Group11: Final demo for Miniaturized Langmuir Blodgett Trough

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1. Introduction

The Langmuir-Blodgett (LB) film method has been widely used for producing nano films. In the traditional LB film method, the film is formed by transferring a monolayer of molecules or nanoparticles from the air-water interface to a solid substrate using vertical dipping or horizontal lifting techniques. The LB film method provides a high level of control over the structure and orientation of the film, making it a valuable tool in fields such as surface science, materials science, and nanotechnology. However, the LB film method also has some limitations, including difficulties in characterizing the properties of the ultra-thin films and in controlling the film thickness with high precision. Typically, researchers use a lifter to obtain a sample and a microscope to observe its quality. Despite its widespread use, the traditional LB film method has limitations in terms of effectiveness and control over the system.

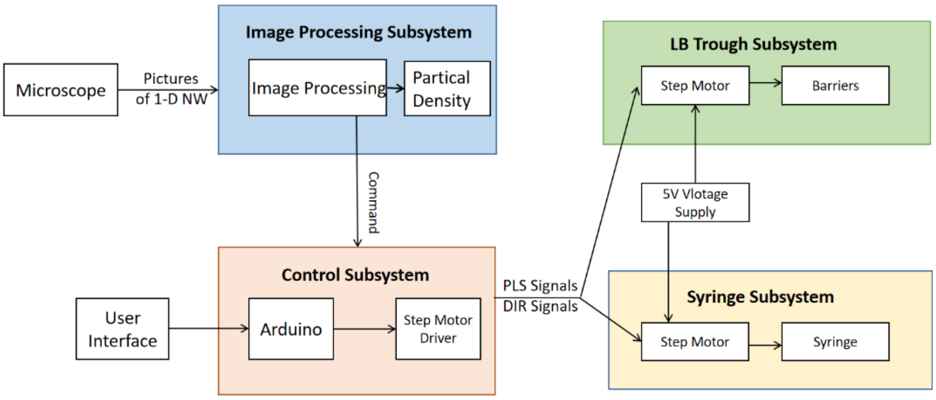
To address these limitations, a new method has been developed that improves upon the traditional LB film method. This new method utilizes advanced imaging techniques and computer algorithms to monitor and analyze the film in real-time. By using this approach, researchers can gain a more comprehensive understanding of the film’s properties, including its thickness, uniformity, and surface roughness. Additionally, this new method provides more precise control over the system, allowing researchers to optimize the film’s properties for specific applications. This new LB film method represents a significant advancement in the field of nano film production and has the potential to enable new applications in areas such as nanoelectronics and nanophotonics. Here is how we can solve it, basing on the traditional method, we can increase the efficiency by directly put the PTFE trough under the microscope, which means we can observe the situation of the film in the real time. What’s more, basing on the real time image, we can use software to analysis it and control the syringe pump and barriers’ motion to get closer to a better film quality and density that we wanted.

2. High Level Requirements List

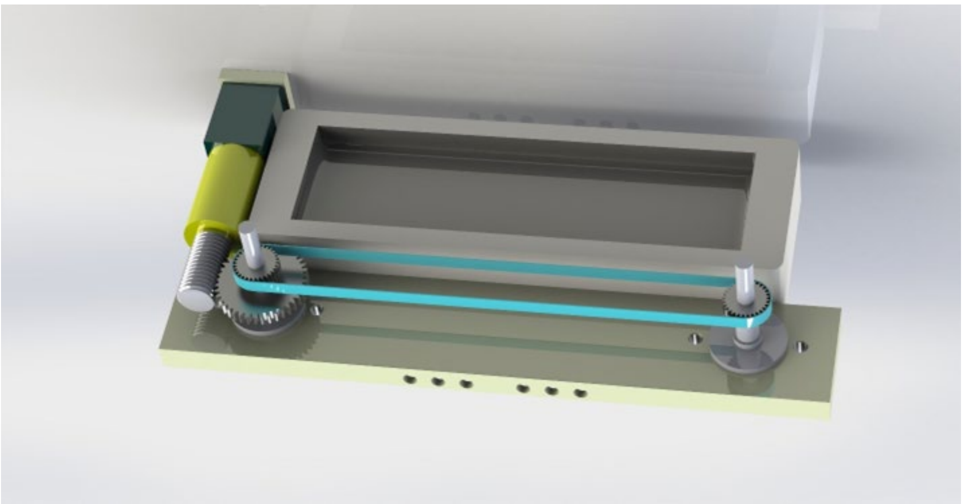
High-level requirements	Description
Barriers’ moving speed	To achieve a better film quality, the barriers’ moving speed is supposed to reach a range of 1mm/min to 12mm/min, which means we need to set a high gear ratio to decelerate the step motor
Trough requirement	The trough should be smooth enough to reduce the friction between the barriers, ensuring a smooth and fluent operation. Precision of the trough need to be high to reach a flat and horizontal water surface.
Size limitation	The space underneath the microscope is limited, we only have 13cm x 22cm x 3cm space. And we will also need to change the objective while operation, so there won’t be any objects on the objective change route.

3. Design

3.1 Block Diagram



3.2 Physical Design



Subsystem Points Summary Table

subsystem	requirement	score
Transport subsystem (Mechanical Part)	1.The barriers can move smoothly with low friction. 2.The barriers can move vertically to the belt.	__/20
Transport subsystem (Electrical Part)	1. The step motor moving speed can adjust from 0.25mm/min to 12mm/min. 2.The vibration is small enough that it will not influence the film process.	__/10
Size limitation	The whole trough should be able to be placed within 13cm x 22cm x 3cm space. Make sure nothing will touch the objects.	__/5
Image Processing	1. Analysis the images input, output the density of the particle film. 2. Analysis whether the film is formed, output instructions to the control system.	__/10
Interaction subsystem	The user interface is simple to understand so that the freshman can use the project to finish experiment.	__/5