Smart control of ACs through machine learning

Project by team: **POWER RANGERS**
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1 Introduction

Room air conditioning devices are one of the major power hungry devices and these devices consume maximum power when they are switched ON, so in a room when multiple ACs are switched ON simultaneously blindly they draw a huge current instantaneously which creates a huge load on the grid which may lead to its failure and blackouts. Aim of the design is to avoid blindly switching ON ACs and instead develop a smart machine learnt algorithm to smartly operate ACs considering user's comfort as well.

2 Design

In the previous design, the upper(T_u) and lower bound(T_l) on the temperature were fixed due to the fact that only two ACs has to be switched ON at a time. Using only two ACs user was not comfortable in the room all the time, so we added a mode called USER_DEFINED wherein a user can input his comfortable temperature into the system and with the learnt knowledge the system will decide how many ACs to be used at a time to get that particular temperature. Here all the temperatures are measured by a sensor kept at a equal distance from all the ACs. The system has the following modes at which it can be operated:

- **POWER_SAVER:** In the room only 2 ACs will be used, so the T_u and T_l gets fixed to 28 and 30 respectively, this T_u, T_l come from the machine learnt data.
- **USER_DEFINED:**
  - User inputs the comfortable temperature(T_l)
  - System uses the required number of ACs wisely
  - Fixes the T_u and T_l accordingly
- **MACHINE_LEARNING:** In this mode system learns about the condition and cooling profile of the lab, i.e. with how many number of ACs what is the T_l that can be achieved. This learnt data is stored as a lookup table and accessed whenever user asks for a desired temperature. this learning process can be carried out during a free time such as holidays.

2.1 Hardware and Software tools Used

- Centralized controller as Raspberry PI(R-Pi).
- AC actuators as Arduino nano

- Temperature sensor interfaced to R-Pi
- Python for R-Pi programming

3 Working

After T_u and T_l gets fixed w.r.t. a particular mode, ACs are switched ON accordingly, as soon as the room temperature measured by the interfaced sensor reaches T_l ACs are switched OFF and system waits until the temperature raises to T_u where the ACs are again turned ON. Also all the ACs are utilized for equal amount of time by this scheduling algorithm thereby giving equal loads to all of them. Figure shows temperature increase and decrease cycle of the AC.

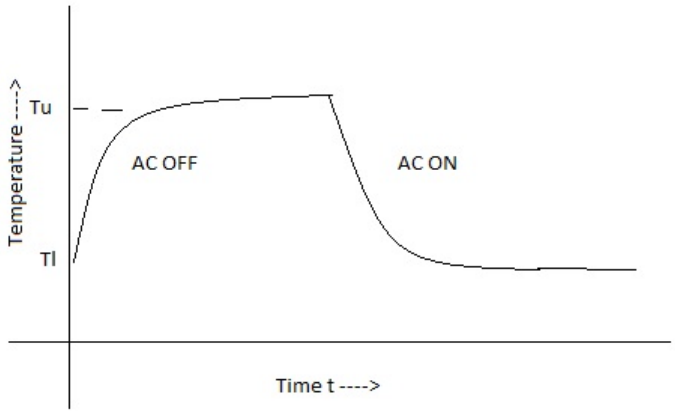

Figure 1: Temperature rise and fall and ACs behavious

4 Impact:

Successful in implementing machine learning based algorithm for smart control of ACs and deploying the developed software into the hardware and tested all the modes for desirable working.

5 Automation:

Successful in automating the air conditioning of the room by smartly using only required number of ACs at a time. Implemented machine learning based algorithm for smart control of ACs and deploying the developed software into the hardware and tested all the modes for desirable working.

6 Scalability:

Scalability here accounts in increase in the machine learning time. When given a room with larger number of ACs, system has to learn what is the T_l that is achieved by turning ACs ON staring from 2 to all. This lookup table updation enables scheduling the required number of ACs in accordance with user input.

7 Cost Effectiveness:

Hardware required are just aurduino actuators and centralized R-Pi controller and a temperature sensor.