

A Review of Smart Bench Technology

Miss. M. D. Dhage¹, Miss. T. A. Bhorakade², Miss. K. B. Konade³, Prof. S. J. Pardeshi⁴

Students, Department of E&TC¹⁻³

Assistant Professor, Department of E&TC⁴

Brahmdevdada Mane Institute of Technology, Solapur, Maharashtra, India

Abstract: *The Smart Bench for Students is an innovative approach toward developing sustainable and technology-integrated campus infrastructure. This system is designed to provide students with comfort, convenience, and connectivity in public or educational spaces. The bench integrates renewable energy through solar panels, enabling self-sufficient power generation to charge electronic devices via USB and wireless charging modules. It incorporates IoT (Internet of Things) features such as temperature, humidity, and occupancy monitoring to analyze environmental conditions and usage patterns. The system uses an ESP32 microcontroller as the main control unit, interfaced with sensors and a cloud-based IoT platform (Blynk or ThingSpeak) to store and display real-time data. A smart LED lighting system is included for illumination during nighttime and energy-efficient operation through motion detection. The proposed model not only promotes renewable energy utilization but also enhances the student experience by providing a digitalized and eco-friendly outdoor study environment. The design encourages the adoption of smart infrastructure in educational institutions, contributing to the concept of sustainable "Smart Campuses." Furthermore, the system is cost-effective, easy to maintain, and scalable for implementation in schools, colleges, and public areas. This research aims to bridge the gap between technology and sustainability while improving student accessibility and environmental awareness..*

Keywords: Smart Bench, IoT, Renewable Energy, Solar Power, Smart Campus, Sustainable Design, ESP32, Wireless Charging

