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TECHNICAL CHALLENGES PROBLEM_VIT

Feb 26, 2025

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Prediction of Refrigerant Leakage from Split AC System

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BACKGROUND

- **Refrigerant leakage in Heating, Ventilation, and Air Conditioning (HVAC) systems** is a critical issue that affects system efficiency, environmental safety and operational cost for maintaining indoor air quality and comfort. Predicting leaks early can help mitigate these issues. The leakage of HFC and HCFC type refrigerants will have adverse impact on climate change both directly because these refrigerants have high greenhouse warning potential (GWP), ozone layer depletion and indirectly as leaking systems are less energy efficient. There are also high financial penalties associated with the additional energy and service costs, downtime, and food wastage or lost production of preserved goods. The direct effect of GWP are rising global temperatures, extreme weather conditions and melting glaciers.

Refrigerant:	**GWP Value:**
CO2	1
R410A	2088
R134A	1430
R454A	238
R1233 zd (e)	1
R513A	573

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PRODUCT OVERVIEW

OUTDOOR PRODUCT DETAILS

OD Unit Model : TTKA36KB50BA
Type : Single Speed Cooling Only
Heat Exchanger - Plate Fin
Refrigerant - R410A
OD Volts/Ph/Hz - 220-240/50/1

Air System :
Fan, Motor, Grills

INDOOR PRODUCT DETAILS

ID Unit Model : MCDA36DB0
Type : Cooling Only
Heat Exchanger - Plate Fin
ID Volts/Ph/Hz - 220-240/50/1

Refrigeration System :
Coil

Air System :
Blower, Motor

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SCOPE: KEY OBJECTIVE AND FEATURES

KEY OBJECTIVE:

- Identify a workable solutions that helps to predict refrigerant leakage from the split HVAC system
  - Energy & Cost Savings: Solutions that help to predict refrigerant leakage, improve system efficiency, and lower the running costs.
  - Real-time Monitoring: Optimize the solution for real time prediction of refrigerant leakages build with high accuracy.
  - Scalability: Design solution to be scalable for different types and sizes of split AC units
  - Cost-effectiveness: Design a scalable solution that is cost-effective to implement and maintain under a budget of 10000inr

KEY FEATURES OF SOLUTION:

- **New technology:** Use advanced technologies/methods/models to predict potential refrigerant leaks.
- **Data Visualization:** Provide clear and informative visualizations of split AC system status, predicted anomalies against historical trends of data collected performance- monitored parameters for comparison.
- **Alert System:** Implement an alert system that notifies users of predicted leakage via multiple channels (e.g., SMS, app notifications).
- **Reporting and Analytics:** Offer detailed reports and analytics on system performance, predicted refrigerant leakage, duration for occurrence(failure point), monitor key technical attributes, predict the source of failure points and provide potential maintenance recommendations.

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PREDICTIVE LEAKAGE STRATEGIES

EXPECTED DELIVERABLES:

- A workable solutions
- Documentation explaining methodology and implementation.
- Performance report showcasing accuracy, efficiency, and feasibility.

HARDWARE & SOFTWARE CONSIDERATIONS:

- Participants can use open-source tools .

GUIDELINE TOOLS THAT COULD BE USED:

- Programming: Python, MATLAB, C++
- AI/ML Frameworks: TensorFlow, Scikit-learn, PyTorch
- IoT Platforms: Arduino, Raspberry Pi, ESP32
- Cloud Computing: AWS, Google Cloud, Azure
- HVAC Data Simulation: TRNSYS, EnergyPlus

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FEASIBILITY & EXECUTION TIMELINE (2 MONTHS)

Phase	Tasks	Duration
Week 1-2	Research, team formation, problem refinement, and dataset collection	2 weeks
Week 3-4	Prototyping (if needed) detection & prediction models, initial hardware/software integration	2 weeks
Week 5-6	Testing, refining models, improving accuracy, and optimizing detection methods	2 weeks
Week 7-8	Final testing, report preparation, deployment, and presentation	2 weeks

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Judging Criteria

Criteria	Weight (%)
Innovation& uniqueness	20%
Technical feasibility	20%
Accuracy and reliability of Model Prediction	25%
Scalability and practicality for Split AC	20%
Sustainability and environmental impact	15%

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