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Itgalpura, Rajankunte, Yelahanka, Bengaluru – 560064



SMART MICROGRID USING FACE AUTHENTICATION SYSTEM A PROJECT REPORT

Submitted by

Y R RAHUL – 20221CSE0216

DARSHAN KUMAR C – 20221CSE0231

J MONESH – 20221CSE0242

Under the guidance of,
Ms. SWETHA RAJAGOPAL

BACHELOR OF TECHNOLOGY
IN
COMPUTER SCIENCE AND ENGINEERING
PRESIDENCY UNIVERSITY
BENGALURU
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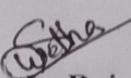
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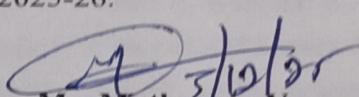


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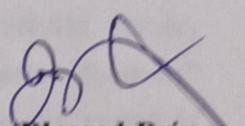
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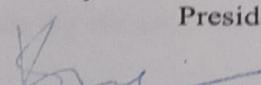
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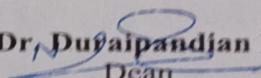

Ms. Swetha Rajagopal
Project Guide
PSCS
Presidency University


Mr. Muthuraju V
Program Project
Coordinator
PSCS
Presidency University

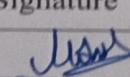
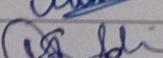

Dr. Sampath A K
School Project
Coordinator
PSCS
Presidency University


Dr. Blessed Prince
Head of the Department
PSCS
Presidency University


Dr. Shakkeera L
Associate Dean
PSCS
Presidency University


Dr. Duaipandjan N
Dean
PSCS & PSIS
Presidency University

Name and Signature of the Examiners

Sl. No.	Name	Signature	Date
1	Syed Mohan Abbasi		03/12/2025
2	Ms. Sumita Guddin		03/12/2025



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DECLARATION

We the students of final year B.Tech in COMPUTER SCIENCE ENGINEERING at Presidency University, Bengaluru, named Y R RAHUL, DARSHAN KUMAR C & J MONESH, hereby declare that the project work titled "**Smart Microgrid using Face Authentication System**" has been independently carried out by us and submitted in partial fulfilment for the award of the degree of B.Tech in COMPUTER SCIENCE ENGINEERING during the academic year of 2025-26. Further, the matter embodied in the project has not been submitted previously by anybody for the award of any Degree or Diploma to any other institution.

Y R Rahul

20221CSE0216

Darshan Kumar C

20221CSE0231

J Monesh

20221CSE0242

PLACE: BENGALURU

DATE: 3-December 2025



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Y R RAHUL

DARSHAN KUMAR C

J MONESH

Abstract

The Smart Microgrid Using Face Authentication System is designed as a secure and intelligent energy-management solution that ensures continuous and efficient power delivery. The system continuously monitors the input from two power sources—a standard transformer supply and a 12V Li-ion battery—and automatically switches between them based on real-time voltage conditions. This automatic source-selection mechanism helps maintain stable power output even when fluctuations or outages occur, aligning with modern smart microgrid control practices discussed in recent studies.

At the core of the setup is an Arduino Nano microcontroller, which collects data from multiple sensors, including two voltage sensors, an ACS712 current sensor, and a DHT11 temperature-humidity sensor. These sensors enable real-time monitoring of electrical and environmental parameters, a feature commonly emphasized in IoT-based microgrid monitoring systems. The collected data is presented on a 16×2 I2C LCD, offering a simple and clear interface for users to observe system performance.

To enhance user interaction, the system integrates an HC-05 Bluetooth module that enables wireless control of loads such as a fan, LED light, or USB output through a mobile application. Additionally, a face authentication module is incorporated to restrict system access to authorized users only, reflecting the trend of embedding biometric security measures into IoT and energy-management applications as highlighted in recent research on lightweight face-recognition frameworks.

The switching of power sources and loads is achieved using a combination of 2-channel and 4-channel relay modules, allowing the system to manage energy distribution safely and efficiently. By combining sensing, control, and secure communication technologies, the microgrid can make informed decisions autonomously and operate reliably under varying conditions.

Overall, the system demonstrates how IoT automation, intelligent control, and biometric authentication can be integrated to create a modern smart microgrid. Such an approach is suitable for smart homes, renewable-energy-based microgrids, and industrial power systems, supporting improved reliability, enhanced security, and greater energy efficiency as discussed across contemporary literature on smart grid innovations.

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Abbreviations

Abbreviation	Full Form
SMGS	Smart Microgrid System
IoT	Internet of Things
LCD	Liquid Crystal Display
I2C	Inter-Integrated Circuit
DHT	Digital Humidity & Temperature Sensor
HC-05	Bluetooth Serial Communication Module
ACS712	Hall-Effect Current Sensor
DC	Direct Current
AC	Alternating Current
SDG	Sustainable Development Goals
SCADA	Supervisory Control and Data Acquisition
CNN	Convolutional Neural Network
TPR	True Positive Rate
GPIO	General Purpose Input/Output
EMI	Electromagnetic Interference
IAM	Identity and Access Management
UART	Universal Asynchronous Receiver–Transmitter
PAN	Personal Area Network
BMS	Battery Management System
MPPT	Maximum Power Point Tracking