NSF-2025

RESEARCH PLAN

PROJECT ID AND TITLE:

- **PROJECT ID:** ***9342301951***
- **PROJECT TITLE:** ***"HOW HEAVY CAN SOUND LIFT? A STUDY ON ULTRASONIC LEVITATORS".***
- **NAME OF THE STUDENT:** ***FAHIMA AFSHIN***
- **NAME OF SCHOOL:** ***SANA MODEL SCHOOL***
- **ADDRESS OF SCHOOL:** ***4/122 GOPARASANALLUR, KATTUPAKKAM, POONAMALLE, CHENNAI, TAMIL NADU, 600 056 , INDIA***

ACOUSTIC LEVITATION TRAPPING MATTERS WITH SOUND

AIM:

To study how the Amplitude of Sound (drive voltage to an ultrasonic transducer) affects the maximum mass of particles that can be levitated in an Acoustic Levitator.

HYPOTHESIS:

My prediction is that, if the drive voltage to the ultrasonic transducer is increased, then the maximum mass of a particle that can be levitated will also increase, because a higher voltage makes the sound waves stronger, which can push up heavier particles.

INTRODUCTION / SHORT ABSTRACT:

Acoustic levitation is a technique in which high frequency sound waves are used to trap small objects in the air without any physical support. This happens when ultrasonic waves form a standing wave between a transducer and a reflector, creating pressure nodes where objects can "float".

In this project, a simple acoustic levitator will be built and tested. By changing the amplitude of sound and recording the maximum mass of particles that can be levitated, the relationship between sound strength and levitation capacity will be studied. The experiment will help demonstrate how invisible sound forces can counteract gravity and open possibilities for applications in material handling and space research.

PROCEDURE:

- **The acoustic levitator setup will be prepared using an ultrasonic transducer and a reflector to create standing sound waves.**
- **The operating frequency of the transducer will be identified by calibration around its resonance point.**
- **Test particles of different known masses will be selected for the experiment.**

- **The amplitude of this sound drive voltage will be varied step by step while keeping other conditions constant.**
- **At each amplitude, the maximum mass of particles that could be stably levitated will be determined and recorded.**
- **The procedure will be repeated multiple Times to ensure accuracy and reliability of results.**
- **The collected data will be tabulated for analysis and interpretation.**

RISKS AND SAFETY:

ULTRASOUND EXPOSURE -

Ultrasonic waves (around 40 kHz) are above the human hearing range but can still cause discomfort or headaches at high power.

SAFETY MEASURES :

To Limit exposure time, keep the apparatus enclosed, and avoid placing ears close to the transducer.

ELECTRICAL HAZARDS -

The transducer and amplifier require electrical connections that may involve High voltages.

SAFETY MEASURES:

To Ensure proper insulation of wires, avoid touching live connections, and handle equipment with dry hands.

SMALL PARTICLES -

Test particles (like beads or powders) can pose choking or inhalation risks if mishandled.

SAFETY MEASURES:

To Handle particles carefully, avoid very fine powders and keep the work space clean.

DATA ANALYSIS:

AFTER ANALYSIS:

BIBLIOGRAPHY:

Boullosa, R. R., et al.

(2013). An Ultrasonic Levitator. Journal of Applied Research & Technology, 11, 857–865. Elsevier

Acoustic Levitation - Wikipedia.

The Wikipedia page on acoustic levitation provides a foundational overview of the principles and current capabilities, noting that while the technique can lift objects weighing several kilograms, the height of levitation is often limited to hundreds of micrometers.

https://youtu.be/y0HXaEEklj8?si=7loif5VTjCcl321m