DESIGN AND FABRICATION OF PORTABLE

SALT WATER TO DRINKABLE WATER

A PROJECT REPORT

Submitted by

HARIHARA SUDHAN. M (927622BME026)
HEMANTH KUMAR. S (927622BME027)
JAGADEEPAN. S (927622BME028)

in partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

in

MECHANICAL ENGINEERING

M.KUMARASAMY COLLEGE OF ENGINEERING, KARUR

ANNA UNIVERSITY: CHENNAI 600 025

MAY 2024

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BONAFIDE CERTIFICATE

Certified that this project report **"DESIGN AND FABRICATION OF PORTABLE SALT WATER TO DRINKABLE WATER"** is the bonafide work of **"HARIHARA SUDHAN. M (927622BME026), HEMANTH KUMAR. S (927622BME027), JAGADEEPAN. S (927622BME028)"** who carried out the project work during the academic year 2023 – 2024 under my supervision. Certified further, that to the best of my knowledge the work reported here in does not form part of 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	**SIGNATURE**
Dr.M.LOGANATHAN M.E., Ph.D.	Dr. R. KAMALAKANNAN,M.E., PH.D. PROFESSOR
HEAD OF THE DEPARTMENT	**SUPERVISOR**
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This project report has been submitted for the end semester project viva voce Examination held on ________________

INTERNAL EXAMINER	**EXTERNAL EXAMINER**

DECLARATION

We affirm that the Project titled **“DESIGN AND FABRICATION OF PORTABLE SALT WATER TO DRINKABLE WATER ”** being submitted in partial fulfillment of for the award of Bachelor of Engineering in Mechanical Engineering, is the original work carried out by us. It has not formed the part of any other project or dissertation on the basis ofwhich a degree or award was conferred on an earlier occasion on this or any other candidate.

Student name	**Signature**
1. HARIHARASUDHAN. M	____________________
2. HEMANTH KUMAR. S	____________________
3. JAGADEEPAN. S	____________________

Name and signature of the supervisor with date

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INSTITUTION VISION & MISSION

Vision

- To emerge as a leader among the top institutions in the field of technical education.

Mission

- Produce smart technocrats with empirical knowledge who can surmount the global challenges.
- Create a diverse, fully-engaged, learner-centric campus environment to provide quality educationto the students.
- Maintain mutually beneficial partnerships with our alumni, industry and professional associations.

DEPARTMENT VISION, MISSION, PEO, PO & PSO

Vision

- To create globally recognized competent Mechanical engineers to work in multiculturalenvironment.

Mission

- To impart quality education in the field of mechanical engineering and to enhance their skills, to pursuecareers or enter into higher education in their area of interest.
- To establish a learner-centric atmosphere along with state-of-the-art research facility.
- To make collaboration with industries, distinguished research institution and to become a centre ofexcellence

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

The graduates of Mechanical Engineering will be able to

- PEO1: Graduates of the program will accommodate insightful information of engineering principlesnecessary for the applications of engineering.
- PEO2: Graduates of the program will acquire knowledge of recent trends in technology and solve problemin industry.
- PEO3: Graduates of the program will have practical experience and interpersonal skills to work both inlocal and international environments.
- PEO4: Graduates of the program will possess creative professionalism, understand their ethicalresponsibility and committed towards society.

PROGRAM OUTCOMES

The following are the Program Outcomes of Engineering Graduates:
Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of
Technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

The following are the Program Specific Outcomes of Engineering Graduates:

The students will demonstrate the abilities

1. **Real world application:** To comprehend, analyze, design and develop innovative products and provide solutions for the real-life problems.
2. **Multi-disciplinary areas:** To work collaboratively on multi-disciplinary areas and make quality projects.

Research oriented innovative ideas and methods: To adopt modern tools, mathematical, scientific and engineering fundamentals required to solve industrial and societal problems

Course Outcomes	At the end of this course, learners will be able to:	**Knowledge Level**
CO-1	Identify the issues and challenges related to industry, society and environment.	Apply
CO-2	Describe the identified problem and formulate the possible solutions	Apply
CO-3	Design / Fabricate new experimental set up/devices to provide solutions for the identified problems	Analyse
CO-4	Prepare a detailed report describing the project outcome	Apply
CO-5	Communicate outcome of the project and defend by making an effective oral presentation.	Apply

MAPPING OF PO & PSO WITH THE PROJECT

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO - 1	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 2	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 3	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 4	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3
CO - 5	3	3	3	3	2	2	2	2	3	3	2	2	3	2	3

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TABLE:1

ABSTRACT

The increasing global demand for freshwater, coupled with the scarcity of traditional water sources, has necessitated the development of innovative and sustainable water purification technologies. This abstract introduces a potable desalination device designed to convert saline water into potable water, addressing the pressing issue of freshwater scarcity in remote and disaster-stricken regions.

The portable desalination unit employs advanced reverse osmosis technology, allowing it to efficiently remove salts and impurities from saline water, producing high-quality freshwater suitable for human consumption and agricultural use. The compact and lightweight design of the device facilitates easy deployment in emergency situations, ensuring access to clean water in areas where conventional water treatment infrastructure may be lacking.

Key features of the portable desalination unit include its energy-efficient operation, utilizing renewable energy sources such as solar power or hand-crank generators. This makes the device suitable for off-grid applications, providing a sustainable and environmentally friendly solution to water scarcity challenges. The modular construction of the system allows for scalability, enabling adaptation to varying water demands and resource availability.

The integration of smart monitoring and control systems ensures optimal performance and resource utilization, enhancing the longevity and efficiency of the portable desalination unit. Additionally, the use of durable and cost-effective materials contributes to the economic feasibility of the technology, making it accessible to a broad range of communities and disaster response organizations

In summary, the development of a portable saline water desalination system offers a promising solution to the global freshwater crisis, particularly in areas facing water scarcity and emergencies. The innovative design, coupled with sustainable energy options and smart technology integration, makes this portable system a versatile and efficient tool for providing reliable access to clean water in challenging environments.

Scope of this project

Water Scarcity Mitigation: Desalination provides an alternative source of freshwater, especially in regions where access to clean drinking water is limited due to high salinity levels in natural water sources.

Technological Advancements: Ongoing research and advancements in desalination technologies aim to improve efficiency, reduce energy consumption, and lower costs associated with the process. Innovations such as membrane-based systems (reverse osmosis, nanofiltration), distillation techniques, and forward osmosis are continually evolving, expanding the scope for more sustainable and cost-effective solutions.

Environmental Impacts: While desalination offers a solution to freshwater scarcity, its widespread adoption requires addressing environmental concerns. The disposal of concentrated brine, energy consumption, and the impact on marine ecosystems remain areas of concern that need to be addressed through better technology and sustainable practices.

Infrastructure Development: Building desalination plants and associated infrastructure offers economic opportunities, job creation, and improved water security for communities, especially in arid and coastal regions.

Integration with Renewable Energy: Integrating desalination processes with renewable energy sources like solar and wind power can make the overall process more sustainable, reducing reliance on fossil fuels and minimizing environmental impact.

Industrial and Agricultural Use: Apart from providing drinking water, desalination can cater to the needs of various industries and agriculture, reducing the strain on existing freshwater sources and enabling sustainable growth in these sectors.

Global Impact: As water scarcity becomes a more pressing global issue due to climate change and increasing population demands, the scope for saltwater to pure water conversion becomes even more significant. Collaboration and knowledge-sharing among countries can enhance access to this technology and address water shortages on a larger scale.

Challenges and Opportunities: There are challenges associated with desalination, such as high initial costs, energy requirements, environmental impacts, and the need for continuous maintenance. Addressing these challenges presents opportunities for innovation and improvement in desalination.

CHAPTER-1

1.INTRODUCTION

Water purification is the process of removing undesirable chemicals, biological contaminants, suspended solids and gases from contaminated water. The goal of this process is to produce water fit for a specific purpose. Distillation. Sea water is heated until it boils. The salt remains in the liquid, and the steam is pure water. The steam is cooled and condensed to make potable water. Water is purified by various processes, some of these are by reverse osmosis or by using UV filtered water purifiers, etc. The water which is not potable or fit for drinking is called raw water and is mostly from the sources like groundwater, rivers, and lakes. Potable water, also known as drinking water, comes from surface and ground sources and is treated to levels that that meet state and federal standards for consumption. Water from natural sources is treated for microorganisms, bacteria, toxic chemicals, viruses and fecal matter. Potable water is not pure water because it almost always contains dissolved. impurities. For water to be potable, it must have sufficiently low levels of dissolved salts. Identify the technology or methods to be employed for sea water desalination and cooling.Consider energy sources for the portable device, such as solar power, battery, or a combinationkey performance indicators (KPIs) to measure the efficiency and effectiveness of the device.

Metrics may include energy efficiency, water production rate, and cooling capacity. Portable water purification devices are self-contained, easily transported units used to purify water from untreated sources (such as rivers, lakes, and wells) for drinking purposes. Their main function is to eliminate pathogens, and often also of suspended solids and some unpalatable or toxic compounds. Distillation. Sea water is heated until it boils. The salt remains in the liquid, and the steam is pure water. The steam is cooled and condensed to make potable water.

CHAPTER-2

2.WORKING

Portable water purification devices are self-contained, easily transported units used to purify water from untreated sources (such as rivers, lakes, and wells) for drinking purposes. Their main function is to eliminate pathogens, and often also of suspended solids and some unpalatable or toxic compounds. Distillation. Sea water is heated until it boils. The salt remains in the liquid, and the steam is pure water. The steam is cooled and condensed to make potable water. Water is purified by various processes, some of these are by reverse osmosis or by using UV filtered water purifiers, etc. The water which is not potable or fit for drinking is called raw water and is mostly from the sources like groundwater, rivers, and lakes. Potable water, also known as drinking water, comes from surface and ground sources and is treated to levels that that meet state and federal standards for consumption. Water from natural sources is treated for microorganisms, bacteria, toxic chemicals, viruses and fecal matter. Potable water is not pure water because it almost always contains dissolved. impurities. For water to be potable, it must have sufficiently low levels of dissolved salts.

CHAPTER-3

3.MATERIALS

Materials Used:

- Metal frame
- Charcoal
- Air supply fan
- Copper pipe
- Gear drive
- Thermoelectric peltier
- DC pump motor
- Battery

3.1. BATTERY

A battery is a source of electric power for the portable salt water to sea water system.

A lithium battery with a capacity of 12V and 16000mAh (milliampere-hours) possesses a higher voltage compared to many common single-cell lithium-ion batteries, which usually operate around 3.7V. The 12V output indicates that this battery likely comprises multiple cells connected in series to achieve this voltage level. With a capacity of 16000mAh, this battery can deliver a steady current of 1 ampere (A) for 16 hours or 16 amperes for 1 hour before exhausting its charge. Keep in mind that the discharge rate affects the actual runtime, and different devices draw different currents.

FIGURE: 3.1

3.2. DC PUMP MOTOR:

A dc pump motor is using to pump water from cooling tank one to cooling tank two.
A 3V DC pump motor is a specific type of motor designed to operate at a low voltage of 3 volts and is specifically engineered for pumping applications. These pumps are commonly used in various situations where a low-power, direct current motor is needed to create fluid flow. Here are some typical uses:

Water Circulation: These pumps can be used in small-scale water circulation systems, like in tabletop fountains, miniature irrigation systems, or hydroponic setups.

Liquid Transfer: They're employed in applications where liquids need to be transferred from one place to another, such as in small liquid dispensers, medical devices, or portable fuel transfer systems.

Cooling Systems: 3V DC pump motors can be utilized in small cooling systems, like in electronic devices or experimental setups requiring liquid cooling.

Air Pumps: In some cases, these pumps can also be adapted for air-related applications, like in small air pumps used for inflatable devices or certain aeration systems.

FIGURE: 3.2

3.3. MINI AIR SUPPLY FAN:

A 12V DC air supply fan refers to a fan specifically designed to operate on a 12-volt direct current (DC) power source. These fans are commonly used in various applications where a low-voltage supply is available or required, such as in automotive, marine, recreational vehicles (RVs), electronics, or off-grid setups where 12V DC power sources are prevalent. Here are some key points about these fans:

Voltage Requirement: They are designed to work efficiently and safely with a 12V DC power supply, which can be obtained from batteries, solar panels with a 12V output, or other DC power sources.

Air Circulation: These fans circulate air within a space or help in directing airflow in a particular direction, aiding in ventilation, cooling, or heat dissipation.

Variety: They come in various sizes, designs, and airflow capacities to suit different requirements. Some may have additional features like speed control, PWM (Pulse Width Modulation) support, or temperature sensors.

Applications: Common applications include cooling electronic components, providing ventilation in confined spaces, improving airflow in vehicles or enclosures, and aiding in heat dissipation in various systems.

Installation: They are relatively easy to install and can be mounted on walls, ceilings, or within enclosures, depending on the specific design and intended purpose.

Efficiency: These fans are generally designed for energy efficiency, especially when used in systems powered by batteries or renewable energy sources like solar panels.

Noise Level: Depending on the fan's design and quality, they can operate quietly or with moderate noise levels, and some fans prioritize low-noise operation for applications where noise is a concern.

FIGURE: 3.3

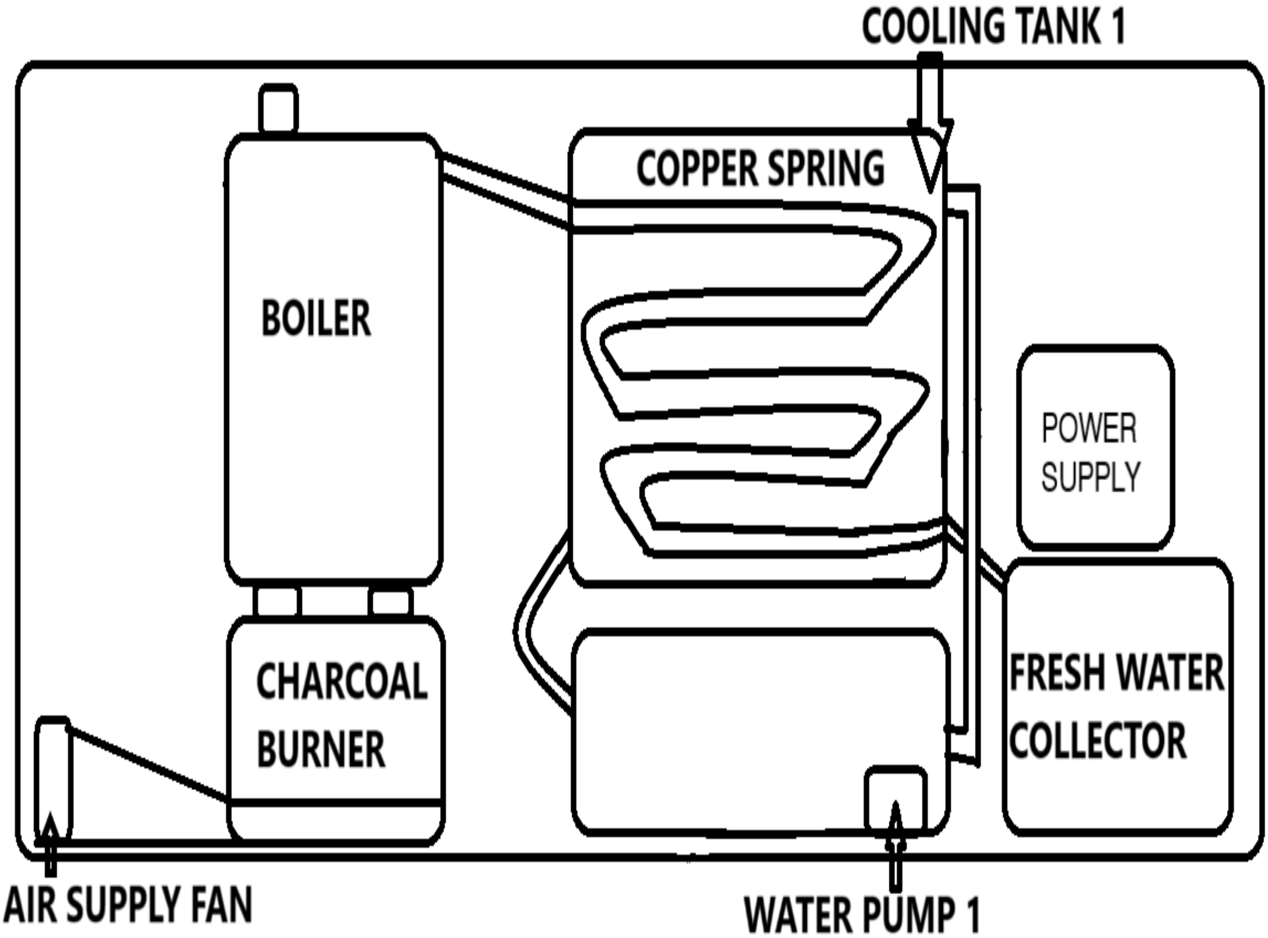
3.4. COST ESTIMATION:

TABLE:3.4

Components	Quantity	Cost (Rs)	Total (Rs)
Boiler	1*200	200	200
Frame	1*800	800	800
DC pump motor	2*100	200	200
Battery(12v)	1*1000	1000	1000
Air supply fan	2*100	200	200
Charcoal	½ kg	50	50
Copper pipe	6 feet	600	600
Charging unit		700	700
TOTAL COST			3750

CHAPTER-4

4.DESIGN



4.1. WORKING MODEL:

CHAPTER-5

5. WORKING PRINCIPLE:

Seawater or other water is pouring into the container. The container capacity of 1 liter with 1l of water is pouring. Using charcoal to burn and heat the container. Initially, it gets heated slowly after it gets some certain temperature it gets boiled water. The unwanted germs are also killed. Due to vapour pressure, it flows through the copper spring to cool the vapour. The water get slow cooling while passing the vapour in the copper spring by the normal water it gets more cooling and drinkable water. Using pipe through get a normal water as well as drinkable water.

5.1. USES:

1. Emergency Situations: In disaster-struck areas.
2. Marine Applications: On boats, ships, or during ocean expeditions where freshwater is limited or unavailable.
3. Military and Field Operations.
4. Outdoor Activities: For hikers, campers, or adventurers exploring remote areas.
5. Individual Preparedness: Compact portable desalination devices.

5.2. ADVANTAGES:

- Cost efficient.
- Bacterias can also killed in water during this process.
- Simple process.
- Easy to maintain.
- No skilled persons are required.

5.3. DISADVANTAGES:

- Old process.
- Time consuming.
- During rainy it is challeng to burn coal.

CHAPTER-6

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