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BIKASH MEHTA

I am a mechanical engineer by degree. I have worked on several projects from the ideation phase to the end product, which includes product design, development, and testing. Apart from mechanical projects, I enjoy working on projects from software development to electronics and learning new things. In most of my projects, I have worked as project owner and team lead; and I have been fortunate enough to work with really good people and lead the team to success.

I am a maker at heart and have been building things out here in Nepal since a young age. Diving into a new project with zero previous knowledge and experience has taught me many things about failure and perseverance. And now, it has become my strength.

This portfolio consists of a few big projects I was involved in from childhood to being an engineer at Yatri Motorcycles - an electric two-wheeler startup.

Thank you for taking the time to view my portfolio.

Bikash

P1 Chassis and Product Development **06/2021 – 12/2022**

Project: Yatri Motorcycles. Project owner and Team lead

Fig: P1 Full Motorbike CAD Model

With the goal to **"reinvent the urban-mobility",** the main objective to design this motorbike to make sure this bike is available to all the customer without being in range anxiety. With efficient assembly and design for manufacturing (DFM) in mind, the bike was designed for better maneuverability and reliability. The suspension system was designed to provide a comfortable and smooth ride, whether navigating urban streets or more rugged terrains. The suspension included telescopic front forks and twin rear shock absorbers, offering balanced comfort and control.

To protect the battery from crash, I designed dual-cradle chassis that was stiffer enough to withstand the crash at **speed up to 70 kmph**. A dual cradle frame would enhance the bike's ability to absorb stresses, reduce flex, and maintain rigidity, crucial for smooth acceleration and cornering.

Fig: P1 Chassis CAD Model

Fig: P1 Full panel CAD model

Road Load Data Acquisition (RLDA) **06/2022 - 04/2023**

Project: Yatri Motorcycles. Project owner and Team lead

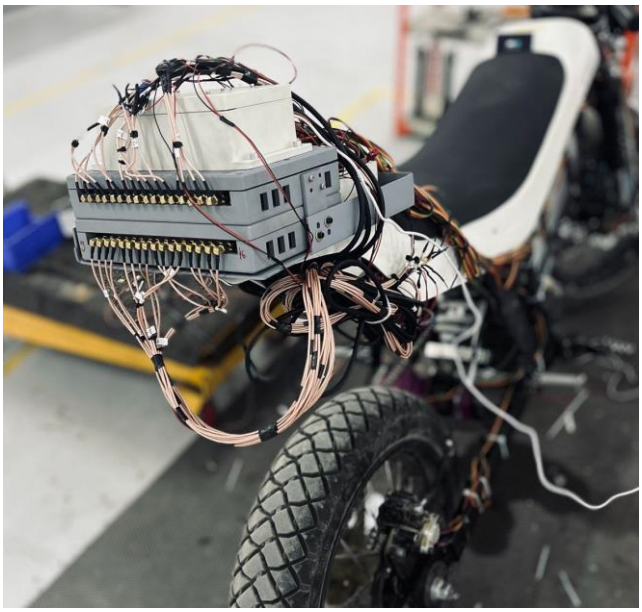

Fig: In-house DAQ collects data
at 48,000 data points per second.

Fig: First RLDA test on controlled small sine bump

To accurately model the vehicle's durability, we need to understand the conditions the vehicle will be subjected to in its lifetime. **RLDA**, pneumatic **fatigue rig**, and **bump rig** are part of the durability testing project; from three tests, we acquire data, validate data, and do accelerated tests of the vehicle.

Before road testing, using an inline **load cell** on modified suspension, the suspension character is verified.

During the test, at first, the test bike is driven in a controlled environment to **correlate** data with **MBD** models using **strain gauges**, **accelerometers**, and **LVDT**. Then the test bike is driven on real roads to measure the damage caused by real-world usage using the same sensors. The acquired data is filtered and processed to fine-tune MBD and FEA models and validate the vehicle's durability.

In our initial trials, we achieved **more than a 90% correlation** between the test model and the CAE model.

Data Acquisition System (DAQ) **06/2021 - 02/2023**
Project: Yatri Motorcycles. Project owner

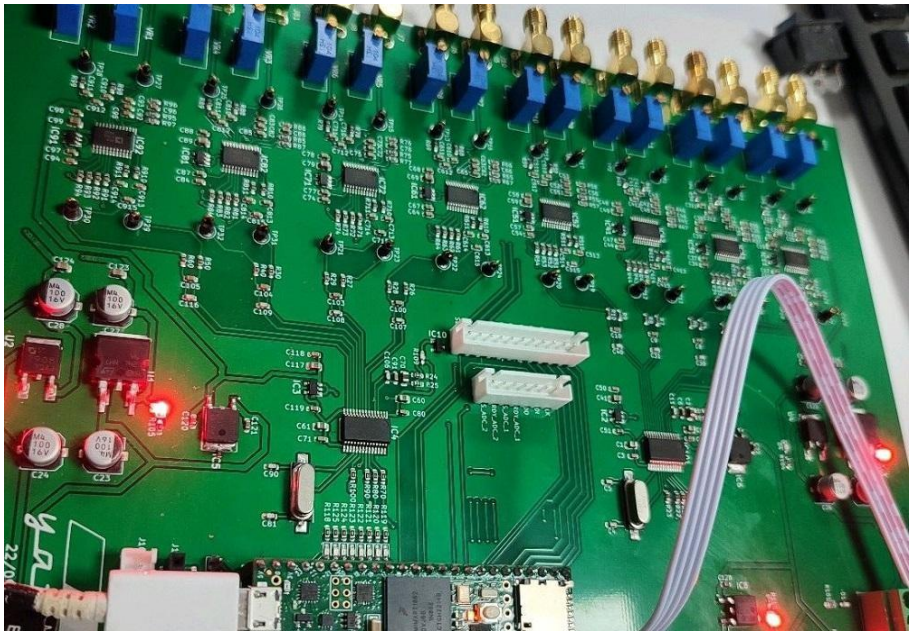
Fig: DAQ board for high speed and low noise data acquisition

Acquiring **48,000 data per second** and analog signals with **10uv resolution** requires a fast and precise sigma delta Analog to Digital Converter (**ADC**), **low noise** and **high CMMR** Programmable Gain Amplifier (**PGA**), efficient code, and good electronics design.

When I was the sole person in the test and validation team, and the project required the DAQ system, I had never had experience with electronics other than Arduino. I thought of trying it on my own. The hardest part for me was that the industry and its terms were vast and complex compared to what I read. And I kept on getting stuck. I selected the wrong design and wrong parts because I didn't fully understand the specifications and missed certain sections which were critical for my workflow. After a few iterations, hands-on tests, and some modelling, things finally clicked.

In this project, I selected an **ADC** and **microcontroller** for our use case and **wrote the library** based on the datasheet. Also, I worked on **writing high-speed data to SD cards** and **writing performant code**. Later on, after a dedicated electronics team member got hired, I oversaw the selection of amplifiers and the design of the DAQ board. This project helped me feel confident on the electronics side of things.

The board worked flawlessly to acquire 16-channel differential analog data from strain gauges, 10 accelerometers, and 2 LVDTs.

Pneumatic fatigue test rig **12/2020 - 12/2021**

Project: Yatri Motorcycles. Project owner and Team lead

While RLDA showed how much stress (and indirectly force) our parts see in the real world, we need a fatigue test rig to find if a part will survive under such loading conditions within its lifetime.

Designing a fatigue test rig was my first job after completing my internship at Yatri. After going over various designs, I settled on a pneumatic system. But before then, I had **never seen a pneumatic cylinder, solenoid valve, or load cell.** I also had no experience with **linear and rosette strain gauges.** Designing and developing a complete pneumatic fatigue test rig in conjunction with developing testing criteria was an immense challenge.

The fatigue test rig has been used to test the **fatigue characteristics** of the front frame, swingarm, and other individual components in an **accelerated and controlled manner**.

With a new update to the rig, a single rig performs **a million cycles** of loading in less than a week with variable loading profiles. Four independent tests can be performed now simultaneously. Tests carried out on this rig helped us to catch mistakes that might have gone unnoticed on the CAE model.

For the video, please see: YouTube

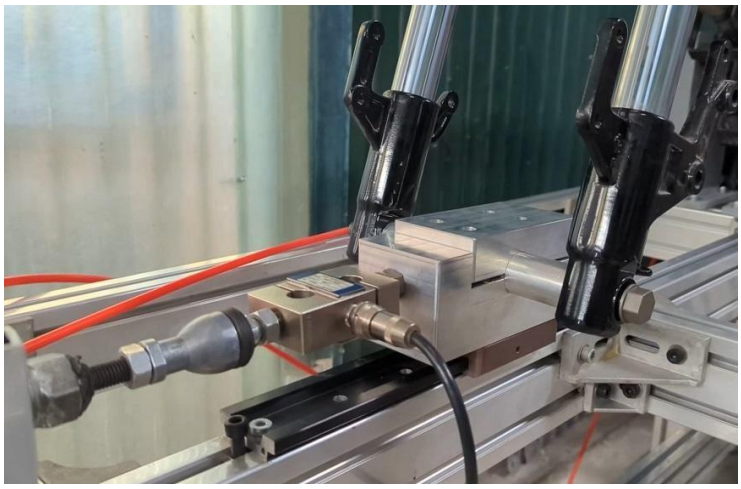

Fig: Pneumatic fatigue test of front frame

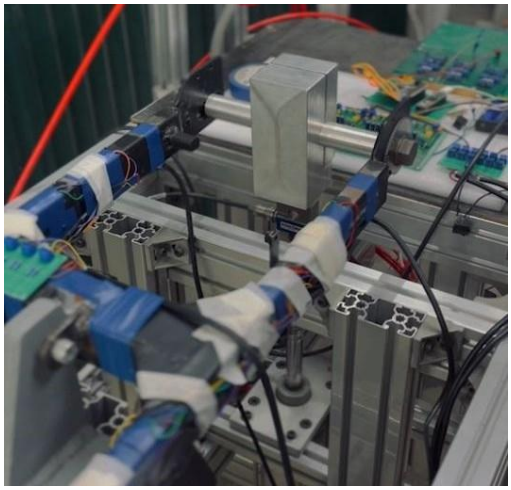

Fig: Pneumatic fatigue test of swingarm

Bump rig **02/2021 - 06/2022**

Project: Yatri Motorcycles. Project owner and Team lead

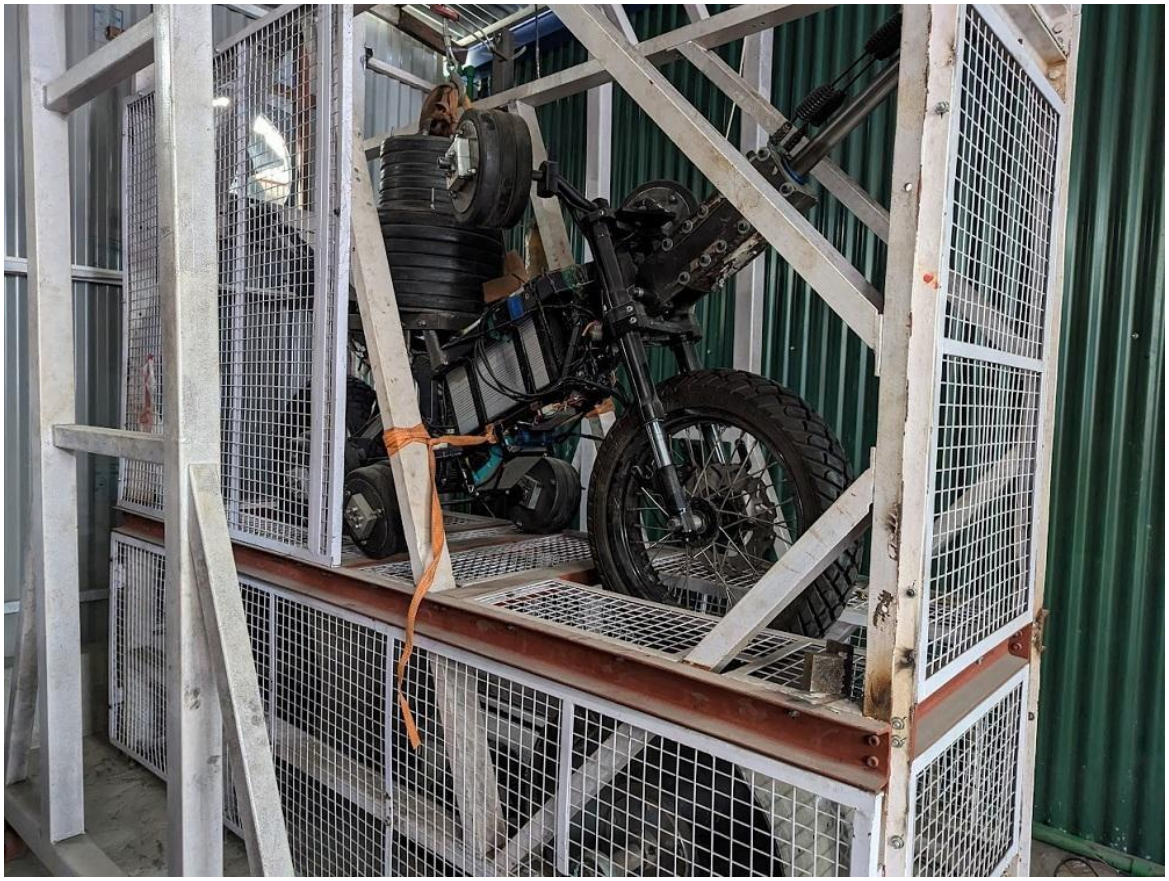

Fig: Laden test bike on two rollers with bumps ready for test.

While it is possible to do component-level tests on a fatigue rig, we require a bump rig to perform a complete vehicle-level accelerated test.

The bump rig possibly had the maximum iterations of sub-components but minimal iterations of the main concept. It started with discussions with the **MBD** and **FEA** team about loading on the rig and the test team on how to hold the test vehicle without inducing side loads. The test rig is designed from the ground up to allow **free longitudinal and vertical translation motion**. The test vehicle is held at the front and back with two large bearings lined with Frelon to handle enormous side forces if the vehicle sways out of course.

The test vehicle is loaded with weights on handlebars and footpegs to simulate the rider and pillion load. The test rig can induce more than 10,0000 km of road load on a single day.

For the video, please see: YouTube

Jigs and Fixture **08/2021 - 05/2022**

Project: Yatri Motorcycles. Project owner and Team lead

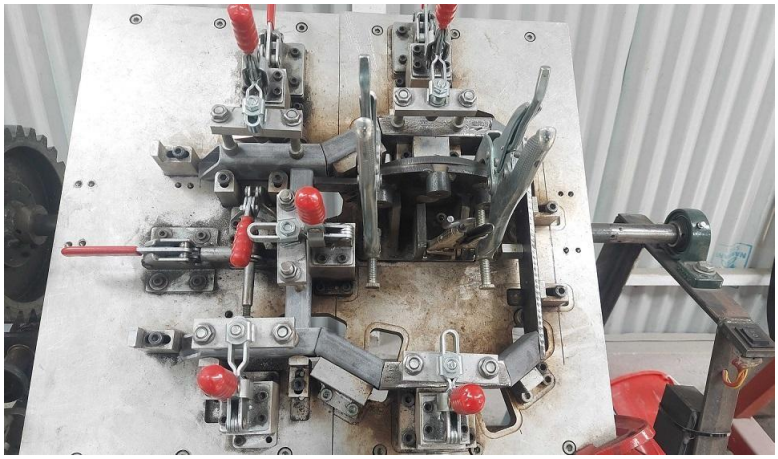

Fig: Fixture of bottom half section

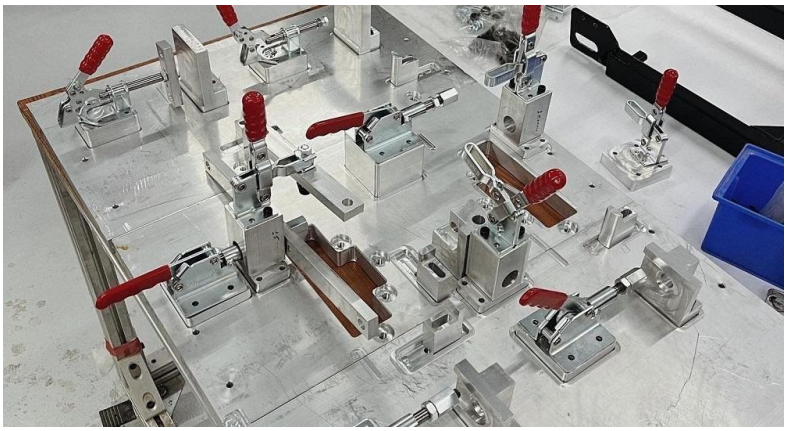

Fig: Swingarm fixture being manufactured in-house

Repeatability in a manually welded product can make or break the product.

On our prototype chassis, we were using temporary fixtures that caused issues with repeatability. I was asked to make a production-ready chassis. Before that, I had never even seen professional jigs fixtures.

The project started from the ground up by understanding the end requirement - repeatability. I worked on the design to ease the manufacturability of jigs as well as the manufacturability of chassis on it. The fixtures were designed on **Autodesk Inventor** and manufactured in-house. Every fixture is housed on a rotatable weld table to weld major sections in one shot and keep **distortion** to a minimum.

For below **$6000**, including materials and man hours for **five sub-components and one marriage welding fixture**, the fixtures held **±1 mm tolerance** on manually **welded chassis.**

Note: I was also responsible for making the first prototype chassis at Yatri Motorcycles for the P0 model.