Final Project report

on

Zero Emission Radiative Cooling for Automobile Industry

As a part of

Student Research Project Grant-SRPG-Under Graduate-

2023-24

Funded by

Foundation For ISHRAE, Research, Science, Technology (FIRST)

Submitted by:

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Under the guidance of:

Prof. Achintya Mukhopadhyay
Professor, Mechanical Engineering Department
Jadavpur University

Acknowledgements

We would like to express our heartfelt gratitude to the Foundation for Innovation and Research in Science and Technology (FIRST) for funding this project under the Student Research Project Grant (SRPG) 2023-24. Their support has been invaluable in enabling us to successfully carry out this work.

We are deeply grateful to ISHRAE (Indian Society of Heating, Refrigerating and Air Conditioning Engineers) for providing us the opportunity to undertake this project. Their initiative allowed us to explore and contribute to an exciting area of research in cooling in the automobile industry.

A special thank you to our project guide, Prof Achintya Mukhopadhyay and Prof. Sourav Sarkar, whose constant guidance, ideas, and solutions helped us overcome numerous challenges throughout the project. Their expertise and encouragement were essential to our progress.

We would also like to extend our sincere thanks to the ISHRAE Jadavpur University Students Chapter for their assistance and collaboration during the project.

Lastly, we are thankful to our university, for providing us with the necessary resources and support, without which this project would not have been possible.

Declaration

We, the undersigned, hereby declare that the project work titled "Zero Emission Radiative Cooling for Automobile Industry" submitted as part of the Student Research Project Grant (SRPG) 2023-24 is the result of our original work carried out under the guidance of Prof. Achintya Mukhopadhyay.

We affirm that all the information, data, and results presented in this project report are accurate to the best of our knowledge and understanding. The research, experimentation, and simulations conducted were performed by the project team, and any external sources or references used have been duly acknowledged.

Furthermore, we declare that this project has not been submitted to any other institution or organization for the award of any degree, diploma, or other qualification.

Date: 13/09/2024
Place: Jadavpur University, Kolkata.

Signature of Team Members:

1. Soumyadeep Khamrai _____
2. Nishant Dey _____
3. Sandipan Das _____
4. Ayush Barua _____
5. Nilendu Dikshit _____
6. Suprabhat Das _____

Certificate from Project Guide

This is to certify that the project titled "Zero Emission Radiative Cooling for Automobile Industry" was successfully completed by the following students as part of the Student Research Project Grant (SRPG) 2023-24:

- Soumyadeep Khamrai
- Nishant Dey
- Sandipan Das
- Ayush Barua
- Nilendu Dikshit
- Suprabhat Das

The project was carried out under my guidance, and the team worked diligently to conduct experiments and meet the project objectives. The results obtained are satisfactory and at par with expected outcomes of the experiment.

This certificate is issued in recognition of the team's efforts and completion of the project.

Achintya Mukhopadhyay

Signature of Guide

Professor
Department of Mechanical Engineering
Jadavpur University, Kolkata-700 032

Table of Contents

Abstract

The project titled **“Zero Emission Radiative Cooling for Automobile Industry”** explores the potential of using radiative cooling technology to complement, rather than replace, traditional vehicle cooling systems. The objective is to reduce the thermal load on conventional cooling techniques, thereby contributing to fuel savings and lowering energy consumption in vehicles.

The team conducted extensive experiments exploring the use of radiative cooling in automobiles. Prototype demonstrated a **temperature reduction of approximately 2.7°C at night**, which is higher than similar experiments. The system's performance was tested under varying weather conditions,both during day and night, highlighting the effects of sunlight and cloud cover on the cooling process.

While the project is partially completed, the results are promising and demonstrate the system’s potential to reduce the load on conventional cooling mechanisms. This research represents a step towards integrating sustainable technologies in vehicle design to support energy conservation in the automotive industry.

Project Objectives

Our project had the following objectives:

1. To understand whether radiative cooling can be used as a potential passive cooling technique in vehicles.
2. Studying the cooling rates under dynamic conditions and making efforts to improve convection shields.
3. Predicting the break-even point of radiative cooling technology in Indian climate conditions.
4. Calculating the approximate energy saved in the process and whether it is practical economically to use radiative cooling in vehicles.

Now we will perform experiments to find answers to each of them.

Research Methodology

Instrument Selection

Temperature sensors form the core of our experiment. So, inaccuracies in the data will lead to wrong analysis. Further we cannot validate our results and thus we cannot make our experiments repeatable and reproducible. So here is the accuracy and precision data of the instruments used in this experiment.We have used a mercury thermometer to display the true value. However, its least count is 1℃. Since we expect to have small temperature differences, we preferred to use such sensors which can measure at least up to 1 digit after the decimal.

Sl. No	Name of Instrument	Accuracy
1	Mini Digital LCD Thermo/Hygrometer	Temperature ±1°C Humidity ±5%
2	Glass Mercury Thermometer	±0.1°C
4	Digital Thermo/Hygrometer with clock	Temperature ±1°C Humidity ±5%(35%-75%)
5	Anemometer	Air velocity ±5% Air temperature ±2°C
6	USB Temperature Data Logger	Temperature ±0.5°C; Range:-5.55°C-70°C

Care is taken to handle instrument errors, if any. All data presented here are after necessary corrections have been done.
For overnight data, or periodic data collection, we used pre-calibrated data loggers. It can be used to change the interval after which reading needs to be taken.

Selection of Radiative material and Convective Shield

Several compounds have been mentioned in literature which demonstrate passive radiative cooling. Recently several photonic crystals have been developed which have much better performance and can achieve cooling even under direct sunlight.

However, aluminium foil and scotch tape combination is chosen because it is low cost, and easily available.

Objective 1

To test whether radiative cooling can be used as a potential passive cooling technique in vehicles, we perform a series of experiments.

Experiment 1 (Day time)

An aluminum sheet metal was cut to form a scaled down replica of a commercial vehicle like the Maruti swift, which is commonly used as a taxi in Kolkata.
The box was placed under direct sunlight on a hot sunny day in the month of August, 2024.

Observations: Here are the readings:

Material	aluminium box shaped like a vehicle,
Convective Layer	Aluminium plate, covered with 15 micron aluminum foil. Convective shield: Scotch tape
Surface area to Volume ratio	0.211 mm^{-1}
Ambient temperature	34.9°C
Steady state temperature	36.8°C
Temperature drop	Temperature did not decrease but rather increased.
Remarks	Inside of the box attained higher temperature as compared to ambient. This effect was similar to what is observed when a car is placed under direct sunlight. So the concept of radiative cooling could not be achieved in this case.

Test Setup of the experiment.

Inferences:

1. The **mass of air** inside the box might be just **too high** for the radiation to cool, and the effective radiative surface area of the car was not enough. So it was decided to try the concept on a smaller scale before shifting to the full scale model.
2. Also it was observed that **small air bubbles** were trapped in between the aluminium foil and the sheet metal, decreasing the effective conduction of the metal sheet.

Experiment 2 (Day time)

A small box made of cardboard ,was used to try and prove the concept of radiative cooling. We used **mercury thermometers** to record temperatures inside the box and the ambient temperature. Then the difference in temperature is recorded.

Observation:

Material	cardboard box
Convective Layer	Cardboard box covered with aluminum foil of thickness 15 micron. Convective shield: Scotch tape 2 layers
Ambient temperature	34.2°C
Steady state temperature	33.6°C

Temperature drop	0.6°C.
Remarks	We observed fractional temperature differences. However, the experiment was very **unreliable** as the temperature difference could not be observed at all times of the day.

Inferences:

1. The performance of radiative cooling depends highly on weather conditions. In a cloudy environment, the drop could not be observed.
2. The cardboard box needs to be replaced with conducting metals.
3. The surface area to volume ratio needs to be changed, and the experiments to be repeated to test the extent of radiative cooling.
4. A data logger should be used to make the readings more consistent, accurate and reliable.

Experiment 3 (Night time)

We used the same cardboard box, but replaced the top of the box with a aluminium sheet

Observations:

Material	Box with 5 sides made of cardboard dimensions $27 \times 16 \times 6$ cm , the top surface is replaced with aluminium metal
Convective Layer	aluminum metal covered with aluminum foil of thickness 15 micron. Convective shield: Scotch tape 2 layers
Surface Area to Volume ratio	0.166 mm^{-1}
Ambient temperature	30.9°C
Steady state temperature	27.8°C
Temperature drop	3.1°C (night)
Remarks	The experimental results align with findings in the literature, confirming that radiative cooling is significantly dominant on a clear night.

Inferences:
Variations in ambient temperature must be taken into account for more accurate measurements. Environmental temperature fluctuations may affect the internal temperature of the box, potentially compromising the integrity of the experiment.

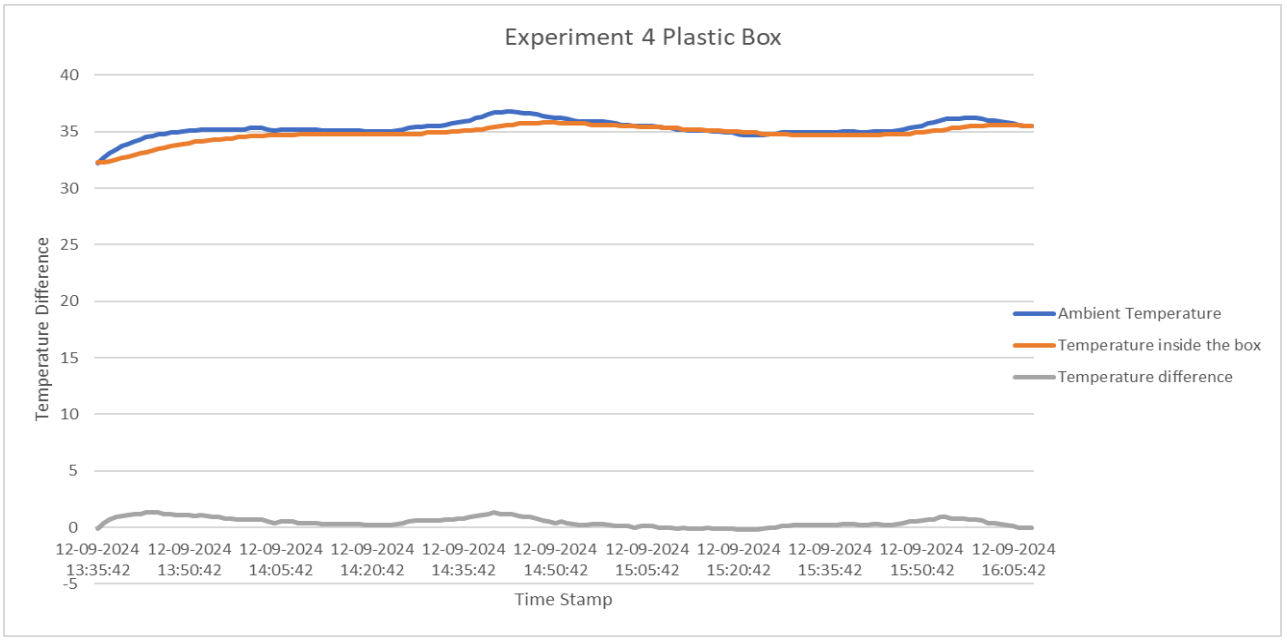
Test setup of the experiment conducted at night. The device on right is the temperature sensor.

Experiment 4: (Day time)

The vehicle is not a completely enclosed space; it has windows that allow sunlight to enter, adding heat to the interior environment. To accurately simulate this radiative load, a transparent plastic box is used. The aluminium layer on top acts like a roof, simulating the condition of direct, diffuse, radiative cooling loads.

Material	plastic box with dimensions $40 \times 23 \times 14\ mm$ tin sheet on top
Convective Layer	aluminum foil of thickness 10.5 micron, covered with scotch tape 1 layer.
Surface Area to Volume ratio	0.209 mm^{-1}
Temperature drop	Max drop: 1.30°C Min drop: -0.20°C (above the ambient temperature) Average drop: 0.46°C
Remarks	Despite the weather being cloudy, the temperature drops were not significant enough.

Test setup of the experiment. The plastic box, covered with reflective material. Data loggers are used in this experiment.



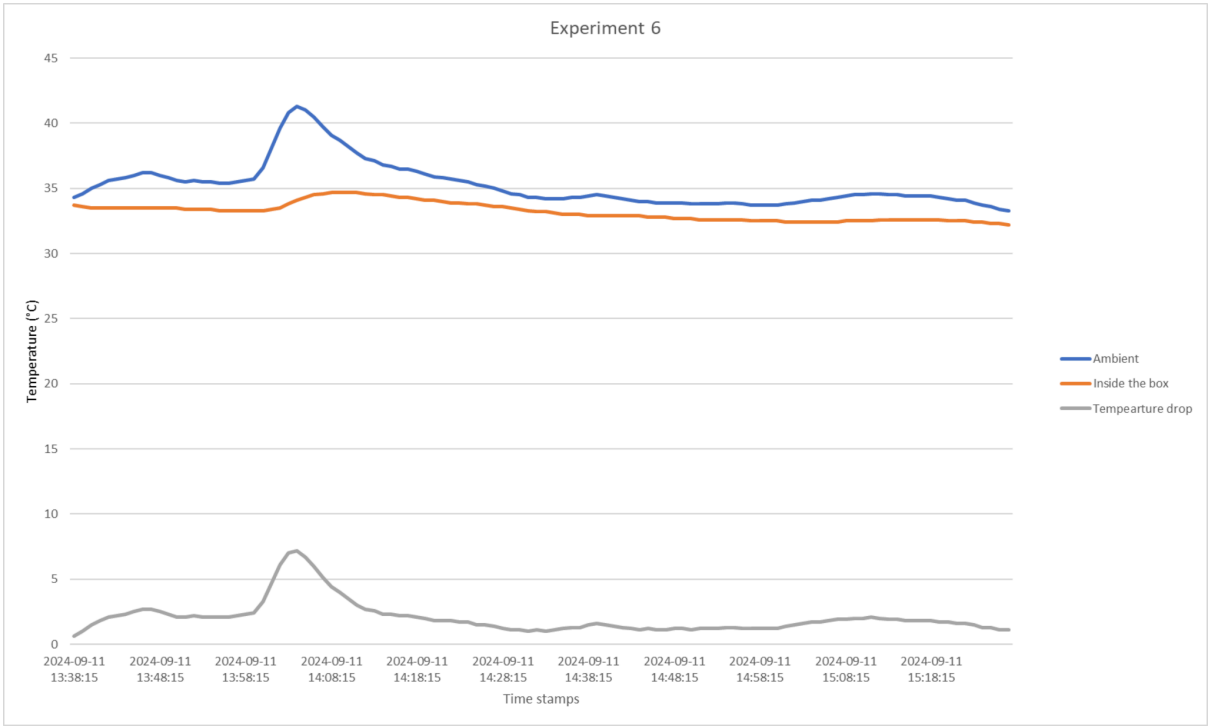
Inferences:

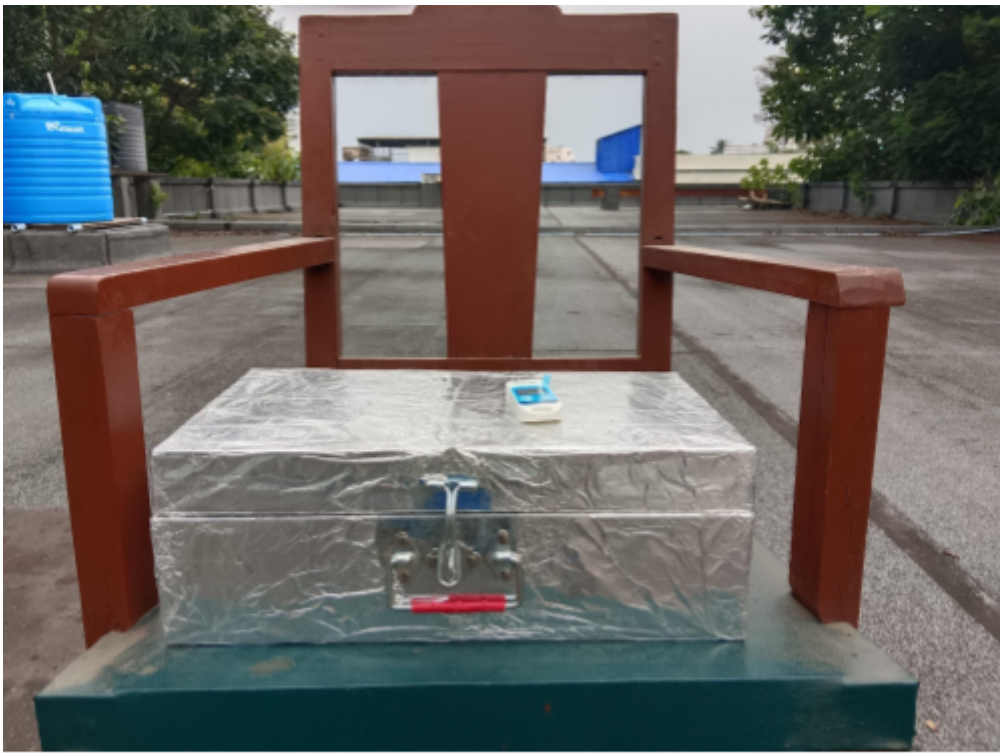
Temperature drops have not been significant primarily due to a single radiating surface. So, in an actual vehicle, where radiative load will be significant, radiative cooling with aluminium foil and scotch tape as a radiative surface will not be effective at day time.

Experiment 5: (Day time)

The vehicle is made up mostly of aluminium

Material	aluminium box $23 \times 17 \times 8\ mm$
Convective Layer	aluminum foil of thickness 10.5 micron, covered with scotch tape 1 layer.
Surface Area to Volume ratio	0.329 mm^{-1}
Temperature drop	Max drop:7.94°C Min drop: 1.34°C Average drop: 2.77°C
Remarks	The experiment was conducted on a cloudy day, and the sudden temperature spike occurred when the sun briefly appeared. The temperature inside the box lagged, which prevented a significant increase. The temperature drop obtained is higher than what is achieved in other experiments.



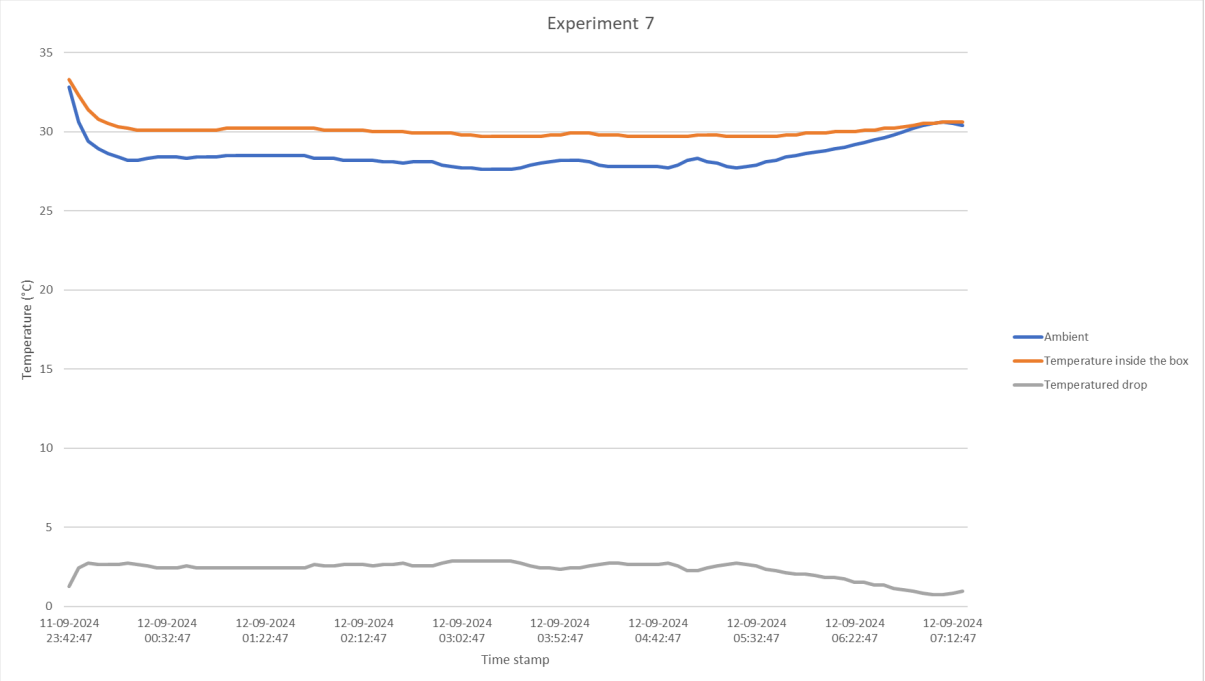


Test setup of the experiment. Readings were taken on a cloudy day in the afternoon.

Inferences:
The experiment shows such a high difference in temperature because of a cloudy day, when the solar radiation is low. The experiment needs to be repeated under similar conditions on a bright sunny day to test its performance.

Experiment 6:(Night time)

Material	aluminium box $23 \times 17 \times 8\ mm$
Convective Layer	aluminum foil of thickness 10.5 micron, covered with scotch tape 1 layer.
Surface Area to Volume ratio	0.329 mm^{-1}
Temperature drop	Max drop: 2.84°C Min drop: 0.74°C Average drop: 2.32°C
Remarks	The experiment was conducted on a cloudy night.



The setup of the experiment. Data was collected overnight.

Final conclusion on objective 1:

1. **High Surface Area to volume ratio:** From a series of experiments we have concluded that higher surface area to volume ratio, the better temperature drops can be achieved. Higher volume means higher thermal inertia, and thus resulting temperature drops are lower.
2. So to achieve significant temperature drops, larger radiative surfaces are required. Hence it might not be sufficient if only the roof of the vehicle acts like a radiative surface.
3. Best weather conditions for radiative cooling are cloudy day and clear night. Under such conditions, even during the day temperature drop of 2°C below the day is possible.

Objective 2

This objective focuses on studying cooling rates under dynamic conditions. It includes:

- Simulating the heat loads generated by both the passengers and the engine.
- Conducting experiments to measure cooling performance while the vehicle is in motion.

Simulation of Heat Loads

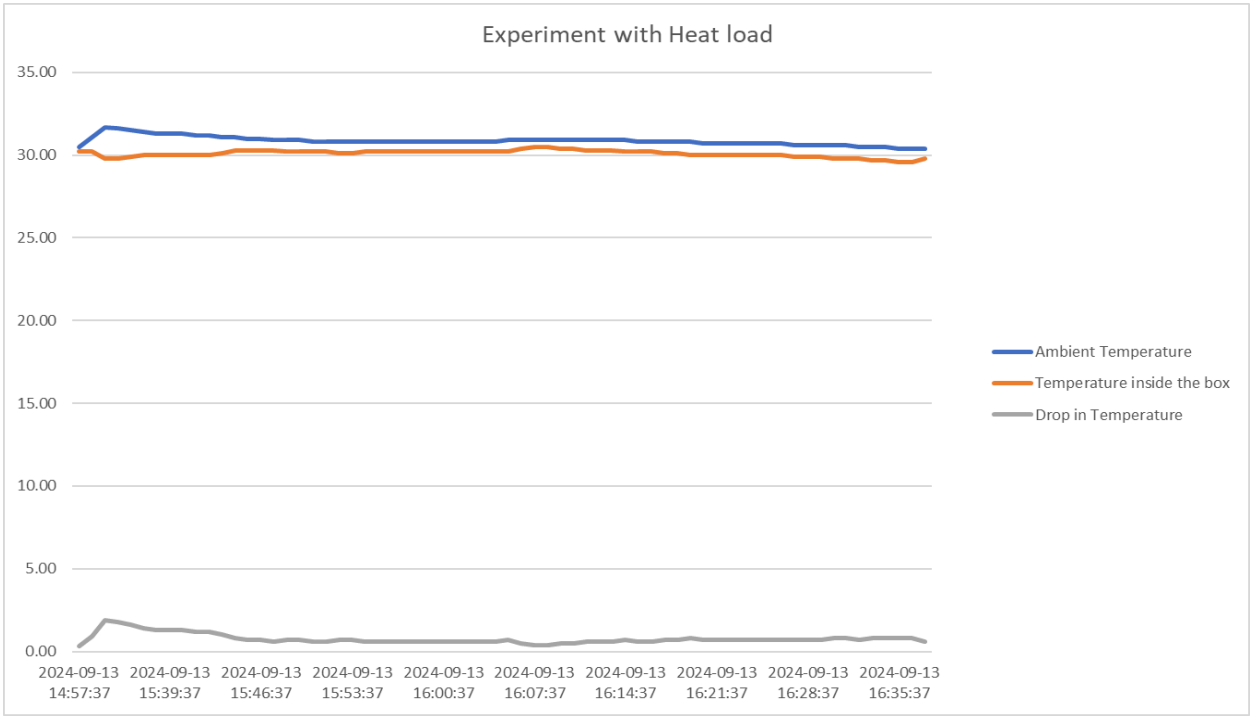
There are several thermal loads that the air conditioning in the vehicle needs to work against to achieve cooling. Some of them include metabolic load, radiation load, engine load, etc. In this Experiment we simulate the metabolic loads.

The metabolic activities inside the human body constantly create heat and humidity (i.e. perspiration). This heat passes through the body tissues and is finally released to the cabin air. This amount is considered as a heat gain by the cabin air and is called the metabolic load.

According to ANSI/ASHRAE Addendum g to Standard 55-2010, *Thermal Environmental Conditions for Human Occupancy*, the estimated heat generation for a driver and a seated passenger is 85 W/m² and 55 W/m², respectively. Therefore, to simulate the thermal loads, we need to generate 55 W of heat per square meter for a person seated inside the vehicle.

Experiment 7: With heat load, Day time

Material	aluminium box $23 \times 17 \times 8\ mm$
Convective Layer	aluminum foil of thickness 10.5 micron, covered with scotch tape 1 layer.
Surface Area to Volume ratio	0.329 mm^{-1}
Temperature drop	Max drop: 1.9°C Min drop: 0.74°C Average drop: 2.32°C
Remarks	A 100 W light bulb was used as a heat source and was operated in the range 70-80 W by using a variable resistance (rheostat). The experiment was conducted on a cloudy day.



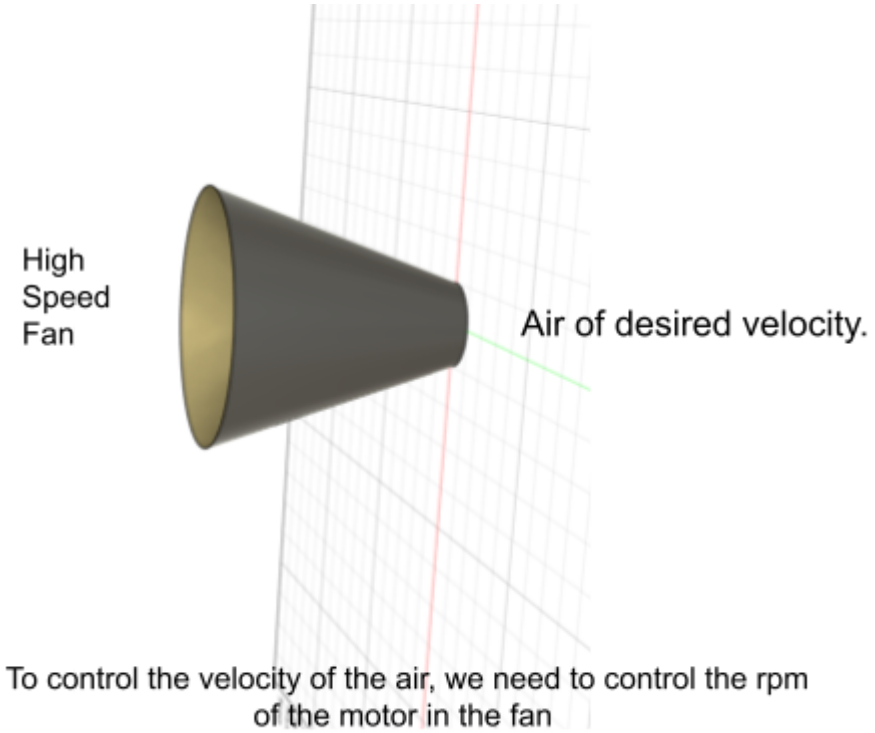
Test Setup of the experiment. Rheostat is used to vary the heat loads.

Simulation of Speed of Vehicle

The vehicle moves at a certain speed. The average speed of a taxi on the roads of Kolkata is maximum 60 km/hr. Performing heat transfer calculations, it was determined that due to convection heat transfer from the surface, the temperature drops will decrease. However, that is something which is not desired. So a convective shield needs to be used.

However, according to market research, fans/ blowers which are readily available, and easy to use cannot produce such high velocity. So we need a nozzle to increase the speed.

We have already designed the CAD model of the nozzle. But its manufacturing and testing is incomplete due to the lack of funds.



Conclusion

In conclusion, our project has successfully demonstrated that radiative cooling using a simple combination of aluminum foil and scotch tape can serve as an effective passive cooling technique. This approach achieved notable temperature reductions, highlighting the potential of low-cost materials in cooling applications. However, in recent years, several advanced compounds have been synthesized with more promising radiative cooling performance, which could be explored for even greater efficiency in future studies.

Regarding the remaining two objectives, our designs are finalized and ready for the manufacturing phase. Once manufacturing begins, we anticipate validating our design's full potential and testing its utility under more operating conditions. This progress marks a critical step toward further optimizing radiative cooling solutions, contributing to energy savings and sustainability in the automotive sector and beyond.

Cost Report

Serial No.	Item	Quantity	Price (INR)	Bill Link
A	Non Recurring (Capital Items)			
1	11/2 inch nut	10	70	Nut_bill.pdf
2	Aluminium Sheet 2x61/2	1	494	Al sheet_…
3	Aluminium Sheet Roll	1	720	
4	Rheostat 8 inch(50 ohm 2A)	1	799	Rheostat…
5	Glass Mercury Thermometer	1	345	Mercury t…
6	Scotch Tape	1	225	Scotch T…
7	Mini Digital LCD Thermo Hygrometer	1	136	Thermoh…
8	Digital Thermo Hygrometer with clock	1	725	
9	Holder	1	20	Bulb_bill.…
10	Wire	10 gauges	80	
11	100 W bulb	1	22	
12	60W bulb	1	30	
12	6 W	1	22	
13	2 pin top	1	20	
14	Mini Digital LCD Thermo Hygrometer	1	185	digital th…
15	Freshwrapp Aluminium Foil 10.5 micron , width 300 mm, 72 m	1	599	aluminiu…
16	100 ohm 0.25W resistor metal film resistor (pack of 100)	1	29	
17	330 ohm 0.25W resistor metal film resistor resistor (pack of 100)	1	29	robu bill …

18	digital multimeter LCD	1	169	
19	Standard shipping	1	99	
20	aluminium foil	1	50	aluminiu…
21	anemometer	1	1000	anemom…
22	Temperature Data logger	2	4000	data logg…
23	Thermocol box for insulation	1		
24	aluminium foil	1	440	thermoco…
26	Heavy Duty Staple gun	1	750	staple gu…
	Manufacturing Expenses			
	Aluminium Sheet work-1		300	
27	Aluminium Sheet work-2		300	
	Riveting/Machining Works		250	
		Sub Total	1050	
		Grand Total	11908	
B	**Recurring Cost**			
1	Consumables (Cellotape, Electrical tape, Fevicol, etc)		558	
2	Travel		672	
3	Other Costs		500	
C	Total Cost of project so far		13638	

Bills Attached

No. 5385 CASH MEMO Date 06/08/24

LOKENATH PAPER HOUSE

55/B, Sree Ram Thakur Saranl (Central Road,), Kolkata - 32

Name .....

Address .....

Pcs	Particulars	Rate	Amount Rs.	P.
1	Aluminium foil		50	—
	Thank You	TOTAL	50	—

2024-25 GST NO. 19AEAPN8726Q1ZP Signature

Tax INVOICE (Original for Recipient)

ROBU.IN
Your Ideas, Our Parts

MACFOS LIMITED
(Formerly known as MACFOS PVT LTD)
Sumant Building, Dynamic Logistics Trade Park
Survey No. 75/1 Dighi, Bhosari Alandi Road Pune 411015
Maharashtra MH
India
02068197600
CIN: L29309PN2017PLC172718
info@robu.in
GSTIN: 27AALCM3536H1ZA

Customer

Nishant Dey

Kantaranguni near dvc more
electric office
Adra dist purulia
Purulia, 723121
West Bengal,WB,
India
8145446758
nishantdey12@gmail.com

Place of Supply: 19 - West Bengal

Shipping Address

Nilendu Dikshit

Room No 60, A2 Block, Jadavpur Main Hostel,
Prince Anwar Shah Road,
Near Jadavpur Police Station,
Kolkata, 700032
West Bengal,WB,
India
8145446758
nishantdey12@gmail.com

Invoice# INV2425/118419

Invoice Date:	Sale Order:	Reference:
02/08/2024	2187280	INV2425/118419

	Description	HSN	Rate	Qty	Disc	Amount	IGST	Total
1	[582205] 100 Ohm 0.25W Metal Film Resistor (Pack of 100)	85334090	₹ 24.580000	1.00	₹ 0.00	₹ 24.58	₹ 4.42 (18.0%)	₹ 29.00
2	[582405] 330 Ohm 0.25W Metal Film Resistor (Pack of 100)	85334090	₹ 24.580000	1.00	₹ 0.00	₹ 24.58	₹ 4.42 (18.0%)	₹ 29.00
3	[5983] Digital Multimeter Small Yellow Color LCD AC DC Measuring Voltage Current	85151100	₹ 143.220000	1.00	₹ 0.00	₹ 143.22	₹ 25.78 (18.0%)	₹ 169.00
4	[std_chipping] STANDARD SHIPPING	996819	₹ 41.530000	1.00	₹ 0.00	₹ 41.53	₹ 7.47 (18.0%)	₹ 49.00
				Total:	4.000			

Item	Taxes	Amount
1	18% IGST (Sale)	₹ 42.09

Subtotal	₹ 233.91
Taxes	₹ 42.09
Total	₹ 276.00

Amount in Words:TWO HUNDRED AND SEVENTY-SIX INDIAN RUPEE
Payment terms: Immediate Payment
Whether tax is payable under reverse charge: No

This is a computer generated invoice.

Subject to PUNE Jurisdiction

TAX INVOICE (Original for Recipient)

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https://plus.google.com/+RobuInlabs

MACFOS LIMITED
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Customer

Nishant Dey

Kantaranguni near dvc more
electric office
Adra dist purulia
Purulia, 723121
West Bengal,WB,
India
8145446758
nishantdey12@gmail.com

Place of Supply: 19 - West Bengal

Shipping Address

Ayush Barua

Barua Para, Near Banerjee Hat,
Vill-South Jalkhura, PO+PS-Maheshtala, Dist- South
24 Parganas
Kolkata, 700141
West Bengal,WB,
India
8145446758
nishantdey12@gmail.com

Invoice# INV2425/113981

Invoice Date:	Sale Order:	Reference:
28/07/2024	2179650	INV2425/113981

	Description	HSN	Rate	Qty	Disc	Amount	IGST	Total
1	[890191] FY-12 Mini LCD Digital Thermometer ,Hygrometer	85312000	₹ 115.250000	1.00	₹ 0.00	₹ 115.25	₹ 20.75 (18.0%)	₹ 136.00
2	[std_shipping] STANDARD SHIPPING	996819	₹ 41.530000	1.00	₹ 0.00	₹ 41.53	₹ 7.47 (18.0%)	₹ 49.00
				Total:	2.000			

Item	Taxes	Amount
1	18% IGST (Sale)	₹ 28.22

Subtotal	₹ 156.78
Taxes	₹ 28.22
Total	₹ 185.00

Amount In Words:ONE HUNDRED AND EIGHTY-FIVE INDIAN RUPEE
Payment terms: Immediate Payment
Whether tax is payable under reverse charge: No

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TAX INVOICE (Original for Recipient)

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GSTIN: 27AALCM3536H1ZA

Customer

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electric office
Adra dist purulia
Purulia, 723121
West Bengal,WB,
India
8145446758
nishantdey12@gmail.com

Place of Supply: 19 - West Bengal

Shipping Address

Ayush Barua

Barua Para, Near Banerjee Hat,
Vill-South Jalkhura, PO+PS-Maheshtala, Dist- South
24 Parganas
Kolkata, 700141
West Bengal,WB,
India
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Payment terms: Immediate Payment
Whether tax is payable under reverse charge: No

This is a computer generated invoice.

Subject to PUNE Jurisdiction

amazon.in

Tax Invoice/Bill of Supply/Cash Memo
(Original for Recipient)

Sold By :
THERMO PLAST INDUSTRIES
* RZ-16 Sayyad Nangaloi gaon ,New GH-6 Park lane T point, LeftPaschim vihar
New Delhi, Delhi, 110087
IN

Billing Address :
Rajasree Dey
C/264 B Bapuji Nagar, Jadavpur
KOLKATA, WEST BENGAL, 700092
IN
State/UT Code: 19

PAN No: AAJPK7357B
GST Registration No: 07AAJPK7357B1ZQ

Shipping Address :
Rajasree Dey
Nilendu Dikshit
Room No 60, A2 block, Jadavpur University Main Hostel, Prince Anawar Shah Road,
KOLKATA, WEST BENGAL, 700032
IN
State/UT Code: 19
Place of supply: WEST BENGAL
Place of delivery: WEST BENGAL

Order Number: 403-4347289-7712325
Order Date: 31.07.2024

Invoice Number : ZNL4-4848
Invoice Details : DL-ZNL4-316931945-2425
Invoice Date : 31.07.2024

Sl. No	Description	Unit Price	Discount	Qty	Net Amount	Tax Rate	Tax Type	Tax Amount	Total Amount
1	Thermocare anemometer wind speed meter With LCD Backlight Portable Digital | B07X88RY3T (Anemometer) HSN:90318000	₹847.46	₹0.00	1	₹847.46	18%	IGST	₹152.54	₹1,000.00
	Shipping Charges	₹33.90	-₹33.90		₹0.00	18%	IGST	₹0.00	₹0.00
TOTAL:								₹152.54	₹1,000.00

Amount in Words:
One Thousand only

For THERMO PLAST INDUSTRIES:

For Thermo Plast Industries
Prop.

Authorized Signatory

Whether tax is payable under reverse charge - No

Payment Transaction ID:	Date & Time:	Invoice Value:	Mode of Payment:
TQhuN4CXbl6lgVSmGNA75Fe1wuZABLunbcQ	31/07/2024, 12:20:40 hrs	1,000.00	UPI

NAG HARDWARE
B172 Raja S.C. Mullick Road
Sukanta Market
Kolkata 700032

02/04/2024

1) Aluminium Sheet
2' x 6½' = 13 Sqft
38/-

494.00

Rs. 494.00

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24x7 All India Toll Free Helpline : 1800209454З

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Tax Invoice/Bill of Supply/Cash Memo
(Original for Recipient)

Sold By :
Diwakar Instruments Company
Comet Scientific Industries, 3467 Kacha Bazar,
Near Sadar Police Quarters
AMBALA, HARYANA, 133001
IN

PAN No: CTEPD9831M
GST Registration No: 06CTEPD9831M1ZD

Billing Address :
Soumyadeep khamrai
9c Naskarpara Road, Santoshpur, Near NR pharmaceutical
KOLKATA, WEST BENGAL, 700075
IN
State/UT Code: 19

Shipping Address :
Soumyadeep khamrai
Soumyadeep khamrai
9c Naskarpara Road, Santoshpur, Near NR pharmaceutical
KOLKATA, WEST BENGAL, 700075
IN
State/UT Code: 19
Place of supply: WEST BENGAL
Place of delivery: WEST BENGAL

Order Number: 408-2625580-1525942
Order Date: 31.03.2024

Invoice Number : IN-3623
Invoice Details : HR-1012043895-2324
Invoice Date : 31.03.2024

Sl No	Description	Unit Price	Qty	Net Amount	Tax Rate	Tax Type	Tax Amount	Total Amount
1	Comet Borosilicate Glass Mercury Thermometer for laboratory industrial and household temperature measurement of liquids milk and chemicals (110) | B09FFHBT69 (MT-01PC-0110) HSN:7017	₹275.42	1	₹275.42	18%	IGST	₹49.58	₹325.00
	Shipping Charges	₹16.95		₹16.95	18%	IGST	₹3.05	₹20.00
TOTAL:							₹52.63	₹345.00

Amount in Words:
Three Hundred Forty-five only

For Diwakar Instruments Company:

Authorized Signatory

Whether tax is payable under reverse charge - No

Payment Transaction ID:	Date & Time:	Invoice Value:	Mode of Payment:
TQhuMfd031lvEWs9OptAxSMfVBUBe9Qp8uW	31/03/2024, 21:34:37 hrs	345.00	UPI

amazon.in

Tax Invoice/Bill of Supply/Cash Memo
(Triplicate for Supplier)

Sold By :
RAHUL
981, SECTOR-16, HOUSING BOARD COLONY,
Ambala
Ambala, HARYANA, 133001
IN

PAN No: FZQPR2640R
GST Registration No: 06FZQPR2640R1ZD

Billing Address :
Soumyadeep khamrai
9c Naskarpara Road, Santoshpur, Near NR pharmaceutical
KOLKATA, WEST BENGAL, 700075
IN
State/UT Code: 19

Shipping Address :
Soumyadeep khamrai
Soumyadeep khamrai
9c Naskarpara Road, Santoshpur, Near NR pharmaceutical
KOLKATA, WEST BENGAL, 700075
IN
State/UT Code: 19

Place of supply: WEST BENGAL
Place of delivery: WEST BENGAL

Order Number: 408-3916200-7870735
Order Date: 31.03.2024

Invoice Number : IN-1316
Invoice Details : HR-349503573-2324
Invoice Date : 31.03.2024

Sl. No	Description	Unit Price	Qty	Net Amount	Tax Rate	Tax Type	Tax Amount	Total Amount
1	ECNEICS Rheostat 8 inch (35 ohms 2 Amp.) | B0CKFBQ8GL (Rheostat_8inch) HSN:8533	₹677.12	1	₹677.12	18%	IGST	₹121.88	₹799.00
TOTAL:							₹121.88	₹799.00

Amount in Words:
Seven Hundred Ninety-nine only

For RAHUL:

Authorized Signatory

Whether tax is payable under reverse charge - No

Payment Transaction ID:	Date & Time: 31/03/2024, 21:34:37 hrs	Invoice Value: 799.00	Mode of Payment: UPI
TQhuMfd031lvEWs9OptAxSMtV5UBe9Qp8uW			

amazon.in

Tax Invoice/Bill of Supply/Cash Memo
(Original for Recipient)

Sold By :
THERMO PLAST INDUSTRIES
* RZ-16 Sayyad Nangaloi gaon ,New GH-6 Park lane T point, LeftPaschim vihar
New Delhi, Delhi, 110087
IN

Billing Address :
Rajasree Dey
C/264 B Bapuji Nagar, Jadavpur
KOLKATA, WEST BENGAL, 700092
IN
State/UT Code: 19

PAN No: AAJPK7357B
GST Registration No: 07AAJPK7357B1ZQ

Shipping Address :
Rajasree Dey
Nilendu Dikshit
Room No 60, A2 block, Jadavpur University Main Hostel, Prince Anawar Shah Road,
KOLKATA, WEST BENGAL, 700032
IN
State/UT Code: 19
Place of supply: WEST BENGAL
Place of delivery: WEST BENGAL

Order Number: 403-4347289-7712325
Order Date: 31.07.2024

Invoice Number : ZNL4-4848
Invoice Details : DL-ZNL4-316931945-2425
Invoice Date : 31.07.2024

Sl. No	Description	Unit Price	Discount	Qty	Net Amount	Tax Rate	Tax Type	Tax Amount	Total Amount
1	Thermocare anemometer wind speed meter With LCD Backlight Portable Digital | B07X88RY3T (Anemometer) HSN:90318000	₹847.46	₹0.00	1	₹847.46	18%	IGST	₹152.54	₹1,000.00
	Shipping Charges	₹33.90	-₹33.90		₹0.00	18%	IGST	₹0.00	₹0.00
TOTAL:								₹152.54	₹1,000.00

Amount in Words:
One Thousand only

For THERMO PLAST INDUSTRIES:

For Thermo Plast Industries
Prop.

Authorized Signatory

Whether tax is payable under reverse charge - No

Payment Transaction ID:	Date & Time:	Invoice Value:	Mode of Payment:
TQhuN4CXbl6lgVSmGNA75Fe1wuZABLunbcQ	31/07/2024, 12:20:40 hrs	1,000.00	UPI

amazon.in

Tax Invoice/Bill of Supply/Cash Memo
(Triplicate for Supplier)

Sold By :
RAHUL
981, SECTOR-16, HOUSING BOARD COLONY,
Ambala
Ambala, HARYANA, 133001
IN

PAN No: FZQPR2640R
GST Registration No: 06FZQPR2640R1ZD

Billing Address :
Soumyadeep khamrai
9c Naskarpara Road, Santoshpur, Near NR pharmaceutical
KOLKATA, WEST BENGAL, 700075
IN
State/UT Code: 19

Shipping Address :
Soumyadeep khamrai
Soumyadeep khamrai
9c Naskarpara Road, Santoshpur, Near NR pharmaceutical
KOLKATA, WEST BENGAL, 700075
IN
State/UT Code: 19

Place of supply: WEST BENGAL
Place of delivery: WEST BENGAL

Order Number: 408-3916200-7870735
Order Date: 31.03.2024

Invoice Number : IN-1316
Invoice Details : HR-349503573-2324
Invoice Date : 31.03.2024

Sl. No	Description	Unit Price	Qty	Net Amount	Tax Rate	Tax Type	Tax Amount	Total Amount
1	ECNEICS Rheostat 8 inch (35 ohms 2 Amp.) | B0CKFBQ8GL (Rheostat_8inch) HSN:8533	₹677.12	1	₹677.12	18%	IGST	₹121.88	₹799.00
TOTAL:							₹121.88	₹799.00

Amount in Words:
Seven Hundred Ninety-nine only

For RAHUL:

Authorized Signatory

Whether tax is payable under reverse charge - No

Payment Transaction ID:	Date & Time: 31/03/2024, 21:34:37 hrs	Invoice Value: 799.00	Mode of Payment: UPI
TQhuMfd031lvEWs9OptAxSMtV5UBe9Qp8uW			

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To, M/s.

Date: 8/4/24

S.No.	Particulars	Qty.	Rate	Amount
	Coff 1½ Nut			70/-

R 70/

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Tax Invoice/Bill of Supply/Cash Memo
(Original for Recipient)

Sold By :
COCOBLU RETAIL LIMITED
*Survey Number 99/1, Mamidipally Village, Shamshabad
HYDERABAD, TELANGANA, 500108
IN

Billing Address :
Ayush
Ankush Mondal Car care, Natunhat Bus Stand,
Kolkata 700141
KOLKATA, WEST BENGAL, 700141
IN
State/UT Code:19

PAN No:AAJCC8517E
GST Registration No:36AAJCC8517E1ZM
Dynamic QR Code:

Shipping Address :
Ayush
Ayush
Ankush Mondal Car care, Natunhat Bus Stand,
Kolkata 700141
KOLKATA, WEST BENGAL, 700141
IN
State/UT Code:19
Place of supply:WEST BENGAL
Place of delivery:WEST BENGAL

Order Number:408-5966376-2499556
Order Date:15.03.2024

Invoice Number :HYD3-1352307
Invoice Details :TG-HYD3-1271137075-2324
Invoice Date :15.03.2024

Sl. No	Description	Unit Price	Qty	Net Amount	Tax Rate	Tax Type	Tax Amount	Total Amount
1	3M Scotch BOPP Packaging Clear Tape (Transparent) | 48mm x 50 Meter | Pack of 2 | for Packaging, Decorating and DIY | B01CSGVBZQ (B01CSGVBZQ) HSN:90178090	₹190.68	1	₹190.68	18%	IGST	₹34.32	₹225.00
TOTAL:							**₹34.32**	**₹225.00**

Amount in Words:
Two Hundred Twenty-five only

For COCOBLU RETAIL LIMITED:

Authorized Signatory

Whether tax is payable under reverse charge - No

Tax Invoice

Order Id: **OD431934920666760100**
Order Date: 01-08-2024, 12:01 PM

Invoice No: **FACT6G2500000941**
Invoice Date: 01-08-2024, 09:02 PM

GSTIN: 27AIEPG9749E1Z2
PAN: AIEPG9749E

Sold By
Shree Shyam Enterprises,
1305 B Wing, Corona Building, Dosti Imperia,
Manpada, , THANE - 400610
GST: 27AIEPG9749E1Z2

Shipping ADDRESS
Nilendu Dikshit,
Room no 60, A2 block, Jadavpur University Main Hostel,
Prince Anawar Shah Road,
Near Jadavpur police station,
Kolkata - 700032, IN-WB

Billing Address
Nilendu Dikshit,
Room no 60, A2 block, Jadavpur University Main Hostel,
Prince Anawar Shah Road,
Near Jadavpur police station,
Kolkata - 700032, IN-WB

Product	Description	Qty	Gross Amount	Discount	Taxable Value	IGST	CESS	Total
Freshwrapp Aluminium Foil 72m, Thickness 10.5 microns, Width 300mm Aluminium Foil 72 FW-FWN | FRESHWRNEW01_ES | IMEI/SrNo: [[]]	HSN: 76071991 | IGST: 18.00% | CESS: 0.00%	1	599.00	-0.00	507.63	91.37	0.00	599.00
	Shipping and Handling Charges	1	0.00	0	0.00	0.00	0.00	0.00

TOTAL QTY: 1

TOTAL PRICE: 599.00
All values are in INR

Seller Registered Address: Shree Shyam Enterprises,
13, 1305, B Wing, Corona, Dosti Imperia,, Manpada, THANE - 400607.
Declaration
The goods sold are intended for end user consumption and not for resale.
FSSAI License number: null

E. & O.E.

Ordered Through
Flipkart

Shree Shyam Enterprises
Authorized Signature

amazon.in

Tax Invoice/Bill of Supply/Cash Memo
(Original for Recipient)

Sold By :
Diwakar Instruments Company
Comet Scientific Industries, 3467 Kacha Bazar,
Near Sadar Police Quarters
AMBALA, HARYANA, 133001
IN

PAN No: CTEPD9831M
GST Registration No: 06CTEPD9831M1ZD

Billing Address :
Soumyadeep khamrai
9c Naskarpara Road, Santoshpur, Near NR pharmaceutical
KOLKATA, WEST BENGAL, 700075
IN
State/UT Code: 19

Shipping Address :
Soumyadeep khamrai
Soumyadeep khamrai
9c Naskarpara Road, Santoshpur, Near NR pharmaceutical
KOLKATA, WEST BENGAL, 700075
IN
State/UT Code: 19
Place of supply: WEST BENGAL
Place of delivery: WEST BENGAL

Order Number: 408-2625580-1525942
Order Date: 31.03.2024

Invoice Number : IN-3623
Invoice Details : HR-1012043895-2324
Invoice Date : 31.03.2024

Sl No	Description	Unit Price	Qty	Net Amount	Tax Rate	Tax Type	Tax Amount	Total Amount
1	Comet Borosilicate Glass Mercury Thermometer for laboratory industrial and household temperature measurement of liquids milk and chemicals (110) | B09FFHBT69 (MT-01PC-0110) HSN:7017	₹275.42	1	₹275.42	18%	IGST	₹49.58	₹325.00
	Shipping Charges	₹16.95		₹16.95	18%	IGST	₹3.05	₹20.00
TOTAL:							₹52.63	₹345.00

Amount in Words:
Three Hundred Forty-five only

For Diwakar Instruments Company:

Authorized Signatory

Whether tax is payable under reverse charge - No

Payment Transaction ID:	Date & Time:	Invoice Value:	Mode of Payment:
TQhuMfd031lvEWs9OptAxSMfVBUBe9Qp8uW	31/03/2024, 21:34:37 hrs	345.00	UPI

amazon.in

Tax Invoice/Bill of Supply/Cash Memo
(Original for Recipient)

Sold By :
Clicktech Retail Private Limited
*NDR Vanshil, warehouse Park LLP, raghudevpur, Panchla, Howrah
Kolkata, West Bengal, 711322
IN

Billing Address :
Mrityunjoy das
78/3, Vivekananda Sarani, Garfa
KOLKATA, WEST BENGAL, 700078
IN
State/UT Code:19

PAN No:AAJCC9783E
GST Registration No:19AAJCC9783E1Z4
Dynamic QR Code:

Shipping Address :
Mrityunjoy das
Mrityunjoy das
78/3, Vivekananda Sarani, Garfa
KOLKATA, WEST BENGAL, 700078
IN
State/UT Code:19
Place of supply:WEST BENGAL
Place of delivery:WEST BENGAL

Order Number:404-3881065-1528364
Order Date:09.09.2024

Invoice Number :CCX1-567480
Invoice Details :WB-CCX1-1931600335-2425
Invoice Date :09.09.2024

Sl. No	Description	Unit Price	Discount	Qty	Net Amount	Tax Rate	Tax Type	Tax Amount	Total Amount
1	amazon basics 3 in 1 Heavy Duty Staple Gun with staples - (4-14mm) 600 Pieces | B07W48JF1C (B07W48JF1C) HSN:83052000	₹634.74	₹0.00	1	₹634.74	9%	CGST	₹57.13	₹749.00
						9%	SGST	₹57.13	
	Shipping Charges	₹83.90	-₹83.90		₹0.00	9%	CGST	₹0.00	₹0.00
						9%	SGST	₹0.00	
TOTAL:								**₹114.26**	**₹749.00**

Amount in Words:
Seven Hundred Forty-nine only

For Clicktech Retail Private Limited:

Authorized Signatory

Whether tax is payable under reverse charge - No

*ASSPL-Amazon Seller Services Pvt. Ltd., ARIPL-Amazon Retail India Pvt. Ltd. (only where Amazon Retail India Pvt. Ltd. fulfillment center is co-located)

Customers desirous of availing input GST credit are requested to create a Business account and purchase on Amazon.in/business from Business eligible offers

Please note that this invoice is not a demand for payment

H

To HAREKRISHNA CENTER

₹440

Pay again | Split with friends

Completed

7 Sept 2024, 8:00 pm

Indian Bank 0035

UPI transaction ID
425136356380

To: HAREKRISHNA CENTER
q839740220@ybl

From: Mr Koustav Bhattacharjee (Indian Bank)
koustavexams786@oksbi

Google transaction ID
CICAgPC715CCGw

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