

The Flow of Magnetic Particles in Viscous Fluid

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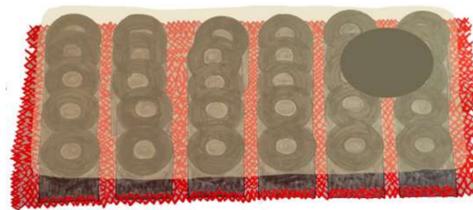


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Abstract

The project proposed by Dr. Mahdi Vaezi entails creating a device that tests and succeeds in the guidance of magnetic particles in a viscous fluid. This device is made up of electromagnets attached to a 3D printed TPE filament mesh.

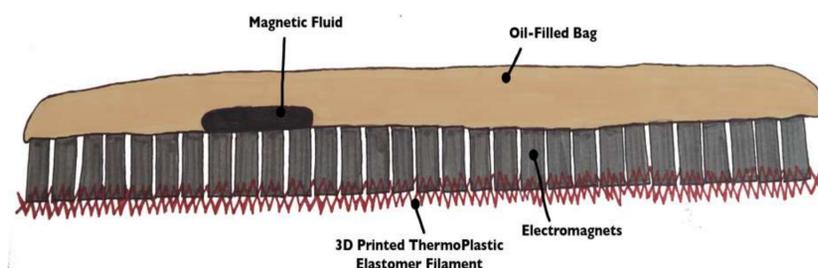
On top of the electromagnets a viscous fluid is placed containing oil and magnetic fluid.



Introduction

This project involves the start-up design and construction of a low-cost procedure that will entail the usage of magnetic particles, particularly iron oxide particles, for future possibility in drug delivery and/or magnetic hyperthermia. This project will be testing the difficulty of guidance of the magnetic particles and explore the convenience and flexibility of the device for efficiency in the flow of magnetic particles in a viscous fluid.

Methods and Materials



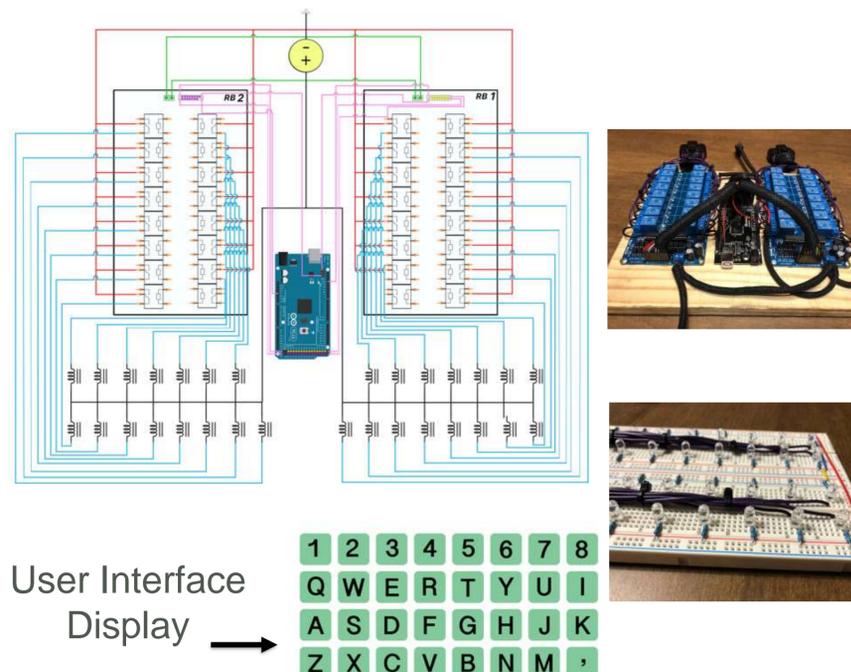
Design:



- 30 electromagnets attached to a 3D printed TPE Filament
 - TPE Filament used for durability and flexibility of prototype
- A bag of oil, which represents the viscosity of blood in the human body, with a droplet of magnetic fluid placed on top.
 - The magnetic fluid will be the magnetic carriers for drugs

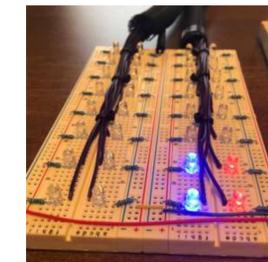
The electromagnets are attached to a 12 V power supply and some are selectively chosen to turn on and off to have the magnetic fluid flow to a specific spot to illustrate magnetic drug delivery.

Circuit & Microcontroller Programming:

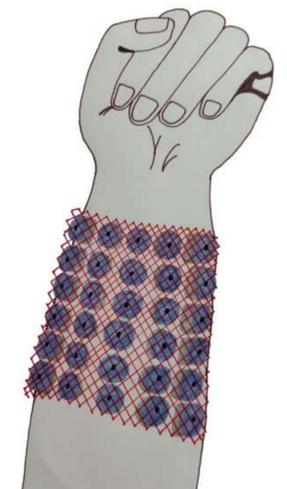


Discussion/ Results

Testing of the prototype was successful in its ability to demonstrate the goal of our project and its extensive capabilities in customizability, user simplicity and effectiveness in its assigned tasks. Functionality of the prototype was recorded and displays the intended modes of operation.



Future entails a device that is a flexible and safe to use on human beings for purpose of magnetic drug delivery.



Conclusions

This design was created to explore the limitations of guidance in current procedures with magnet drug delivery/hyperthermia. Through this design, we experimented and designed a device using electromagnets and a program using the Arduino Mega that manually controls these electromagnets to guide magnetic particles in a viscous fluid.

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