

SOLAR THERMAL COLLECTOR AIR CONDITIONING SYSTEM USING NANOFLUID

A PROJECT REPORT

Submitted by

**DEEPAK SHARMA [Reg No: 1181210099]
SMITHA MURALIDHARAN [Reg No: 1181210127]
SAURAV DAS [Reg No: 1181210148]**

Under the guidance of

Mrs. R. GANGA DEVI
(Assistant professor (O.G), Department of Mechatronics Engineering)

*In partial fulfillment for the award of the degree
of*

**BACHELOR OF TECHNOLOGY
in
MECHATRONICS ENGINEERING**

of

FACULTY OF ENGINEERING & TECHNOLOGY



S.R.M. Nagar, Kattankulathur, Kancheepuram District

MAY 2016

SRM UNIVERSITY
(Under Section 3 of UGC Act, 1956)

BONAFIDE CERTIFICATE

Certified that this project report titled **“SOLAR THERMAL COLLECTOR AIR CONDITIONING SYSTEM USING NANOFLUID”** is the bonafide work of **“DEEPAK SHARMA, SMITHA MURALIDHARAN and SAURAV DAS”**, who carried out the project work under my supervision. Certified further, that to the best of my knowledge the work reported herein does not form any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

SIGNATURE OF THE GUIDE

MRS. R. GANGA DEVI
GUIDE

Assistant professor (O.G)
Department of Mechatronics
Engineering

**SIGNATURE OF HEAD OF
THE DEPARTMENT**

Dr. G. MURALI
HEAD OF THE DEPARTMENT

Professor
Department of Mechatronics
Engineering

Signature of the Internal Examiner

Signature of the External Examiner

ABSTRACT

Air conditioning and refrigeration demand is rapidly increasing in many parts of the world, especially in moderate climatic regions. Air conditioners and refrigerators are the only equipment that consume more than 70% of the entire electricity usage in a household. This results in a dramatic increase in electricity demand on hot summer days, which causes an unwanted increase in the use of fossil fuel and nuclear energy, which in turn, leads to global warming and air pollution. This project aims to make use of solar thermal energy in air conditioning systems and reduces the power consumption of the compressor. In this system, work done by the compressor is decreased using solar thermal collectors for heating the refrigerant R-134a contained in a double pipe arrangement with the nanofluid circulated in the outer tube. The refrigerants temperature increases due to the thermal conductivity property possessed by the Al_2O_3 /water nanofluid which comprises of nanoparticles having size less than 50nm dispersed in a base fluid of water. During this study, atmospheric temperature, fluid temperature at the collector and the temperature at compressor were measured to investigate the COP of the system.

ACKNOWLEDGEMENT

Firstly, we would like to express our sincere thanks to **Dr. G. Murali**, Head of the Department for the support to carry out this project. We dedicate our highest gratitude to **Mrs. R. Ganga Devi** for the encouragement to do a project that is useful for the society, helping to reduce the cost of living in day to day life and also for her guidance throughout the course of this project. We also wish to thank **Mr.Vivek Bachhawat**, from National Engineers for his knowledge and experience on air-conditioning systems. We are thankful to our respective parents for their unwavering support during this venture and providing us the strength to persist.

LIST OF FIGURES

Figure No.	Figure Description	Page No.
1.1	Block Diagram of System	1
1.2	Systematic Diagram	3
1.3	Refrigeration Cycle	5
1.4	Evacuated Tube Collector	6
1.5	Flat-Plate Collector	6
1.6	Double Pipe Heat Exchanger	8
3.1	Layers of Solar Thermal Collector	12
3.2	Sheet Metal Cut-Out Dimensions	13
3.3	Sheet Metal Box	14
3.4	Layer of PU Foam	15
3.5	Aluminium Sheet	16
3.6	Copper Pipe	16
3.7	Arrangement of Spiral Flow Copper Pipe	17
3.8	Tempered Glass	18
3.9	Solar Thermal Collector	18
3.10	Arduino Uno	19
3.11	Temperature Sensor	20
3.12	Flow Rate Sensor	21
3.13	LCD	21
3.14	Circuit connections in collector	22
3.15	Components of Air Conditioning system	22

3.16	Compressor	23
3.17	Condenser Coil	23
3.18	Capillary Tube	24
3.19	Evaporator Coil	25
3.20	Housing Dimensions	26
3.21	Air conditioning system setup	26
3.22	Arduino Uno	27
3.23	Relay	27
3.24	Circuit connections for control system	28
3.25	Ultrasonic Sonicator	29
3.26	Comparison between water and nanofluid solution	30
4.1	Flowchart for Flow and Temperature Sensing	31
4.2	Flowchart for Control System	33
5.1	Graph between temperature and time of collector	38
5.2	Graph between COP and time	40
5.3	Graph showing run time of compressor without fluid	41
5.4	Graph showing run time of compressor with water	42
5.5	Graph showing run time of compressor with nanofluid	43

LIST OF TABLES

Table No.	Table Description	Page No.
5.1	Temperature, Pressure and enthalpy values of R-134a	39
5.2	Comparison of run time	44

LIST OF SYMBOLS

Symbols	Symbol Description
F	Fahrenheit
Btu	British Thermal Unit
lb	Pound
PSI	Pounds per square inch
H	Enthalpy
°C	Degree Celsius

