International Scientific Journal of Engineering and Management (ISJEM)
Volume: 05 Issue: 05 | May – 2026
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata
ISSN: 2583-6129
DOI:10.55041/ISJEM07350

Wattwise: Energy Saving Prediction and Consumption System

Ramya R
Department of Computer Science and Engineering, K.S. Institute of Technology (Affiliated to VTU, Belagavi). Visvesvaraya Technological University, Belagavi - 590018. Bengaluru, Karnataka - 560109, India.
ramyar@ksit.edu.in

Navya K
Department of Computer Science and Engineering, K.S. Institute of Technology (Affiliated to VTU, Belagavi) Visvesvaraya Technological University, Belagavi - 590018. Bengaluru, Karnataka - 560109, India.
navyak_cse2023@ksit.edu.in

J M Harshitha Reddy
Department of Computer Science and Engineering, K.S. Institute of Technology (Affiliated to VTU, Belagavi). Visvesvaraya Technological University, Belagavi - 590018. Bengaluru, Karnataka - 560109, India.
jmharshithareddy_cse2023@ksit.edu.in

Yashaswini B
Department of Computer Science and Engineering, K.S. Institute of Technology (Affiliated to VTU, Belagavi). Visvesvaraya Technological University, Belagavi - 590018. Bengaluru, Karnataka - 560109, India.
yashaswinib_cse2023@ksit.edu.in

Jeevitha A P
Department of Computer Science and Engineering, K.S. Institute of Technology (Affiliated to VTU, Belagavi). Visvesvaraya Technological University, Belagavi – 590018. Bengaluru, Karnataka - 560109, India.
jeevithaap_cse2023@ksit.edu.in

ABSTRACT

Electricity bills seem to go up every month, but honestly, most people have no clue which gadgets are draining their power. The old smart meters don't help much—they just give you a big number and leave you guessing. That's exactly why we created WattWise.

WattWise uses AI to make sense of your energy usage. It relies on something called Non-Intrusive Load Monitoring—basically, you don't need to stick fancy sensors everywhere. One smart meter does the job. Machine learning kicks in and breaks down who's actually using what. You get clear info on how much your fridge, TV, or washer is guzzling.

Here's the deal: WattWise pulls appliance-level data straight from your main meter, uses AI to spot the patterns, and instantly flags any major spikes or odd activity.

If your power jumps up out of nowhere, or something turns on late at night, you'll know right away. It doesn't stop there—WattWise gives you quick, personalized tips so you can start saving. It's really all about putting you in control. No outrageous fees, just a tool that fits real life and keeps pace as things change.

KEYWORDS

Smart Energy Management, Non-Intrusive Load Monitoring (NILM), Energy Prediction, Artificial Intelligence, Load Disaggregation, Smart Meter Analytics, Demand Forecasting, Sustainable Computing.

1. INTRODUCTION

Most of us barely think about electricity. We just flip a switch, lights come on, and that's that—until the bill shows up and the number makes you do a double take. One month, you're good. The next, your bill shoots up and you have no clue why. Did the fridge go haywire? Did someone leave the AC cranked all day? Who can say. Meanwhile, the lights stay on in empty rooms, a bunch of gadgets keep humming along, and your costs slowly creep up.

Here's where WattWise comes in. Forget about those complicated graphs or sorting through endless data. WattWise actually shows you which appliances are eating up your power. The trick is something called Non-Intrusive Load Monitoring—NILM for short. It acts like a tiny energy detective inside your home. There's no need for a bunch of sensors or tangled wires. NILM just figures out what's running.

WattWise doesn't stop there, though. It combines NILM with smart AI that learns your home's patterns. If your heater suddenly turns into a furnace or your washer kicks on at 2 a.m., WattWise will spot it and tell you exactly what's up. So instead of shrugging at another huge bill, you finally get real answers. And it gives you clear, simple advice that actually saves you cash. No more head-scratching. Just straightforward results. That's WattWise.

2. PROBLEM STATEMENT

Most energy monitors just give you a big number for your electricity use, but they don't tell you what's actually driving up your bill. You're left guessing which appliances are the culprits. Without real details, it's tough to find the leaks or make any meaningful changes, so cutting waste feels out of reach.

Some of the fancier systems do track each appliance, but you have to stick a sensor on everything you own. That adds up quickly—money-wise and hassle-wise. Keeping all those gadgets running smoothly just isn't practical for most people or businesses.

And here's the kicker: almost none of these monitors can see what's coming next. They don't use your past data to predict your future use, and they won't warn you about odd surges or weird patterns before it's too late. So you end up wasting power without knowing it until you get hit with a big bill.

WattWise flips the script.

It uses AI and Non-Intrusive Load Monitoring (NILM), so it figures out what's using electricity just by watching your main meter. No extra hardware all over your house. It learns, tracks everything in real time, spots problems before they get expensive, and even gives you smart tips to cut down on waste. All that, without the big price tag or complicated setup.

3. OBJECTIVES

WattWise is out to shake up how we use electricity. The idea's pretty clear: show people exactly where their energy goes, help them spot what's being wasted, and let them save some cash. The system tracks each appliance's energy use with NILM tech, and then leans on AI to figure out what users will actually need next. That way, the advice isn't just generic—it's tailored to how you live.

But it's not just a silent number cruncher. WattWise notices weird habits or waste, then pops up with practical tips that are realistic for each person.

It keeps things easy and affordable, whether you're living in a tiny apartment or running a big office.

Really, WattWise closes the gap between what folks assume about their energy use and what's actually on their bill.

It takes all that confusing data, boils it down into clear advice, and makes sustainable choices feel effortless—almost like you've always done it this way.

4. PROPOSED SYSTEM: WATTWISE

WattWise isn't just another energy platform—it actually makes sense of your smart meter data and turns it into tips you can use right away to keep your power bills down. If you've ever wondered what's really going on with your appliances, WattWise digs in and shows you exactly which ones are running and how much they're using. No extra sensors, no fuss.

The magic happens with NILM tech. Instead of a single, boring number for your whole house, WattWise pulls apart the mess and tells you—yeah, that's the fridge cycling on, or your washer eating more juice than you thought. It keeps things simple but detailed.

Then the AI gets personal. It checks out your energy routines, spots when you tend to use more power, and flags those moments when you're about to hit peak demand.

You get a little notice before your bill surges, almost like your phone's warning.

5. METHODOLOGY

Step 1: Data Acquisition

First, we grab aggregate power consumption data straight from the smart meter at regular time intervals.

ISSN: 2583-6129
DOI:10.55041/ISJEM07350

Step 2: Signal Preprocessing
Then we clean things up. We filter out noise, normalize the readings, and flag any major changes or events in the data.

Step 3: NILM Load Disaggregation
Once the data's tidy, we use NILM methods and machine learning to separate out the overall power signal into the energy use of individual appliances.

Step 4: Feature Extraction
Here we dig for the important stuff—voltage, current, active and reactive power, and unique usage patterns across different time frames.

Step 5: AI-Based Prediction
Here's where the AI really gets to work. It combs through your energy data and picks up on how you actually use electricity. Maybe your power usage jumps at midnight or dips around lunchtime—those little things you'd probably never notice yourself. The AI catches those patterns you miss.

Step 6: Optimization & Feedback
Now, it puts all that information to work. The system uses what it found and sends you handy advice you can actually follow. You get real-time tips—helpful nudges tailored to your routine. It points out exactly where you're wasting energy and tells you how to fix it, plain and simple. No need to guess or stress. Just easy, clear guidance that actually works.

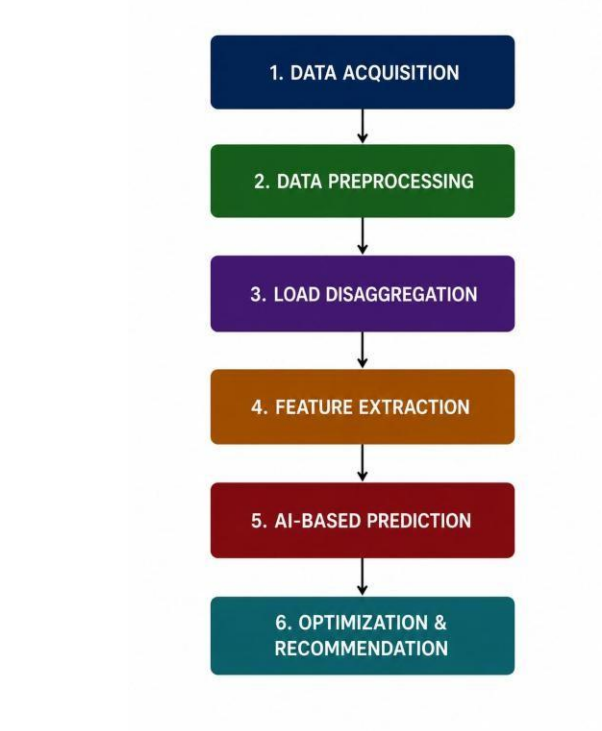

Fig 1: Methodology

6. SYSTEM ARCHITECTURE

WattWise is built around six main layers, each playing a key role in making energy monitoring smarter and more predictive. First, the Smart Meter Layer grabs all the electricity usage data from homes or buildings. Next comes Preprocessing, which cleans up that data and evens it out so the system can analyze it more accurately. The NILM Engine dives deeper by breaking down how much power each appliance uses. Meanwhile, the AI Prediction Module looks ahead, forecasting energy demand and flagging anything unusual.

Then, the Optimization Layer takes all this analysis and turns it into real advice—helping people cut back on wasted energy. The User Dashboard pulls everything together, sharing clear and interactive insights so anyone can understand what's happening.

With this modular setup, WattWise can scale easily, keeps costs in check, and works fast enough for real-time demands. That means it fits right in across all kinds of energy systems, no matter the size or complexity.

It's modular, so you can scale up easily, keep costs down, and everything responds in real time.

7. AI MODEL USAGE

WattWise packs a punch with just a smart meter and some clever tech. It skips the overload of sensors and goes straight to the source—using AI and Non-Intrusive Load Monitoring to figure out which machines are eating up your electricity. The system scans your electricity data with tools like LSTM, Random Forest, and XGBoost, picking up patterns and spotting those odd spikes you probably wouldn't notice yourself.

Every day, WattWise keeps an eye on how you're using power. If your energy use jumps out of nowhere, you'll get a quick alert—no surprises waiting for you on your bill. The forecasting feature flags trouble ahead, and anomaly detection looks out for anything off, like appliances acting up or weird surges.

The thing is, WattWise doesn't just drown you in numbers and charts. It breaks all that data into simple, useful tips you can actually follow. You don't need to know tech, and you definitely don't need a big budget. It works anywhere—your apartment, your office, or even a big business. Frankly, it's one of those low-key tools that helps everyone use energy smarter, without making life any harder.

8. KEY FEATURES: WATTWISE

WattWise is a smart, straightforward energy management system that skips all the usual hassle. Instead of wiring up every appliance with its own sensor, you only need one smart meter. Behind the scenes, advanced NILM technology picks apart your overall energy use and figures out which appliances are using what. It's easier on your wallet, less of a headache to set up, and it actually works for homes and businesses alike.
The heart of WattWise is its real-time monitoring. As you go about your day, it tracks your energy use, showing you exactly where your electricity's going. AI's doing the heavy lifting in the background — with models like LSTM, Random Forest, and XGBoost — so WattWise does more than just tell you what's happening. It gives you sharp predictions about your future energy use, and it's spot-on.
But WattWise doesn't stop there. It watches out for weird spikes and inefficient habits, flagging anything strange the moment it happens. If it spots wasted energy, the system doesn't just ping you with a generic warning — it tells you exactly what's wrong and how to fix it. The dashboard is friendly and clear, with visuals anyone can get. You don't have to be an expert to take control of your energy use.

9. ADVANTAGES

WattWise takes energy monitoring up a notch. Unlike most options out there, it uses sharp analytics and a wallet-friendly, expandable design. You don't have to clamp a sensor onto every single appliance. Instead, just one smart meter does the trick, all thanks to its AI-powered NILM technology. So the whole setup costs less, installs quickly, and barely needs any maintenance.
But there's more. WattWise doesn't just report what you've already used—it looks ahead, studying your habits and predicting your future energy needs. Now, you spot issues before they hit your wallet, and you stop wasting power before it even happens.
On top of that, you see exactly how each appliance fits into your daily life. The system breaks down the details and throws in practical suggestions for cutting back. It's a simple push in the right direction to help you waste less. And with its modular setup, it's just as at home in a studio apartment as it is in a corporate tower, a school, or a big commercial building.

10. APPLICATIONS

WattWise slides easily into the world of modern energy management. Its smart monitoring and predictions make it handy just about anywhere you want to rein in energy use.
In smart homes, people can finally see which gadgets are actually eating up power. They get live updates and helpful predictions, so it's clear exactly where to trim waste and save money each month.
But it's not just a home thing. WattWise handles apartment buildings and large commercial spaces too. Tracking energy across big properties is even more important there, with so many people sharing the same supply. WattWise sifts through all that data, flags any odd spikes, and gives building managers the info they need to make things run smoother—saving power and reducing costs along the way.
Schools and campuses see the upside too. From classrooms to science labs to admin wings, WattWise encourages smarter energy use and helps these places work toward more sustainable setups. Even with complex smart grids or IoT-powered systems, WattWise fits right in. It supports demand response, forecasts load changes, and just makes managing energy smarter. Because it's flexible and powered by AI, WattWise doesn't just solve today's problems—it's ready to help tomorrow's smart cities push for real efficiency and sustainability.

11. RESULTS AND EXPECTED IMPACT

WattWise shows you exactly how much energy your home uses, all the way down to each individual appliance. Its smart AI learns your habits, figures out what you'll need next, and sends real tips to help you cut down on waste. If electricity prices jump or the grid's under pressure, WattWise jumps in with quick, straightforward advice so nothing catches you off guard.
Why does this matter? You finally see where your energy and your money actually goes. Your bills drop, your home runs smoother, and honestly, once you get the full picture, changing your habits doesn't feel so impossible.

12. CONCLUSION

WattWise really shakes up how we manage energy at home. Thanks to its AI and NILM technology, it doesn't just crunch boring electricity numbers—it breaks them down, appliance by appliance, showing you exactly where your power goes and what you can do about it. Instead of just tracking your usage, you actually get to know your own habits and see how to make things better.With all the talk about smarter grids and greener lifestyles, WattWise isn't just another gadget—it's a genuine leap forward. It helps you take charge of your electricity and actually work toward real energy independence.

13. ACKNOWLEDGEMENT

We would want to thank our guide Ms.Ramya R for guiding us and being there throughout the project.
We would also want to mention our gratitude towards the Department of Computer Science and Engineering for being there.

IEEE REFERENCES

[1] M. N. Silva and Q. Liu, "A Review of NILM Applications with Machine Learning Approaches," *Computers, Materials & Continua*, vol. 79, no. 2, pp. 2971–2989, 2024.

[2] M. Nutakki and S. Mandava, "Resilient Data-Driven Non-Intrusive Load Monitoring for Efficient Energy Management Using Machine Learning Techniques," *EURASIP Journal on Advances in Signal Processing*, vol. 2024, no. 62, pp. 1–19, May 2024.

[3] E. B. Silva *et al*., "Non-Intrusive Load Monitoring (NILM): A Systematic Review of Observability Regimes, Methods, and Evaluation Paradigms," *IEEE Access*, 2024.

[4] Y. Li, R. Yao, D. Qin, and Y. Wang, "Lightweight Federated Learning for On-Device Non-Intrusive Load Monitoring," *IEEE Transactions on Smart Grid*, Oct. 2024.

[5] A. A. S. Alquthami *et al*., "A Survey of Traditional and Emerging Deep Learning Techniques for Non-Intrusive Load Monitoring," *AI*, vol. 6, no. 9, 2025.

[6] "Machine Learning Models for Non-Intrusive Load Monitoring: A Systematic Review and Meta-Analysis," *Smart Cities*, 2026.

[7] "Non-Intrusive Load Monitoring: A Systematic Review of Methods, Scenario-Specific Challenges, and Pathways to Practical Deployment," *Energies*, vol. 19, no. 8, 2026.

[8] N. He, D. Liu, Z. Zhang, Z. Lin, T. Zhao, and Y. Xu, "Learning-Based Non-Intrusive Electric Load Monitoring for Smart Energy Management," Sensors, vol. 24, no. 10, p. 3109, May 2024.

[9] L. Fabri, D. Leuthe, L.-M. Schneider, and S. Wenninger, "Fostering Non-Intrusive Load Monitoring for Smart Energy Management in Industrial Applications: An Active Machine Learning Approach," Energy Informatics, vol. 8, no. 54, 2025.

[10] Y. Lu, S. Xu, Y. Liu, and X. Jiang, "Federated Learning-Enhanced Generative Models for Non-Intrusive Load Monitoring in Smart Homes," Scientific Reports, vol. 15, Art. no. 27669, 2025.

[11] Q. Luo, C. Lan, T. Yu, M. Liang, W. Xiao, and Z. Pan, "Federated Learning-Based Non-Intrusive Load Monitoring Adaptive to Real-World Heterogeneities," Scientific Reports, vol. 15, Art. no. 18223, 2025.

[12] M. H. Saleem, M. Taha, M. A. A. Rehmani, et al., "A Comprehensive Review of Machine Learning and Deep Learning Models for Non-Intrusive Load Monitoring: Performance, Analyses, Practical Insights, and Emerging Trends," Applied Intelligence, vol. 55, Art. no. 1020, 2025.

[13] G. W. Hart, "Nonintrusive Appliance Load Monitoring," Proceedings of the IEEE, vol. 80, no. 12, pp. 1870–1891, 1992.

[14] J. Kelly and W. Knottenbelt, "Neural NILM: Deep Neural Networks Applied to Energy Disaggregation," in Proceedings of the 2nd ACM International Conference on Embedded Systems for Energy-Efficient Built Environments, 2015, pp. 55–64.

[15] M. Zeifman and K. Roth, "Nonintrusive Appliance Load Monitoring: Review and Outlook," IEEE Transactions on Consumer Electronics, vol. 57, no. 1, pp. 76–84, 2011.

[16] Z. Pan, H. Wang, C. Li, H. Wang, and J. Zhao, "PerFedNILM: A Practical Personalized Federated Learning-Based Non-Intrusive Load Monitoring," Industrial Artificial Intelligence, vol. 2, Art. no. 4, 2024.