1	**Project type (Strike off those not applicable, refer to the policy document for project types)**	Technology Development or Prototype Development.
2	**Title of the Project**	Development Intelligent AirCooling System
3	**Duration of the project**	12 months
4	**Total Cost**	
5	**Name address and phone numbers of PIs and Co-PI's and Student PI's**	Prof. Rajeev Sangal(PI) Prof. Devendar Singh(Co-PI) Prof. R.K.Mishra(Co-PI) Dr. Pradyumna Ghosh(Co-PI) Dr. M.Z.Khan(Co-PI)

6. General Description of the project:

Evaporative cooling works by employing water's large enthalpy of vaporization. The temperature of dry air can be dropped significantly through the phase transition of liquid water to water vapor (evaporation), which can cool air using much less energy than refrigeration. In extremely dry climates, evaporative cooling of air has the added benefit of conditioning the air with more moisture for the comfort of building occupants. Also, the above mentioned drawbacks are not involved in this method of cooling.
Evaporative Cooling is achieved by the following three ways depending upon the weather conditions,

- **Direct Evaporative Cooling (DEC)** (open circuit) is used to lower the temperature and increase the humidity of air by using latent heat of evaporation, changing liquid water to water vapor. In this process, the energy in the air does not change. Warm dry air is changed to cool moist air. The heat of the outside air is used to evaporate water.
- **Indirect Evaporative Cooling (IEC)** (closed circuit) is a cooling process that uses direct evaporative cooling in addition to some type of heat exchanger to transfer the cool energy to the supply air. The cooled moist air from the direct evaporative cooling process never comes in direct contact with the conditioned supply air. The moist air stream is released outside or used to cool other external devices. Indirect Cooling is an effective strategy for hot-humid climates that cannot afford to increase the moisture content of the supply air due to indoor air quality and human thermal comfort concerns.
- **Two-stage evaporative cooling, or indirect-direct (IDEC)** In the first stage of a two-stage cooler, warm air is pre-cooled indirectly without adding humidity (by passing inside a heat exchanger that is cooled by evaporation on the outside). In the direct stage, the pre-cooled air passes through a water-soaked pad and picks up humidity as it cools. Since the air supply is pre-cooled in the first stage, less humidity is transferred in the direct stage, to reach the desired cooling temperatures. The result, according to manufacturers, is cooler air with a RH between 50-70%, depending on the climate, compared to a traditional system that produces about 70–80% relative humidity in the conditioned air.

On the basis of exergy efficiency, irreversibility and thermal comfort conditions, we concluded from the findings of past researches that DEC is optimum for high temperature and dry climate conditions, IEC is efficient for dry and semi-humid conditions and IDEC is most suitable for hot and semi-humid conditions.

The objective of our present investigation is to design a single system with a feedback control system which makes the system sufficiently intelligent to work suitably in adjusting the temperature and relative humidity of air according to the required thermal comfort under every condition.

7. General Description of experience/ expertise of team on such/ similar projects

Dr. Pradyumna Ghosh and primary research area is heat transfer, nanofluids, porous media flow, microgravity fluid physics and was also involved in

- Development of an Advanced Solar-Hybrid Adsorption Cooling System for Decentralized Storage of Agricultural Products in India, TERI(Tata Energy Research Institute, New Delhi) and DLR, Stuttgart(German Aerospace Establishment) collaborative INCO-DC project funded by European Commission, DG XII(1996-97).

Dr.M.Z.Khan has expertise in Labview based DAS.

8. Deliverables (The deliverables are to be described in each section. If there is no deliverable in a particular section then say the same clearly.):

(a) Prototype: A working model of the process will be delivered at the end of the project.

(b) Process Prototype: NONE

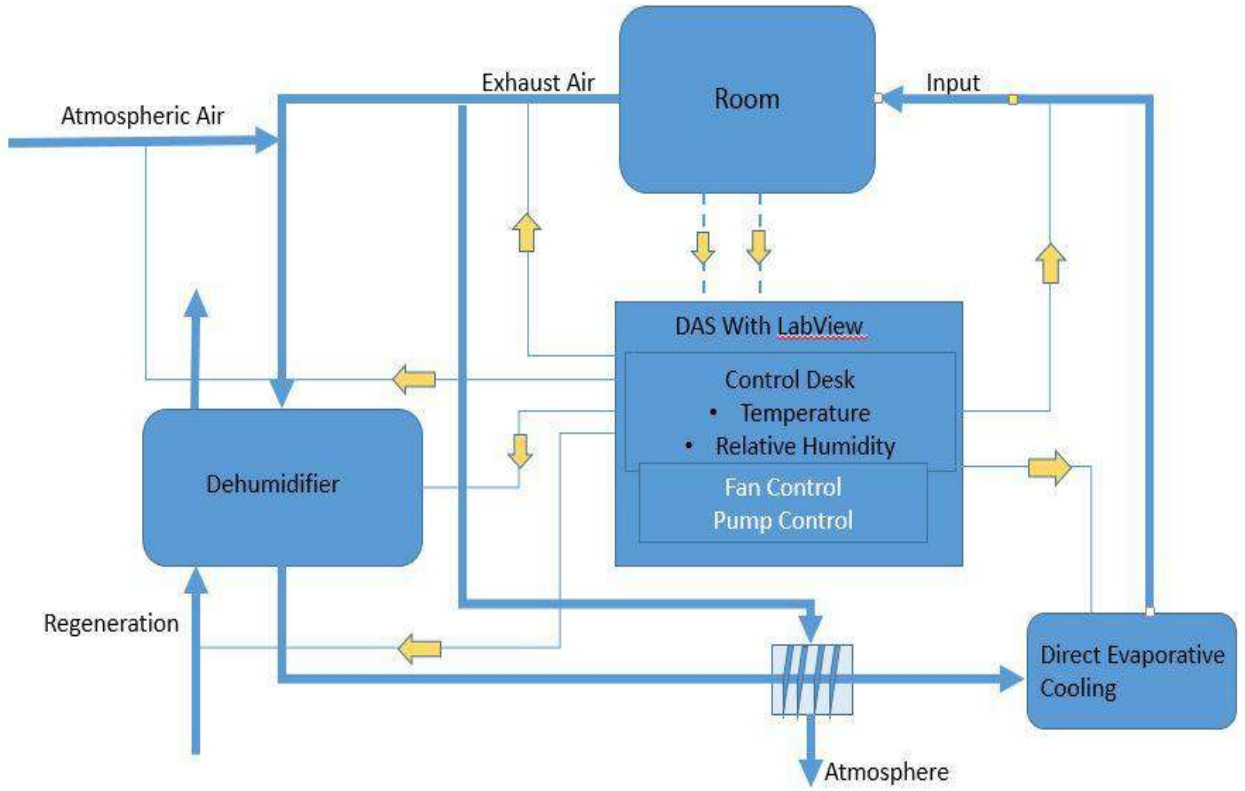
(c) Design/ Technical Document: A report comparing the theoretical and experimental results for the process will be submitted at the end of the project.

(d) Software: LabView software code will be submitted for prototype's optimal performance and to achieve desired result at the end of the project.

(e) Document (audio, visual, write ups web sites etc): NONE

(f) Any other: NONE

9. Method/ Technology to reach the deliverable. (A detailed description of method or technology may be described)



Intelligent Air Cooling System

Processes involved (Assuming monsoon weather conditions) in 12' X 36' X10' room or 24' X 28' X 10' room.

- Hot and humid air from the room is sucked out and a part of it is being passed through a dehumidifier, where it is mixed with some amount of fresh air from outside. The humidity of the mixture decreasing with an increase in temperature.
- The hot and dehumidified air then enters into a heat exchanger where it is sensibly cooled down using the remaining exhaust air from the room and/or by the atmospheric air. The exhaust air is then expelled into the atmosphere.
- The cooled air is further cooled down by Direct Evaporative Cooling where its humidity increases again and the temperature decreases below the atmospheric temperature air.
- The air entering the room has a temperature and humidity which is less than that of the atmospheric air.
- The air in the room is continuously recirculated with addition of fresh air from atmosphere.

10. Time line / mile stones for achieving the deliverables.