

# Terrain Adaptive Position Changing E-Bike

Amijith Sabu<sup>1</sup>, Asif A<sup>2</sup>, Harikrishnan M C<sup>3</sup>, Sankar Joy<sup>4</sup>, Mr. Krishnakumar K<sup>5</sup>

<sup>1-4</sup>Student, Department of Mechanical Engineering,

<sup>5</sup>Mr. Krishnakumar K: Assistant Professor, Department of Mechanical Engineering, RIET,  
Thiruvananthapuram, Kerala, India

\*\*\*

**Abstract** - The terrain adaptive position changing E-Bike is a custom designed electric lite bike that can be used for various purposes. The main intention of the development of this bike is to integrate the use of bikes of multiple categories into one. . Each motorcycle in each categories has its own capabilities and purpose. For example, a sports bike which is designed to be perform track oriented can preferably be used in track or smooth tarmac surfaces. When considering a naked street bike, it is designed for using in city traffic with comfort riding posture. When it comes to an average motorcycle enthusiasts or users, it is not practical to own multiple bikes for every purposes. Our project objective is to combine the use of multiple bikes into a single one by adding an option to change the positions of handlebar, seat and footrest without compromising the strength factor of the motorcycle. By this, a single motorcycle can be used in various terrains and purposes.

**Key Words:** Ergonomics, Electric Bike, Terrain Adaptive, Motorcycle, Riding Posture.

## 1. INTRODUCTION

Motorcycles are an excellent alternative to cars and public transport. Bikes give you the flexibility to navigate around a traffic jam, making it a great way to get around. They are cheaper to maintain compared to a regular car and they also use less fuel. Finding the perfect motorcycle takes an extensive amount of research and shopping. There are a variety of bikes for sale, from off-road farm quad bikes to laid back cruisers. Ergonomics plays an important role in this. From the physiological point of view, a motorcyclist performs a monotonous task in an almost static posture affected by various physical parameters, causing rigidity and decreased blood flow in the muscles. Our project objective is to combine the use of multiple bikes into a single one by adding an option to change the positions of handlebar, seat and footrest without compromising the strength factor of the motorcycle. By this, a single motorcycle can be used in various terrains and purposes. The movements of the handlebar, footrest and seating position are synchronized to an extend to get preferred riding posture of a sports bike, an adventure bike, and a street bike having a standard position.

### 1.1 Ergonomics

Ergonomics is a discipline that combines engineering, physiology, psychology, and statistics to make sure that

designs fit the abilities and strengths of people. It's a study to understand how products, systems, and workplaces can be designed to be comfortable to the end user. The term ergonomics is usually heard in the workplace, but it can also be applied to motorcycles. Riding a motorcycle is all about comfort and feel, and the lack of these factors can make your riding experience lesser than it should be. Aside from the discomfort, an ill-fitting motorcycle increases your risk of accidents. Balance is essential when riding a motorcycle, so both of your feet have to be flat on the pedals. It's dangerous when you're riding on the tip of your toes.

An ill-fitting motorcycle also exposes you to musculoskeletal disorders like neck pain, low back pain, nerve compression, saddle sores and carpal tunnel syndrome.

### 1.2 Riding Posture

Aside from looking for an ergonomic motorcycle, pay attention to your posture when you're seated on the bike. The posture depends on the type of motorcycle. If you're using touring motorcycles or dirt or dual-sport bikes, lean forward slightly or sit upright. This posture also applies to beginner riders. For cruiser drivers, keep your upper torso upright and extend your legs forward. You want your motorcycle trips to be easy and comfortable, and ergonomics plays a part in making sure you're comfortable on the bike. Pay attention to what feels right when testing motorcycles and make sure you're sitting correctly before you head off.

## 2. TYPES OF MOTORCYCLES

There are so many different mixes and matches that have been achieved in motorcycle design making it is not fair to just chalk everything up to either design or thrill. The different combinations deserve to be looked at in totality. Categories of bikes like Naked Street, Adventure, Cruisers, Sports etc. are popular choices around the world.

## 3. PROPOSED MODEL OF TERRAIN ADAPTIVE SEATING POSITION CHANGING E-BIKE

The chassis is designed as a box structure that accommodates some of the parts. It also gives a stable and strong platform for the other parts to be mounted on. This chassis is designed for easy mounting of other parts and is made of Mild Steel.



**Fig -1:** Chassis



**Fig -2:** 3D Model

The above shown is the 3D model of the completed assembly of the proposed model.

### 3.1 Working

The project consists of a chassis on which the front and rear suspensions, rear swingarm, seat, handle unit etc. are mounted. This project allows the rider to adjust the seating position according to the terrain on which the bike is used so that maximum comfort can be attained by the rider. The motorcycle is powered by battery pack which powers the drive DC motor and other motors used for the actuation of the mechanisms used for adjusting the position of the handle, foot pegs, and the seat. The change in riding position is attained by adjusting the position of the handle bar, seat and the foot pegs. The riding triangle is determined by the 3 crucial points. The adjustments are done using different mechanisms for each part. Each of them are electrically controlled by switches and relays.

## 4. MECHANISMS USED

### 4.1 Screw Jack Mechanism

This mechanism is used in the adjustment of the handle and the seat. A jackscrew, or screw jack, is a type of jack that is operated by turning a leadscrew. It is commonly used to lift moderately heavy weights, such as vehicles; to raise and lower the horizontal stabilizers of aircraft; and as adjustable supports for heavy loads, such as the foundations of houses. A screw jack consists of a heavy-duty vertical screw with a load table mounted on its top, which screws into a threaded hole in a stationary support frame with a wide base resting

on the ground. A rotating collar on the head of the screw has holes into which the handle, a metal bar, fits. When the handle is turned clockwise, the screw moves further out of the base, lifting the load resting on the load table. In order to support large load forces, the screw is usually formed with Acme threads.



**Fig -3:** Footpeg



**Fig -4:** Handle

## 5. PROTOTYPE



**Fig -5:** Prototype

The above shown is the prototype of Terrain Adaptive Position Changing E-Bike.

## 6. CONCLUSION

Fabrication of terrain adaptive position changing e-bike is completed and the rider can select required riding posture conveniently according to the riding terrain. Three riding positions are available for selection. The positions of handle bar, seat and footrest can be changed accordingly. The objective of this project is to combine the use of multiple bikes into a single one by adding an option to change the positions of handlebar, seat and footrest without compromising the strength factor of the motorcycle. By this, a single motorcycle can be used in various terrains and purposes. The movements of the handlebar, footrest and seating position are synchronized to an extent to get preferred riding posture of a sports bike, an adventure bike and a street bike having a standard position. Driving fatigue is related to maintaining a specific body posture, absorbing the impact of the road, and generating the necessary forces to control the motorcycle. The mechanisms for the quantification of fatigue are varied. Health problems such as back and finger pain, as well as shoulder afflictions, have been identified. Additionally, health problems can result in a significant increase in medical costs for motorcyclists. Physical fatigue due to improper riding posture can be minimized by choosing the riding posture according to the terrain.

## REFERENCES

- [1] Abhishek Madhukar Barewar, Abhishek Ashok Padole Yugal Dhanpal Nagpure, Pranav Gaupale, Sagar Bhimraoji Nagmote, Chandan Kumar Ram, Rupali Suresh Raut, Fabrication of automatic screw jack, International Journal of Advance Research and Development, 2018.
- [2] Aldo Salim, Sandy Yehezkiel, Bready Fernando, Tasya Monica, Joshua Richardo, Agustinus Purna Irawan, Concept design for adjustable motorcycle handlebar, 2019.
- [3] Amol S. Amrutkar, N.R. Rajhans, Ergonomic Posture for Motorcycle Riding, 2011.
- [4] Avesta Goodarzi, Amir Soltani and Ebrahim Esmail Zadeh, Handling improvement of motorcycles using active seats, 2007.

## BIOGRAPHIES



“Amijith Sabu  
Student, Department of  
Mechanical Engineering, RIET  
Thiruvananthapuram Kerala.”



“Asif A  
Student, Department of  
Mechanical Engineering, RIET  
Thiruvananthapuram Kerala.”



“Harikrishnan M.C  
Student, Department of  
Mechanical Engineering, RIET  
Thiruvananthapuram Kerala.”



“Sankar Joy  
Student, Department of  
Mechanical Engineering, RIET  
Thiruvananthapuram Kerala.”



“Mr. Krishnakumar K  
Assistant Professor Department  
of Mechanical Engineering,  
RIET, Thiruvananthapuram  
Kerala.”