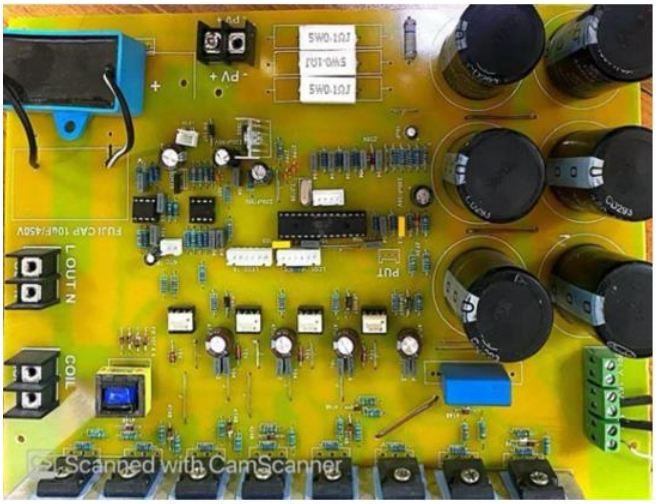
Final Year Project Showcase Batch 2021
Year 2025

Department: Electronics Engineering Programme: Electronics Engineering	
1	**Project Title** Design of a Battery-Less Solar Inverter with IoT-Based Smart Monitoring
2	**Project Idea** This project presents cost effective and sustainable solar inverter systems which removes the use of batteries while incorporating real time monitoring through IoT systems. Thus, making energy management easy for rural and urban areas.
3	**Process** This inverter was designed through a high-power transformer-less configuration with a digital signal controller (dsPIC30F2010). It includes hardware development (PCB, control circuits, filtering stages), firmware coding (PWM control, ADC, protection), and IoT integration utilizing ESP32 and Blynk platform for real-time data availability. Testing was conducted with six solar panels connected in series and resistive loads.
4	**Outcome** A completely functional 7kW transformer-less, battery-less solar inverter with real-time monitoring capabilities was developed. It achieved 93% efficiency during field tests and provides reliable AC output for residential/industrial use with reduced cost, size, and maintenance.
5	**Evidence (Theoretical Basis)** The aim of our project was to create an integrated hardware and software system to tackle the issue of cost-effective, real-time solar energy conversion and monitoring without relying on batteries. Conventional inverter systems depend significantly on lead-acid batteries, which raise costs and maintenance while also presenting environmental risks. Our approach resolves this problem by creating a topology for inverters that do not require batteries. Following the initial design stage, we effectively created a high-performance inverter circuit utilizing a transformer-free H-bridge configuration and managed by a dsPIC30F2010 microcontroller. Simultaneously, we executed real-time data collection and wireless surveillance utilizing the ESP32 module and the Blynk platform. This hybrid system underwent testing with a live solar array and was confirmed with actual AC load performance, showcasing clean sinusoidal output, dependable switching, and efficient cloud-based monitoring. Our prototype has demonstrated technical feasibility and efficiency, rendering it well-suited for implementation in urban and off-grid locations where energy demand is significant, yet cost-effectiveness and upkeep continue to pose essential challenges.
6	**Impact on Sustainability of Urban Regions or SDG-11 "Sustainable Cities and Communities"** The system supports SDG-11 by providing clean, decentralized energy without batteries, reducing environmental impact and cost. It is ideal for urban regions with energy shortages, offering a reliable power alternative for homes, schools, hospitals, and remote areas.
7	**Competitive Advantage or Unique Selling Proposition** (Cost Reduction, Process improvement, Attainment of any SDG (Sustainable Development Goal), increase of market share or capturing new market or having superior performance over a competitor. In summary, any striking aspect of the project that compels the industry to invest in FYP or purchase it. Some detailed description is required in terms of how, why when what. You can select one or more from the following dropdown and delete the rest of them). Please keep relevant options, delete the rest of them, and correct the sequence

a	**Attainment of any SDG** (e.g. How it is achieved and why it is necessary for the region) **SDG #11 – Sustainable Cities and Communities** With rapid urbanization and increasing energy demand, conventional inverter systems with batteries are unsustainable due to high maintenance, cost, and environmental impact. Our battery-less inverter system with IoT monitoring supports sustainable infrastructure by enabling cleaner energy use, real-time monitoring, and reduced physical footprint—ideal for compact urban spaces and remote communities. **SDG #7 – Affordable and Clean Energy** By eliminating batteries and integrating efficient power conversion, the cost of ownership is reduced by up to 40%, making solar energy more accessible. This fosters adoption of renewable energy solutions in underserved and low-income regions.	
b	**Environmental Aspect** (e.g. carbon reduction, energy-efficient, etc.) Removes the necessity for dangerous lead-acid batteries, minimizing e-waste and ecological pollution.	
c	**Cost Reduction of Existing Product** Removes battery dependency, cutting system cost by 30–40%. Lower operational and maintenance expenses make it feasible for low-income users.	
d	**Process Improvement which Leads to Superior Product or Cost Reduction, Efficiency Improvement of the Whole Process** (e.g. What is the issue is current process and what improvement you suggests) Current market solutions are battery-based and offer minimal monitoring, often limited to basic metering or billing, at 3–4 times the cost. They lack real-time insights and are expensive to maintain. Our solution enables real-time monitoring, fault detection, and performance tracking—making energy distribution more data-oriented, cost-effective, and efficient.	
e	**Capture New Market** (e.g. Niche market or unaddressed segment) Targets untapped off-grid and low-income urban/rural communities that lack access to reliable energy or cannot afford conventional setups with batteries.	
8	**Target Market** (Industries, Groups, Individuals, Families, Students, etc) Please provide some detail about the end-user of the product, process, or service • Off-grid rural and peri-urban households • Urban low-income families • Schools and hospitals in remote areas • NGOs and local governments • Solar installation companies • Disaster relief agencies and mobile clinics	
9	**Team Members** (Names along with email address	Shah Muhammad Hassaan Safi safi4402519@cloud.neduet.edu.pk Hamza Ahmed Sheikh sheikh4411448@cloud.neduet.edu.pk Maham Khaliq khaliq4402395@cloud.neduet.edu.pk Ayash Muhammadhu muhammadhu4499955@cloud.neduet.edu.pk
10	**Supervisor Name** (along with email address)	**Dr. Ghous Baksh Narejo** cld@neduet.edu.pk Department of Electronic Engineering
11	**Video (If any)**	https://drive.google.com/file/d/1dhHGrU8aIH1d25UjSVKVG8jVMwwwDLo4/view?usp=drivesdk

Pictures (If any)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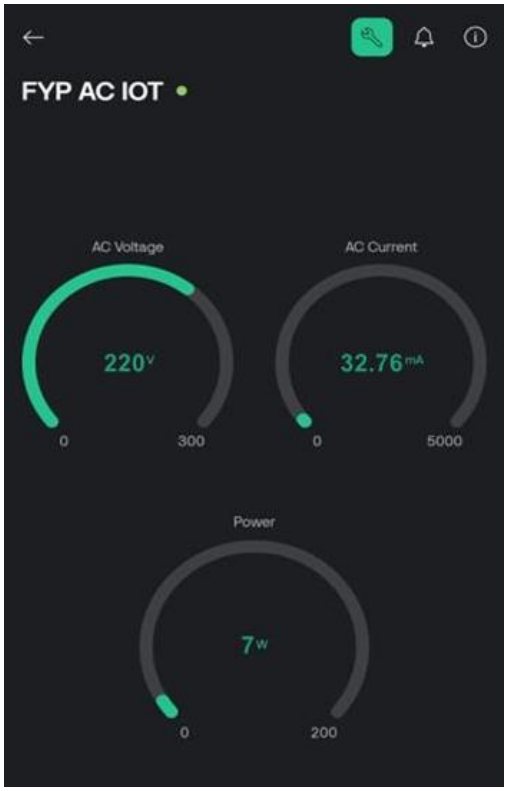
FYP AC IOT
AC Voltage
220
0
300
AC Current
32.76
0
5000
Power
7
0
200