DESIGN LAB PROJECT ME205

GROUP - FRI/_E

SOFTWHEEL ROBOT

OUR TEAM

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CONTENT

INTRODUCTION

- **The Soft Wheel Robot is an innovative cylindrical soft robot propelled by pneumatically actuated channels. Unlike traditional robots with rigid structures, this robot is designed to be flexible, allowing it to navigate various terrains and obstacles with ease. Its unique design enables it to roll in a controlled manner, moving forward, backward, and turning without the need for external attachments or equipment.**
- One of the key features of the Soft Wheel Robot is its fully circular profile, which ensures smooth and uninterrupted rolling motion. This circular design maximizes efficiency and minimizes resistance, allowing the robot to achieve higher speeds compared to previous models. By harnessing momentum from the actuated channels, the robot can propel itself forward while conserving energy.
- **Moreover, all components of the Soft Wheel Robot, including the pneumatic source responsible for powering the actuated channels, are contained within the robot itself. This self-contained design eliminates the need for external connections or tethering, providing the robot with greater freedom of movement and autonomy.**

COMPONENTS USED

PVC PIPES

PVC pipes to form the structural framework

2 WAY SOLENOID VALVES

For precise control of airflow within the pneumatic system

PARTY BALLOONS (X6)

Party balloons as flexible chambers t contain and direct air pressure

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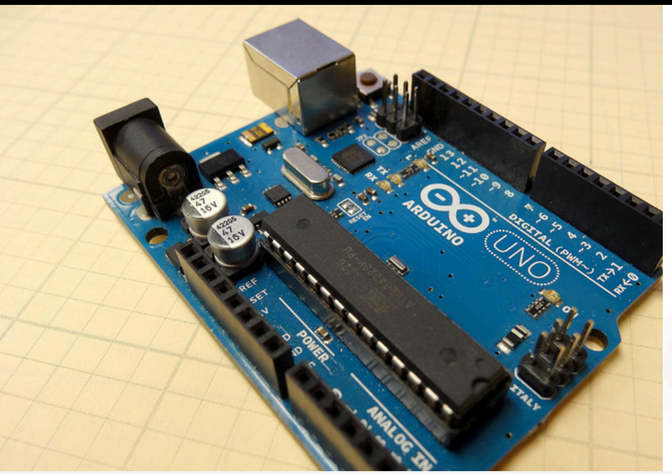
COMPRESSOR

To supply pressurized air to the system

SOME MORE COMPONENTS



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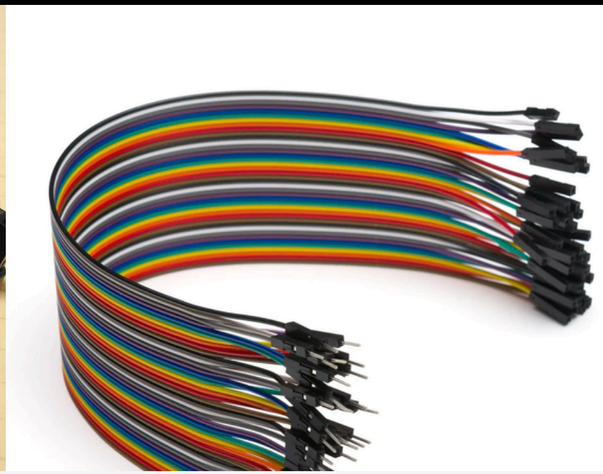
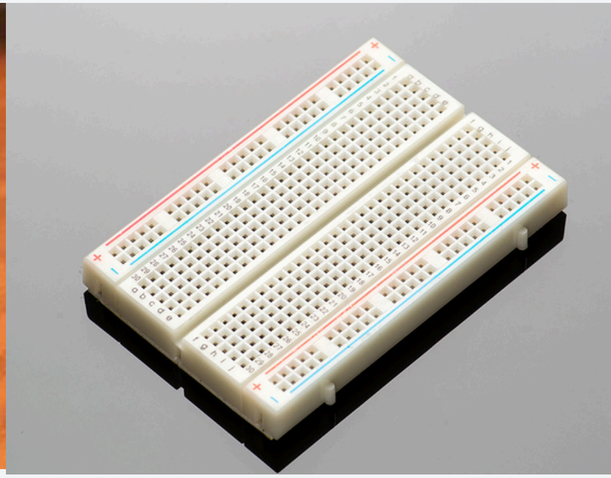
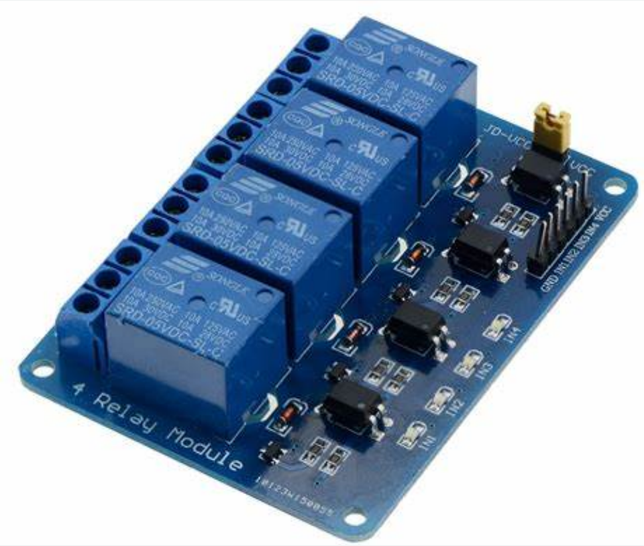


JUMPER WIRES

SOLENOID VALVES



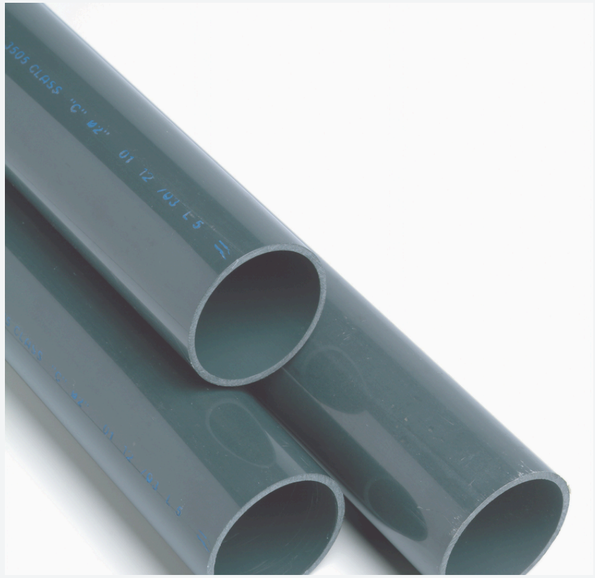
BREADBOARD



4 CHANNEL
RELAY MODULE

BLUETOOTH SESNOR

COMPRESSOR



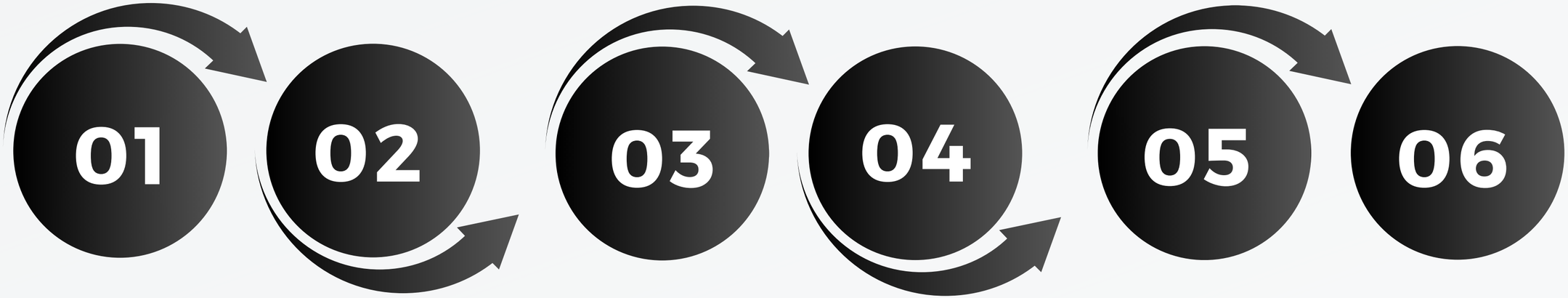
PVC PIPES

FABRICATION STEPS

02) MAKE CASTING MOLDS USING LSR 110

04) ADD THE SILICON TUBES

06) PROGRAMMING ARDUINO



01) PREPARATION OF 3D MOLD

03) CAST THE BODY-(pour the liquid rubber into the mold)
CAST THE BASE - (seal the bottom of the body part).

05) COMPRESSOR AND AIR VALVES

APPLICATIONS

AGRICULTURE

SoftWheel robots in agriculture can navigate uneven terrain with ease, improving efficiency in tasks like planting, harvesting, and soil monitoring, while minimizing soil compaction and crop damage.

HEALTHCARE

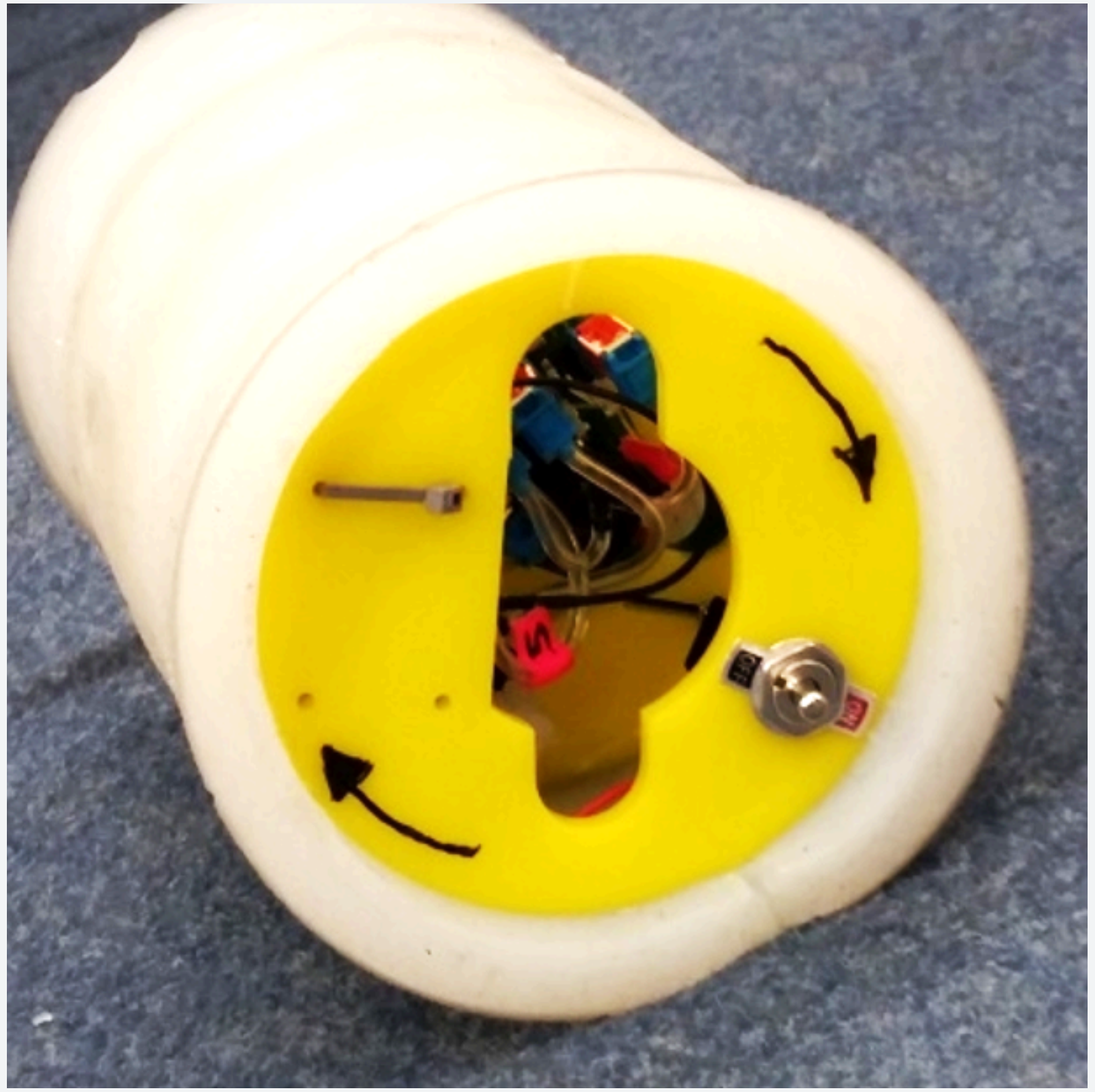
SoftWheel robots in healthcare can facilitate smooth and stable transportation of medical equipment, supplies, and patients within healthcare facilities, reducing vibrations and enhancing comfort during transit.

MANUFACTURING

SoftWheel robots in healthcare can facilitate smooth and stable transportation of medical equipment, supplies, and patients within healthcare facilities, reducing vibrations and enhancing comfort during transit.

WORKING PRINCIPLE

To set up the system, we utilize a PVC duct pipe that has four equidistant holes on both sides to insert party balloons. A manifold that has three outlets was constructed in the mechanical workshop and is attached to a compressor that supplies high-pressure gas. The manifold outlets connect to three solenoid valves that alternate between three balloons. The solenoid valves are then connected to an Arduino and operated using specific code. To enable the solenoid valves to function, relay modules were required, which we created in the Electro-Mechanics lab using transistors and diodes. By utilizing a pneumatic control system, we can inflate and deflate the balloons, or any other deformable material, in a synchronized manner to achieve motion.



IMPROVEMENT CAN BE MADE

Autonomy Enhancement: Integrate advanced sensors, such as LiDAR or depth cameras, to improve the robot's perception of its environment. This will enable better obstacle detection and avoidance, enhancing its autonomy and reducing the need for human intervention.

Payload Capacity Optimization: Conduct a thorough analysis of the robot's structural design and components to identify areas where weight can be reduced without compromising strength. Additionally, explore innovative materials and manufacturing techniques to increase payload capacity while maintaining efficiency.

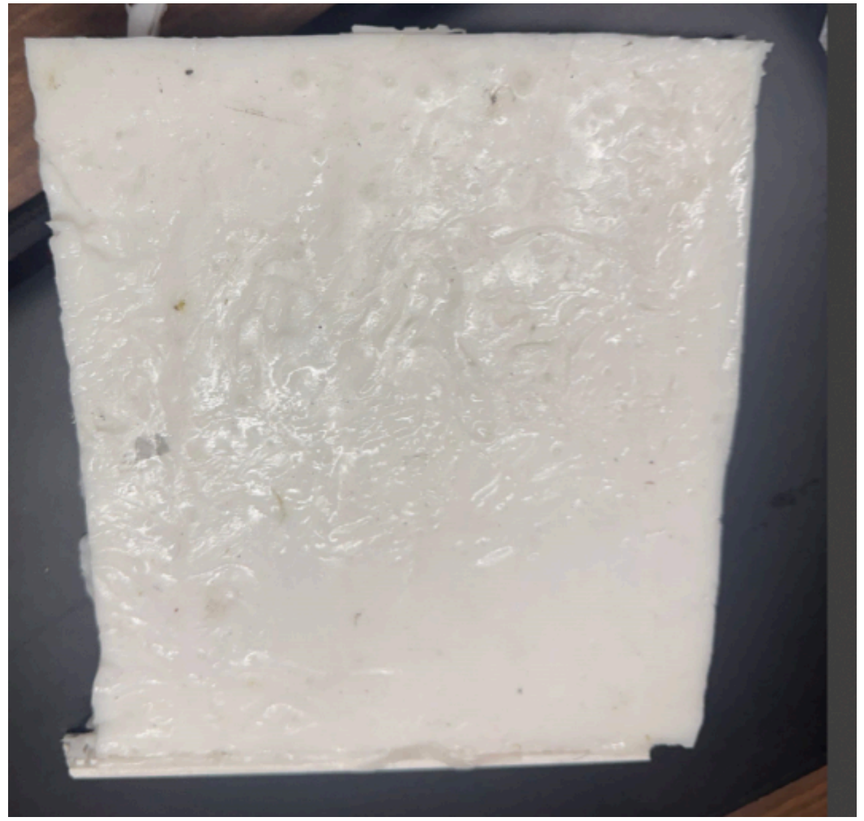
80%

20%

PROBLEM FACED

1) FOR FIRST 15 DAYS WE WERE NOT ABLE TO MAKE MOLD AS 3-D PRINTER IS NOT WORKING

2) MOLD IS DEFECTIVE , SO WE TRY TO OVERCOME THE ISSUE.



PROBLEM FACED

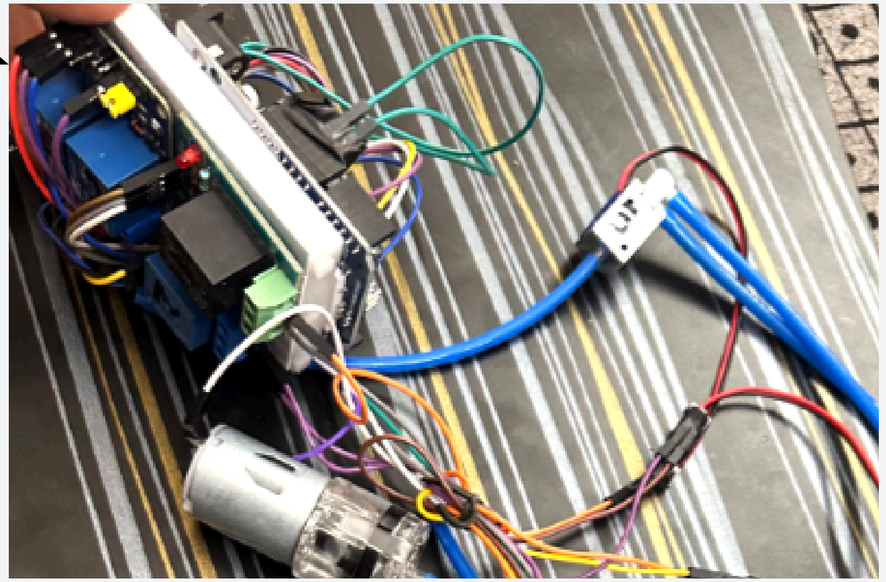
3)WE HAD TO REDUCE THE AREA, SO THAT OUR MOLD IS READY TO USE BUT AGAIN LSR GOT THICKEN AND TIGHT SO MUCH, WE ARE UNABLE TO MAKE THE MOLD.

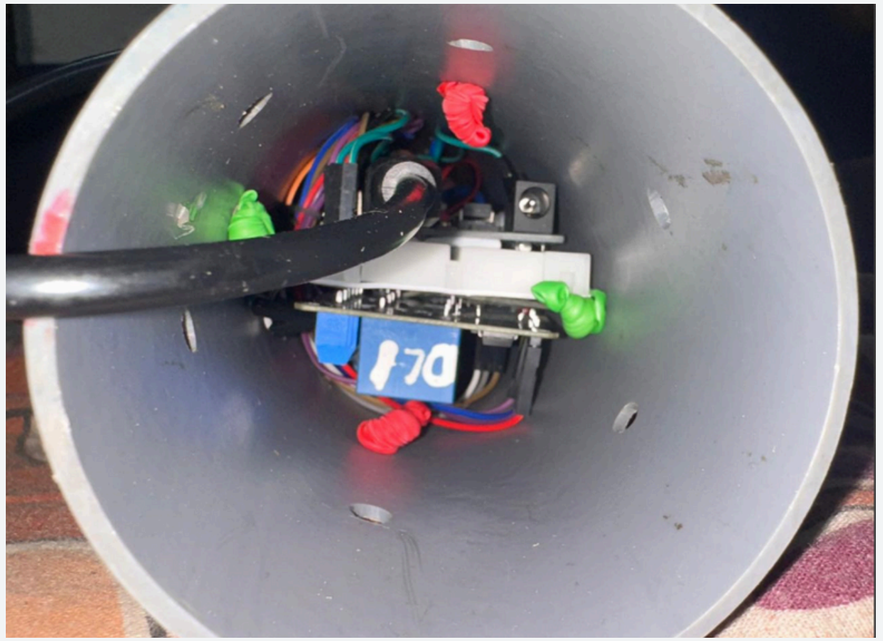
4)FINALLY WE USED BALLOON AS AN ALTERNATIVE BECAUSE WE WERE FACING THE ISSUE OF AIR LEAKAGE IN THE CONNECTOR (3D PRINTER).

ARDUINO UNO

```
int relay_C = 4;
int relay_1 = 7;
int relay_2 = 8;
int relay_3 = 12;

void setup() {
  // put your setup code here, to run once:
  Serial.begin(9600);

  pinMode(relay_C, OUTPUT);
  pinMode(relay_1, OUTPUT);
  pinMode(relay_2, OUTPUT);
  pinMode(relay_3, OUTPUT);

}
void loop() {
    digitalWrite(relay_C, LOW);
  digitalWrite(relay_1, LOW);
  digitalWrite(relay_2, LOW);
  digitalWrite(relay_3, LOW);
```

```
 Serial.println("All relays OFF");
delay(8000);
 digitalWrite(relay_C, LOW);
 digitalWrite(relay_1, LOW);
 digitalWrite(relay_2, LOW);
 digitalWrite(relay_3, HIGH);

 Serial.println("All relays OFF");
delay(8000);
 digitalWrite(relay_C, LOW);
 digitalWrite(relay_1, LOW);
 digitalWrite(relay_2, HIGH);
 digitalWrite(relay_3, HIGH);

 Serial.println("All relays OFF");
delay(8000);
 digitalWrite(relay_C, LOW);
 digitalWrite(relay_1, HIGH);

 digitalWrite(relay_2, LOW);
 digitalWrite(relay_3, HIGH);...
```





CONCLUSION:

In conclusion, We would like to express our heartfelt gratitude to Professor for their invaluable guidance throughout the development of our Softwheel Robot project. Under their mentorship, we embarked on this exciting journey to create a cutting-edge robot that utilizes soft wheels for enhanced mobility and adaptability.

Our project involved extensive research, design, and implementation phases. We explored novel concepts related to soft robotics, including compliant wheel materials, adaptive locomotion, and real-time control algorithms. Professor expertise and encouragement were instrumental in shaping our ideas and pushing us to explore innovative solutions.

The Softwheel Robot represents a significant achievement for our team. We overcame technical challenges, refined our designs, and successfully built a prototype that demonstrates the feasibility of soft wheel technology. Our robot can traverse various terrains, adjust its wheel stiffness, and maintain stability even in unpredictable environments.

Thank you very much!