

**DEVELOPMENT OF INDOOR ENVIRONMENT
MONITORING SYSTEM AND ITS APPLICATION**

by

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CERTIFICATE

This is to certify that the thesis titled “*Development of Indoor Environment Monitoring System and Its Application*” is being submitted by Mr. Anuj Kumar to Indian Institute of Technology Delhi for the award of the degree of **Doctor of Philosophy**. This thesis is a record of bona-fide work carried out by him under our guidance and supervision. In our opinion, the thesis has reached the standards fulfilling the requirements of the regulations relating to the degree.

The results contained in this thesis have not been submitted to any other university or institute for the award of any degree or diploma.

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ABSTRACT

Over the past quarter century, there has been an exponential increase of industries, transportation, and agriculture activities. They have caused complex and serious problems to environmental pollution. So to provide better indoor environment to the occupants it becomes necessary that built environment should be continuously monitored. Hence, there is a growing demand for indoor environment monitoring and control systems.

An indoor environment monitoring system (IEMS) for monitoring the concentrations of indoor air pollutant gases and indoor environmental parameters has been developed in compliance with the IEEE1451.2 standard. The sensor array is implemented using electrochemical sensors. The smart transducer interface module (STIM) is implemented using the PIC18F4550 microcontroller. Network capable application processor (NCAP), implemented in LabVIEW 9.0, and is based on the IEEE 1451.1 standard. NCAP is connected to the STIM via a USB 2.0 transducer independent interface. The level of indoor environment parameters and information regarding STIM can be seen on the graphical user interface (GUI) of the NCAP. Sensors are recalibrated using the potentiometer adjustment technique of signal conditioning circuits. The IEMS is low cost, energy efficient, and portable.

Another important area is the real time processing applications. These are highly dependent on data acquisition which quite often suffers from the problem of missing input variables. Two techniques have been proposed as a solution to the problem of missing input variables for short durations. These are the radial basis

function (RBF) based artificial neural network (ANN) and the linear regression analysis (LRA).

Thermal comfort is one of the most important applications based on data collected by the developed IEM system. In this work, we tried to define the thermal comfort index using ASHRAE55-2004 and ISO7730 standard calculation procedure.

In conclusion, important contributions of the work are summarized. Scope of further work in this area is finally outlined.

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