

Brainstorming on "Two-Wheeler Mobility, Role of Technology"

17th March 2023

The Technology Innovation Hub (TiH) established in IIIT Hyderabad works under 2 heads: Healthcare and Mobility. The objective of the brainstorming held was to improve Two-Wheeler Safety using technological innovation. Autonomous driving using, Artificial Intelligence is the current technology that has impacted operating trends in supporting drivers' safety. However, they are presently available for four-wheeler vehicles. There are significantly fewer papers and research on two-wheeler riding dynamics which brings in a greater need to create a dataset dedicated to motorized two-wheelers. In particular, the dataset concerning driver behaviour on Indian roads can be of interest because of the popularity of two wheelers as a mode of transportation across the country. Thus, an Indian driving dataset (IDD) dedicated for two wheelers is the need of the hour.

On 17th March 2023, we conducted a brainstorming meeting at IIIT Hyderabad campus with a panel consisting of academics, industry experts and Government officials. The panel enumerated some key challenges about 2-wheelers like road infrastructure maintenance issues, heavy traffic and reckless driving. With improving technologies and road conditions, India's accident deaths have steadily decreased over years. However, two-wheeler drivers are still the highest percentage of fatalities.

Technology to lay the path forward on the road safety of two-wheeler riding environment includes improving infrastructure, creating smart accessories (smart helmets), GPS trackers and monitoring and studying the behaviour of the driver under various conditions. This can be done using information like driving speed, frequency of application of brakes, pass distance behaviour and so on. It is also important to study the diverse engine and transmission system parameters under different peripheral conditions. IIIT Hyderabad aims to collect and develop these datasets to better understand the driver dynamics for various road conditions.

For creating these datasets IIIT Hyderabad is coming up with a customized two-wheeler by installing key sensors like accelerometer, gyroscope, GPS tracking, wheel speed measurement, LIDAR, Camera and environmental sensors. Using this, datasets created can be used for studying driver behavioral patterns, road conditions, and driving habits in tight spots. Also, the two-wheeler will be available for researchers across the country to collaborate for data collection and analysis. The two-wheeler will be designed such that

collaborators can install project-specific sensors on board to collect data related to their research.

To this end, there is an open nationwide call for proposals to focus mainly on two-wheeler Safety Technologies, Sensor Technologies, driver safety alerts, accessories, multi-sensors, and vehicle health. (<https://ihub-data.iiit.ac.in/mobility/cfp>)

Research Deliberations

Dr. Deepak Gangadharan elaborated on his team's research on Time series based on event recognition using LSTM, Bi-LSTM with a mechanism aiming to detect specific bad driving patterns and drivers' behavior. This work's vision was to enhance the safety of Two Wheelers through driving event recognition including critical driving events. Hala Mobility founder Srikanth Reddy mentioned trying CNN+RNN hybrid algorithms.

Dr.Kavita Vemuri talked about their research on two-wheeler Safety in Sync with Machine design, driver's physiology, driver's visual attention, environmental conditions. Elaborating, she discussed the centre of gravity (CG) standards that changed in the current markets for two-wheelers. Comparing the driver CG to the vehicle CG, due to the heavyweights of the vehicles, changing the structures of vehicles and seats makes it risky for the rider and pillion too. The manufacturers need to understand this aspect to safeguard the rider on all road conditions, this is where better licensing policies can come in place. Then, there was a study on 2-wheeler- (Scooty) about eye gaze objectivities version of an experienced driver and an amateur, which when analyzed shows that professional riders are more concerned about the pedestrians and prefer being in herds whereas the amateurs more concerned about the vehicles.

Dr.Jaswanth & Dr.Hrishikesh presented their research on the road quality index (RQI) as a numerical score that reflected the level of wear and tear on the road, as well as its overall safety and performance. Using the CNN technique RQI is calculated considering factors such as road conditions, congestion, cognitive distraction, traffic volume and road design. Systems to assist the rider in critical situations and support to avoid accidents.

Dr.Rohit Saluja elaborated about research conducted on counting the number of trees on the road, helmet violations, license plate , pothole recognitions and triple riding cases using GoPro camera where in it highlights all the conditions in a box to enable better visual representation.

Some potential solutions discussed by the panel were:

- Change of skin conductance is a measure while driving a 2-wheeler on a busy street.
- Vehicle-specific attire for high cc 2-wheelers
- Improving the road infra like less potholes, awareness of the roads, better sensors to identify any hindrances on the streets

- *Technology identifying the vehicle condition which can create more significant change for the rider patterns on the road*
- *Intelligent AI vehicle control and sensor networks research to predominantly change the dynamics of the two-wheelers*
- *An Inflatable suit (like an air bag)*
- *Antilock braking system (ABS) can prevent the wheels from locking and enables safe braking, but it needs to become adaptable road conditions*
- *Timely checking the vehicle's health which needs to be in sync with the manufacturers in providing the right parts according to the requirements of the vehicle's usage.*
- *Free helmets from the Government, making helmets mandatory for the rider and pillion, camera fixed in bike console to ensure the rider is wearing helmet.*
- *In-built speed limits in electrical vehicles, Blind spot alerts, 360 degree sensors, depth spacing sensors, statutory rules on changing the vehicle setup monitored at all points.*

Participants

Government/Policy:

1. *Mr.Gopalakrishnan VC, Director -Automotive and EV Sector at Government of Telangana*
2. *Ms.VijayantaAhuja, DGM at International Centre for Automotive Technology*
3. *Mr.Enoch Eapen, Manager at International Centre for Automotive Technology*

Industry:

4. *Mr.Ashok Kumar Jha, Engineering Director at ZF*
5. *Mr.Mullick Koustav, Computer Vision Researcher at Robert Bosch*
6. *Mr.Jitendra Yasaswi Bharadwaj Katta, Computer Vision Researcher at Robert Bosch*
7. *Mr.Shanti Swarup Medasani, Director of Engineering at Mathworks*
8. *Mr.Sant Ranjan, CTO at KPIT*
9. *Dr. Brojeshwar Bhowmick, Principal Scientist at TCS Research Kolkata*

Startups:

10. *Mr.Bharat, Bud E*
11. *Mr.Srikanth, Founder and CEO at Hala Mobility*
12. *Mr.Parshuram Paka, Founder and CEO at Gravton Motors*
13. *Mr.Revanth Vangala,Gravton Motors*
14. *Ms.Vasavi Mylaram, Gravton Motors*

Academia:

15. *Prof. PJ Narayanan, Director at IIIT Hyderabad*
16. *Prof.CV Jawahar, Dean of RnD & Head-Mobility IHub-Data at IIIT-H*
17. *Prof. Deva Priyakumar, Head-IHub-Data at IIIT Hyderabad*

18. *Prof. Ramesh Loganathan, Chair-Outreach,IIIT-H & Head-Innovation & Start-up, IHub-Data*
19. *Dr.Anbumani Subramanian Principal Engineer at Intel & Lead-Platform & Outreach, Mobility*
20. *Dr.RaviKiran, Assistant Professor, Lead-Academics & Projects, Mobility at IIIT-H*
21. *Dr. Aftab Hussain, Assistant Professor at IIIT-H*
22. *Dr.Deepak Gangadharan, Assistant Professor at IIIT-H*
23. *Dr.Kavita Vemuri, Assistant Professor at IIIT-H*
24. *Dr.Anoop Namboodiri, Associate Professor at IIIT-H*
25. *Dr.Girish Varma, Assistant Professor at IIIT-H*
26. *Dr.Jaswanth, Assistant Professor at Woxen University*
27. *Dr.Hrishikesh , Associate Professor at IIIT-Sricity*
28. *Dr.Rohit Saluja, Assistant Professor at IIT-Mandi*
29. *Dr.Maryam Kavesghar, Assistant Professor at Ahmadabad University*
30. *Dr. Stéphane Espié , IFSTTAR, France*
31. *Dr.Vishwajeet Pattanaik, Specialist Scientist, IISc,CiSTUP*
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34. *Mr.Gundimeda Venugopal, Data Foundation,IHub-Data*
35. *Dr.Shankar Gangisetty, Project Scientist, Mobility, IHub-Data at IIITH*
36. *Mr.Govind Krishnan, Translation,IHub-Data*
37. *Mr.Furqan Shaik , PhD student at IIIT-H*
38. *Mr.Sharat Agarwal, PhD student at IIIT Delhi*

