodied in this thesis has not been submitted to any other University or Institute for the award of any other degree or diploma.

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**DECLARATION**

We hereby declare that the work which is being presented in the thesis entitled “Self-Driving Car”, in partial fulfilment of the requirements for the award of the Master of Computer Applications is an authentic record of our own work carried out during the period January, 2025 to May, 2025 under the supervision of Dr. Lalatendu Muduli, Department of Computer Science and Applications, Utkal University, Vani Vihar, Bhubaneswar.

The matters and the results presented in this thesis has not been submitted by us for the award of any other degree elsewhere.

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**ACKNOWLEDGEMENTS**

First and foremost, we acknowledge the Almighty for his blessings and for giving us the strength, courage, wisdom, and moral support during the good and hard times of our project work.

               We would like to thank our supervisor, Dr. Lalatendu Muduli, for giving us the opportunity to undertake this project. We are extremely grateful for his insightful guidance, timely advice, continued support, motivation, and moral support throughout our project work. Especially, we thank him for his kindness and excellent contributions. Few words are too minuscule to convey our deep sense of gratitude for him. It is worth mentioning that without his support and guidance, this project work would not have been possible. It has really been a great honor and privilege to work under his supervision. We would treasure all the quality times and thoughts that we spent with him during the project throughout our lives.

                We would also like to thank all the faculty and staff members of the Department of Computer Science and Applications, Utkal University, Vani Vihar, Bhubaneswar, for their help and support. We are deeply indebted to Prof. Prafulla Kumar Behera, Head of the Department; Prof. Mrutyunjaya Panda, Mr. Haraprasad Naik, Mr. Biswojit Nayak, and Dr. Nibedita Adhikari for their moral support and providing us the necessary facilities for carrying out our project.

                We acknowledge the support received from Mr. Amardeep Das, Assistant Professor, C. V. Raman Global University, Bhubaneswar, for his valuable insights and unwavering guidance throughout our project. We would also like to thank Mr. Rajesh Kumar Sahu, Sr. System Engineer, Infosys, and Mr. Balaram Sahu, Sr. Cloud Architect, DELL, for their technical advice and suggestions for completion of our project. We would also like to thank all our friends for their direct and indirect support and encouragement.

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**ABSTRACT**

Self-driving or autonomous driving technology represents a groundbreaking technical advancement in the field of transportation, artificial intelligence and machine learning algorithms to operate the vehicles by sensing its environment. The development of autonomous vehicle started back in year 1925 where the vehicles were controlled using radio frequency. We have experienced a very substantial changes in theses 100 years. Extensive network guided systems in conjunction with vision guided features is the future of autonomous vehicles. It can be predicted that by the end of this decade the automotive companies will commercially manufacture fully autonomous vehicles with no human assistance.

This thesis presents the design and implementation of a cost-effective, modular self-driving car prototype that integrates real-time computer vision, embedded systems, and IoT functionalities. The system utilizes a Raspberry Pi, ESP32 microcontroller, and L298N motor driver to provide autonomous navigation capabilities, making it an affordable solution for educational and experimental purposes. The proposed system is equipped with a custom-trained YOLOv5 model for traffic sign recognition, real-time lane detection using OpenCV, and advanced safety features such as driver drowsiness and alcohol detection. The integration of a cloud-based monitoring system using ThingSpeak enables remote telemetry and data analysis, enhancing system reliability and scalability.

The mobile application is designed with an intuitive user interface, enabling seamless interaction with the autonomous car's control system. Real-time telemetry data is streamed to the app, providing insights into vehicle diagnostics, environmental awareness, and sensor status. The app also supports over-the-air (OTA) updates, ensuring that new features and improvements can be deployed effortlessly. Security protocols are integrated to safeguard communication between the application and the car, preventing unauthorized access. Furthermore, the modular design of both the mobile application and the autonomous vehicle's system allows for smooth integration of advanced technologies like edge computing and machine learning-based anomaly detection. This architecture not only enhances reliability but also positions the system for scalability in evolving smart city infrastructures. This work also includes a Bluetooth-enabled Android mobile application developed using React Native and Kotlin, allowing for manual control, debugging, and fail-safe operations. The modular architecture ensures the system's extensibility, supporting future enhancements like V2X communication and LiDAR integration.

The results demonstrate the effectiveness of the prototype in real-time traffic scenarios, showcasing its potential as an educational tool and a foundation for future advancements in autonomous vehicle technology. Extensive testing under various environmental conditions highlights the system's adaptability and robustness, ensuring reliable performance in diverse traffic situations. The modular framework allows researchers and developers to experiment with different algorithms and sensor configurations, fostering innovation and learning. These capabilities underscore its value not only as a proof of concept but also as a scalable solution for next generation autonomous vehicle projects.