EcoSync

SMART HVAC FOR A SUSTAINABLE CAMPUS

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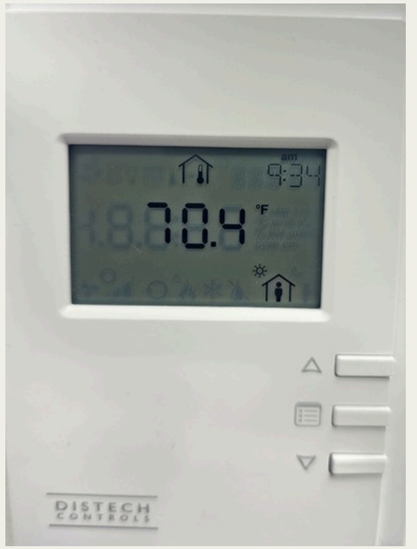
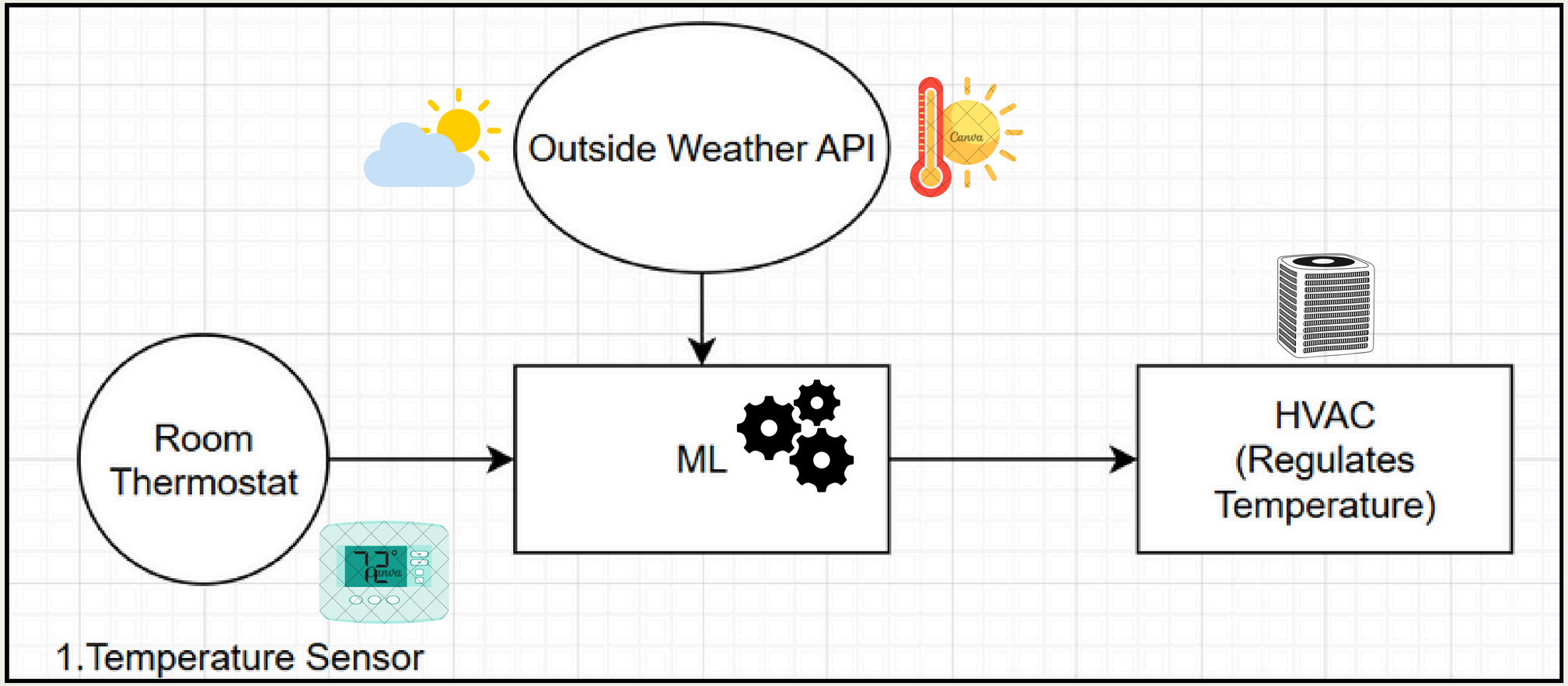
PROBLEM STATEMENT



- Traditional HVAC systems run continuously at fixed settings (70°F), even when rooms are unoccupied, wasting energy.
- Fixed thermostats don’t adjust to real-time occupancy or weather shifts, leaving rooms too hot or too cold.
- Unnecessary use of high energy, increases electricity cost and leaves carbon footprint.
- Running HVAC systems at full capacity especially when not needed results in wearing them out faster.

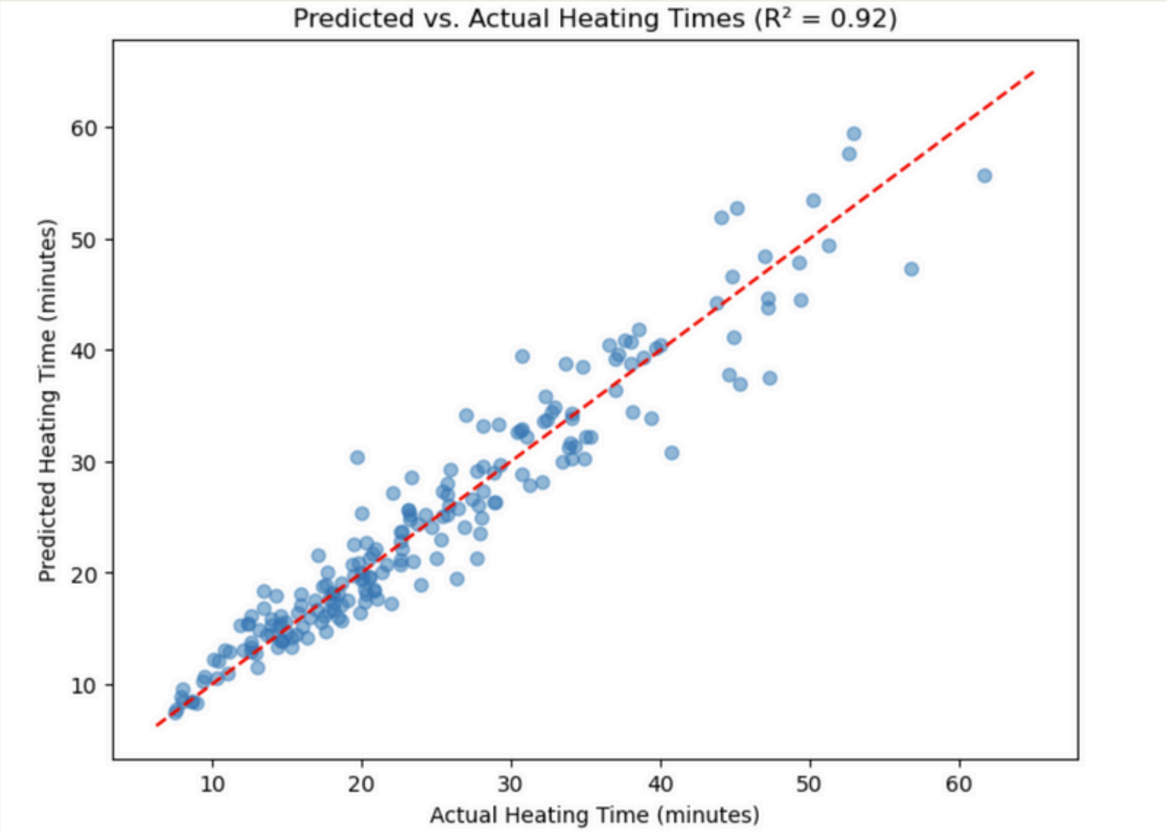
SOLUTION


Outside Weather API
Room Thermostat
ML
HVAC (Regulates Temperature)
1.Temperature Sensor

RESULTS

- A **Random Forest Regressor** model is used for developing this model.

- We achieved a **R^2**(coefficient of determination) Score **0.93** (93% accuracy in predicting HVAC runtime).



D E M O

ENERGY EFFICIENCY SHOWDOWN

Parameter	System 1 (70°F for 24 hrs)	System 2 (60°F for 19 hrs, 70°F for 5 hrs)
Outdoor Temperature (°F)	34	34
Room Size (ft^2)	200	200
COP	3	3
U-value ($BTU/hr \cdot ft^2 \cdot °F$)	0.1	0.1
Temperature Difference (°F)	36 (70 - 34)	26 (60 - 34) for 19 hrs, 36 (70 - 34) for 5 hrs
Time (hrs)	24	19 (60°F), 5 (70°F)
Energy Consumption (kWh)	1.688	1.317
Energy Savings (Wh)	-	371.07 (1,687.68 - 1,316.61)
Percentage Reduction (%)	-	21.99% (371.07 / 1,687.68 × 100)

REFERENCES:

1. HTTPS://WEATHERSPARK.COM/Y/26327/AVERAGE-WEATHER-IN-WORCESTER-MASSACHUSETTS-UNITED-STATES-YEAR-ROUND#GOOGLE_VIGNETTE

2. HTTPS://WWW.ENERGYSAGE.COM/LOCAL-DATA/ELECTRICITY-COST/MA/WORCESTER-COUNTY/WORCESTER/

FUTURE ENHANCEMENTS

1. Dynamic Occupancy and Weather-Adaptive Control
2. Campus-Wide Scalability with Smart Integration
3. Seasonal and Weather-Sudden Adaptive Strategies

Questions?