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(71)Name of Applicant :
1)St. Peter's Engineering College
Address of Applicant :St. Peter's Engineering College, Opp. Forest Academy, Kompally Road, Dullapally, Maisammaguda, Medchal, Hyderabad - 500100, Telangana, India. Hyderabad -----
2)Dr. K. Amaresh
3)Mrs.V.Premalatha
4)Mr.Purushottam Maramamula
5)Dr.Shaik Lakshman
6)Dr. P. Venkata Kishore
7)Mr.Ganesh Nomula
8)Ms.V.Saketha
9)Mr.Nazeer Shaik
10)Dr.Amjan Shaik
11)Mrs.C. Soumi
Name of Applicant : NA
Address of Applicant : NA
(72)Name of Inventor :
1)Dr. K. Amaresh
Address of Applicant :Professor, EEE Department, St. Peter's Engineering College, Opp. Forest Academy, Kompally Road, Dullapally, Maisammaguda, Medchal, Hyderabad - 500100, Telangana, India. Hyderabad ----
2)Mrs.V.Premalatha
Address of Applicant :Asst.Professor, Department of CSE(AI&ML), Siddhartha Institute of Engineering and Technology,Vinobha Nagar , Ibrahimpatnam,R.R. Dist-501506,Telangana, India. Hyderabad -----
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3)Mr.Purushottam Maramamula
Address of Applicant :District R&B Officer, R&B Department, H.No 1-4-367/1, Road No.14, Satya Nagar Colony, Kothapet, Hyderabad-500035,Telangana, India. Hyderabad -----
4)Dr.Shaik Lakshman
Address of Applicant :Asst.Professor, Department of Chemistry, GSS-GITAM (Deemed to be University), Gandhi Nagar, Rushikonda, Visakhapatnam-530045, Andhra Pradesh, India. Visakhapatnam -----
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5)Dr. P. Venkata Kishore
Address of Applicant :Associate Professor CSM Department St. Peter's Engineering College, Opp. Forest Academy, Kompally Road, Dullapally, Maisammaguda, Medchal, Hyderabad - 500100, Telangana, India. Hyderabad -----
6)Mr.Ganesh Nomula
Address of Applicant :Associate Professor, Department of EEE, Siddhartha Institute of Technology and Sciences, Narapally, Ghatkesar,Medchal-Malkajigiri-500088, Telangana, India. Hyderabad -----
7)Ms.V.Saketha
Address of Applicant :Methodist College of Engineering and Technology, King Koti Road, Abids, Hyderabad - 500001, Telangana, India. Hyderabad -----
8)Mr.Nazeer Shaik
Address of Applicant :Asst. Professor, Department of CSE, Srinivasa Ramanujan Institute of Technology, Anantapur- 515001 Andhra Pradesh, India. Anantapur -----
9)Dr.Amjan Shaik
Address of Applicant :Professor of CSE and Dean R&D Cell, St. Peter's Engineering College, Opp. Forest Academy, Kompally Road, Dullapally, Maisammaguda, Medchal, Hyderabad - 500100, Telangana, India. Hyderabad -----
10)Mrs.C. Soumi
Address of Applicant :Assistant Professor, CSE Department, St. Peter's Engineering College, Opp. Forest Academy, Kompally Road, Dullapally, Maisammaguda, Medchal, Hyderabad - 500100, Telangana, India. Hyderabad -----

(57) Abstract :
An adaptive control system designed to optimize energy consumption in robotics, addressing the growing need for efficient, autonomous systems in various applications. As robots are deployed in dynamic environments, their energy consumption fluctuates based on tasks, movement patterns, and external conditions. Traditional control methods often fail to account for these variations, leading to suboptimal energy usage. The proposed adaptive control system integrates real-time data analysis with machine learning algorithms to continuously adjust operational parameters, such as speed, load distribution, and power management, ensuring that energy use is minimized without compromising performance. Key features of the system include a feedback loop that adapts to changing environments and task requirements, as well as predictive models that forecast energy needs based on sensor inputs and past performance. The system also incorporates an optimization framework that dynamically balances energy-saving strategies with the need for precision and task completion. Through extensive simulations and experimental validations, the proposed control system demonstrates a significant reduction in energy consumption while maintaining or improving task efficiency, making it particularly useful for mobile robots, industrial robots, and autonomous vehicles.