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IMPLEMENTATION OF ENERGY EFFICIENT GREEN COOLING UNIT INTEGRATING WITH IOT FOR HEAT SUPPRESSION

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ABSTRACT

The most common problem is the generation of overheating by the computers while it is working. Sometimes the performance and stability of computers can be affected. When there are multiple computers in an air-conditioned room, the generated heat makes the Air Conditioner to do more work, thereby increasing the power consumption of the Air Conditioner while they themselves generate a lot more heat, causing global warming cumulatively. In this paper, a new innovative cooling unit design was proposed to reduce the burden of air conditioner is discussed thereby saving power. By the design of a special type of computer table, the heat generating CPUs can be isolated from the AC room and fresh air from outside can be used to cool them resulting in a separate air circuit. This system further enhanced by integration with IoT. The temperature inside the cooling unit is monitored by a temperature sensor placed inside and the data are transferred to the controller. Depending on the temperature measurement, blower sends the fresh air inside and heat was reduced by bringing down the temperature. This results in reduced power consumption and lower heat generation.

Keywords: Heat Generation, Power Consumption, Computer, IoT, Cooling, Energy Saving.

INTRODUCTION

Computer laboratories and IT industries consisting of multiple computers contain many or powerful air conditioners, just to cool down the extra heat generated by the computers (Excluding the cooling required for people). For example, let us consider a computer lab with 5 air conditioners. Even when there are people in the room with the computers turned off, let's assume they need 2 air conditioners working. But with the computers active, then more air conditioners may need to be turned on maintain the temperature of the room (This was experimentally determined).

It is known that the computers use electricity and generates heat. This heat is removed out from the room by powerful Air conditioners which use more electricity while they themselves generate huge amounts of heat and ultimately all the cumulative heat transferred from both the computers and Air Conditioners are let out into the atmosphere, again which increases the global warming, while it's a bane for using too much electricity unnecessarily.

This paper mainly focuses on extracting the heat from the computers and moves them directly out of the room instead of letting the heat into the room and then cooling them using air conditioners which significantly reduces the power consumption and the heat generation.

This is effectively huge saving because it eliminates the use of 3, 1.5 Tonne ACs in the given example, resulting in savings about 5.8Kwh of energy [1 tonne 3 starred AC consumes ~= 1.954Kw of electricity].

WORKING METHODOLOGY

This paper includes a working prototype which was made for the purpose of testing and demonstration, to attain better understanding about the practicality and feasibility of the concept. The prototype includes a case made for accommodating the CPU of the computer (no modifications of CPU required) with an air pump (fan), cleverly placed air intakes, air exhaust which exhausts all the hot air directly out of the room, thereby eliminating the use of air conditioners to cool down the room.

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Fig 1 Green cooling unit prototype


Fig 2 Top view of cooling fan

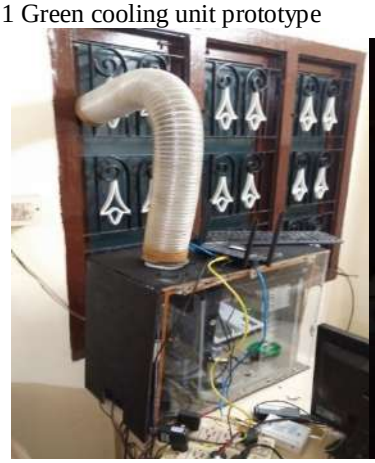
Fig 3 Exhaust system Vented outside the room


Fig 4 Cooling unit with computer system

It is known that hot air rises up due to convection. Therefore, the exhaust fan is placed on the top of the case, which allows the fan to consume lesser energy for moving the hot air out of the case. One end of the aluminium piping (large flexible tube) is connected to the exhaust fan and the other end is channelled out of the room. Hence, the hot air removed by the fan is sent directly out of the room as a result, thereby eliminating the use of air conditioners exclusively to cool down the heat generated by the computers. Simple initiatives make huge change! One small fan eliminates the use of many large air conditioners!

TESTING, RESULTS AND DISCUSSION

Using the proposed model lots of tests was conducted and results were recorded. It is compared with conventional method and plotted. The recorded data revealed of the conducted tests that the proposed model achieves successful cooling of the computers!


Fig 5 Temperature reading

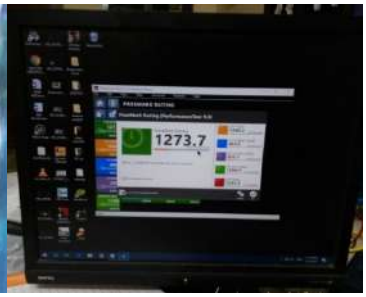

Fig 6 Performance tests

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Table1 Comparative analysis of Temperature results

Time in sec	Without cooling unit Temp ◦C	With cooling unit Temp ◦C
0	35.7	34.6
30	38.5	35.5
60	39.0	36.5
90	39.5	36.7
120	39.8	37.0
150	40.1	37.5
180	40.3	37.5
210	40.4	37.6
240	40.4	37.6
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540	40.7	38.0
570	40.7	38.0
600	40.7	38.0

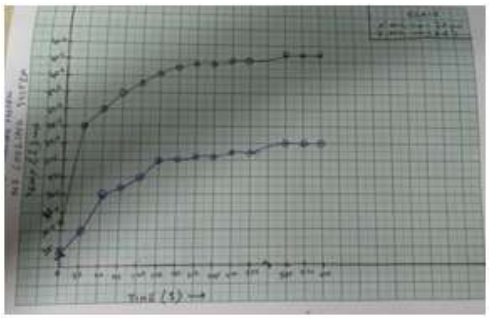

Fig 7 Comparative study of Temperature plot

This model is upgraded by making to be a smarter model by integrating it with IOT. The temperatures inside the Green cooling unit cabinet will be monitored and compared with ambient temperature and then air pump will be controlled accordingly. The Air Conditioners can only cool the air inside the room. It does NOT bring in fresh air containing oxygen. A servo-controlled hatch in Green cooling unit will be opened which delivers fresh air into the room while exhausting the old air outside.

An Oxygen sensor will be used to check the percentage of oxygen inside the room and then activate or deactivate the system. Automation and control can be taken care by a Microprocessor(s). All the statistical data will be uploaded into the CLOUD for ease of usage and analyse as well as it can also be used for remotely accessing the data.

The system is fully powered by Solar Power due to its low power consumption and High Efficiency!

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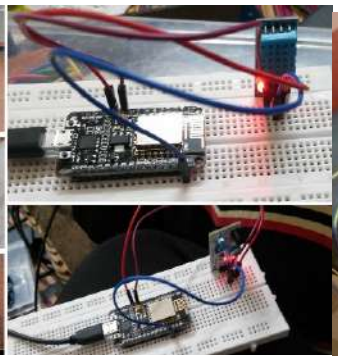
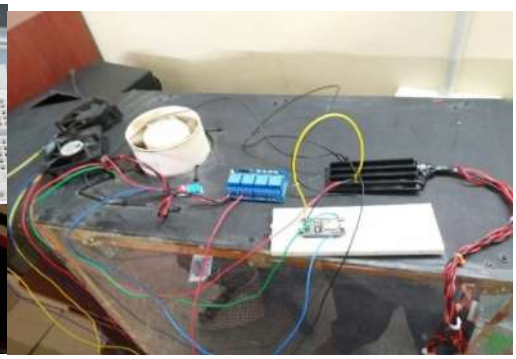

Fig 8 Developing the Smart System

Fig 9 Integration into Green cooling unit

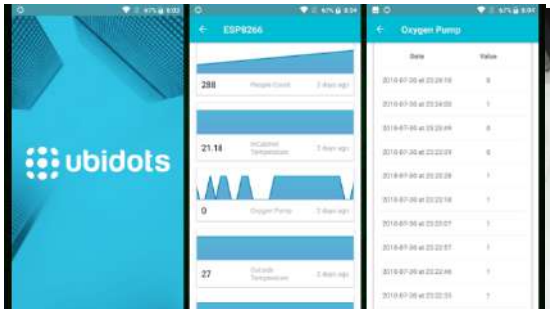

Fig 10 Smart Control and Data Log

Fig 11 Solar array Power system

CONCLUSION

This proposed model saves 98% of the power consumed by the Air Conditioners to cool down the computers. Therefore, if this model is implemented worldwide, thousands of IT industries will get benefited due to very low running costs in comparison. Millions of units (energy) of electricity would be saved each day, with significantly reduced global warming (not only due to reduced heat generation by the air conditioners) but also because thermal power plants are the major power source.

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