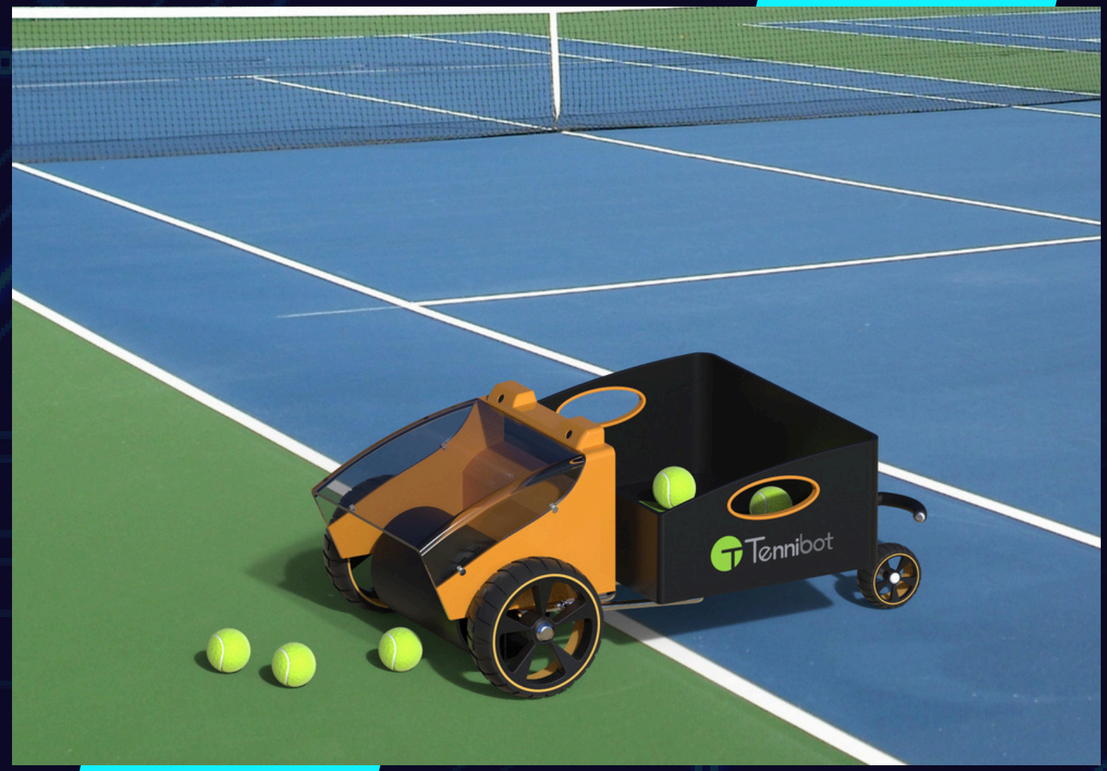
BALL COLLECTOR

BALL COLLECTOR

Utilizing an Arduino board, the Ball Collection Robot project is designed to collect balls autonomously within a specified area. The robot identifies and locates balls within its environment and is equipped with sensors for detection and navigation. Upon detection, the Arduino board processes sensor data to determine the optimal path for collection. Motors controlled by the Arduino drive the robot to the identified balls, while a gripper mechanism enables the robot to pick up and collect them. This project showcases the capabilities of Arduino-based robotics for automated tasks such as object detection and manipulation, making it suitable for applications in various fields, including automation, entertainment, and education.

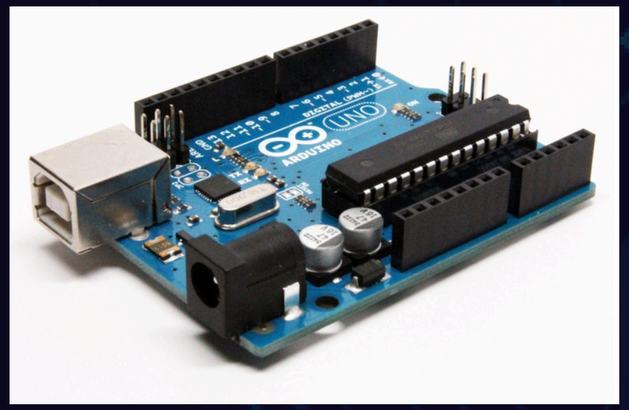


INTRODUCTION

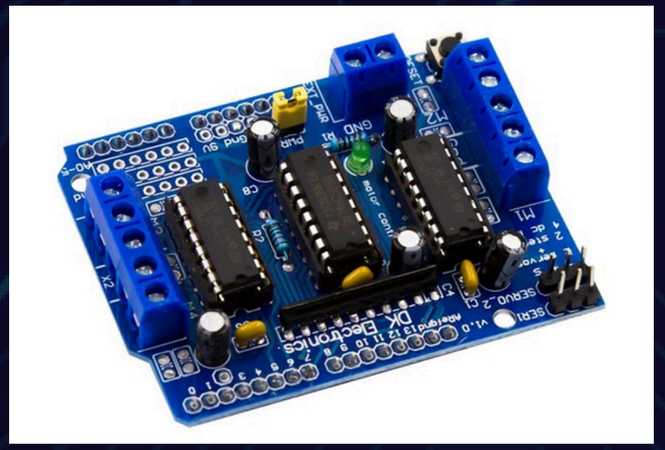
THE BALL COLLECTION ROBOT IS AN AUTOMATED SYSTEM DESIGNED TO DETECT, COLLECT, AND STORE BALLS SCATTERED IN A GIVEN AREA. THIS ROBOT USES SENSORS AND MOTORS TO NAVIGATE ITS SURROUNDINGS, LOCATE THE BALLS, AND PICK THEM UP USING A MECHANICAL ARM OR SUCTION MECHANISM. IT IS ESPECIALLY USEFUL IN ENVIRONMENTS LIKE SPORTS FIELDS, PLAYGROUNDS, OR WAREHOUSES WHERE COLLECTING BALLS MANUALLY CAN BE TIME-CONSUMING. THE GOAL OF THIS PROJECT IS TO DESIGN A SMART, EFFICIENT, AND RELIABLE ROBOT THAT CAN PERFORM THIS TASK WITH MINIMAL HUMAN INTERVENTION.

THE MAIN OBJECTIVE OF THIS PROJECT IS TO DESIGN AND DEVELOP AN AUTONOMOUS ROBOT CAPABLE OF DETECTING, COLLECTING, AND STORING BALLS FROM A DEFINED AREA EFFICIENTLY. THE ROBOT AIMS TO REDUCE MANUAL EFFORT, SAVE TIME, AND IMPROVE ACCURACY IN BALL COLLECTION THROUGH THE USE OF SENSORS, MOTORS, AND CONTROL SYSTEMS.

COMPONENTS



Arduino UNO



L293 Motor Driver shield

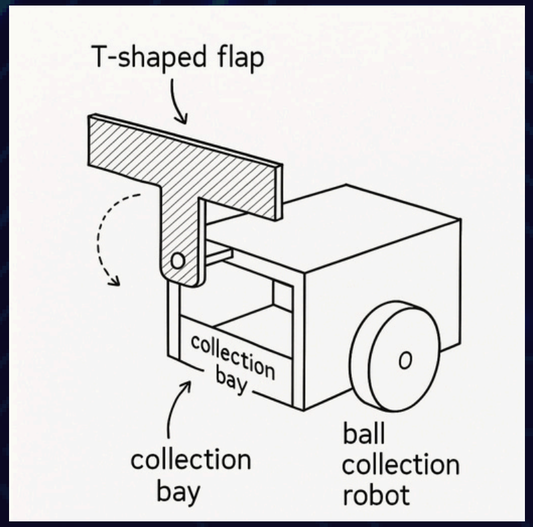
Ultrasonic Sensor

COMPONENTS

DC Motor

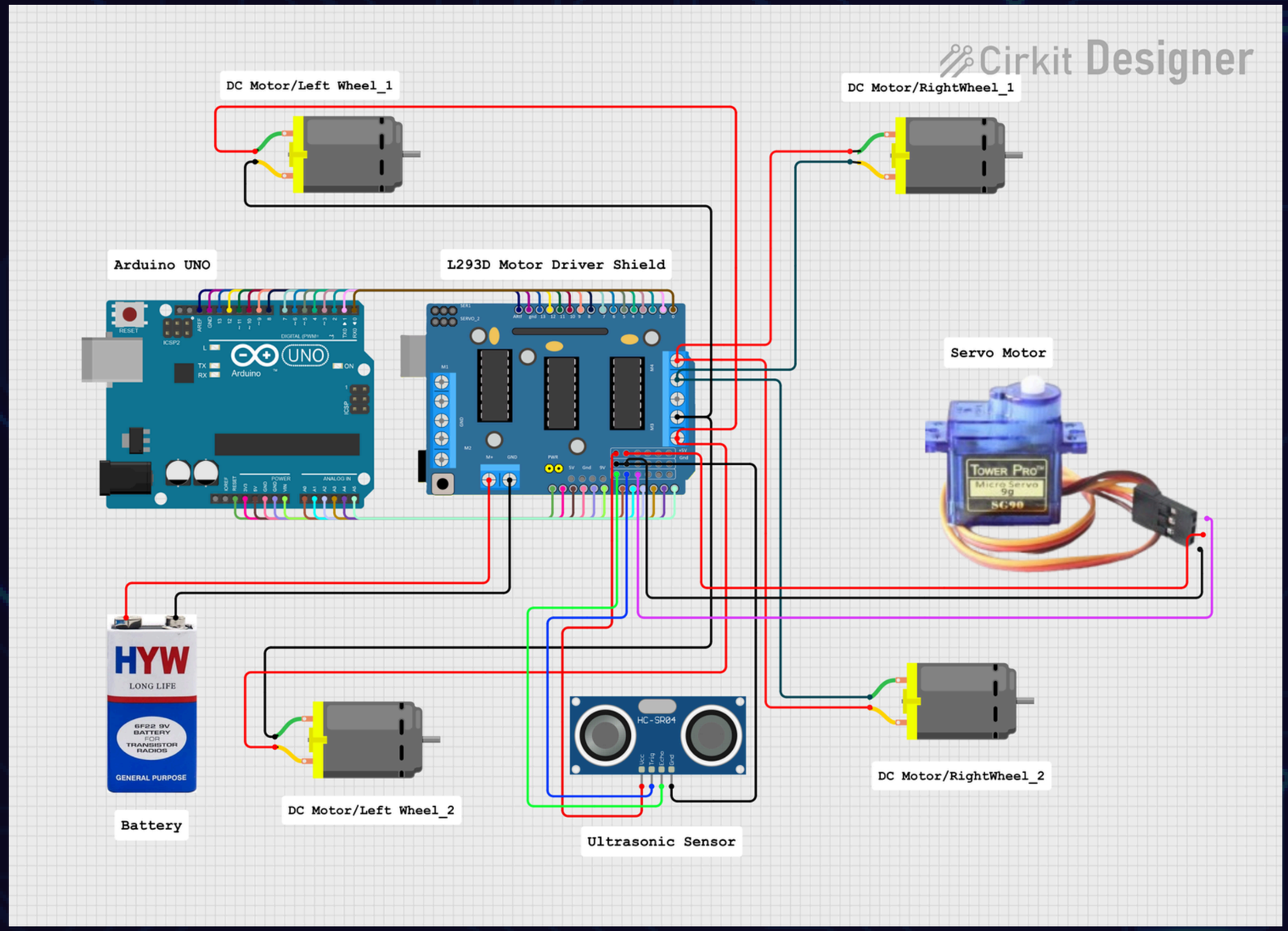
Servo Motor

Batteries



FLAP

CIRCUIT


Cirkit Designer
DC Motor/Left Wheel_1
DC Motor/RightWheel_1
Arduino UNO
L293D Motor Driver Shield
Servo Motor
HYW
LONG LIFE
6F22 9V BATTERY FOR TRANSISTOR RADIOS
GENERAL PURPOSE
HC-SR04
Battery
DC Motor/Left Wheel_2
Ultrasonic Sensor
DC Motor/RightWheel_2

WORKING

01

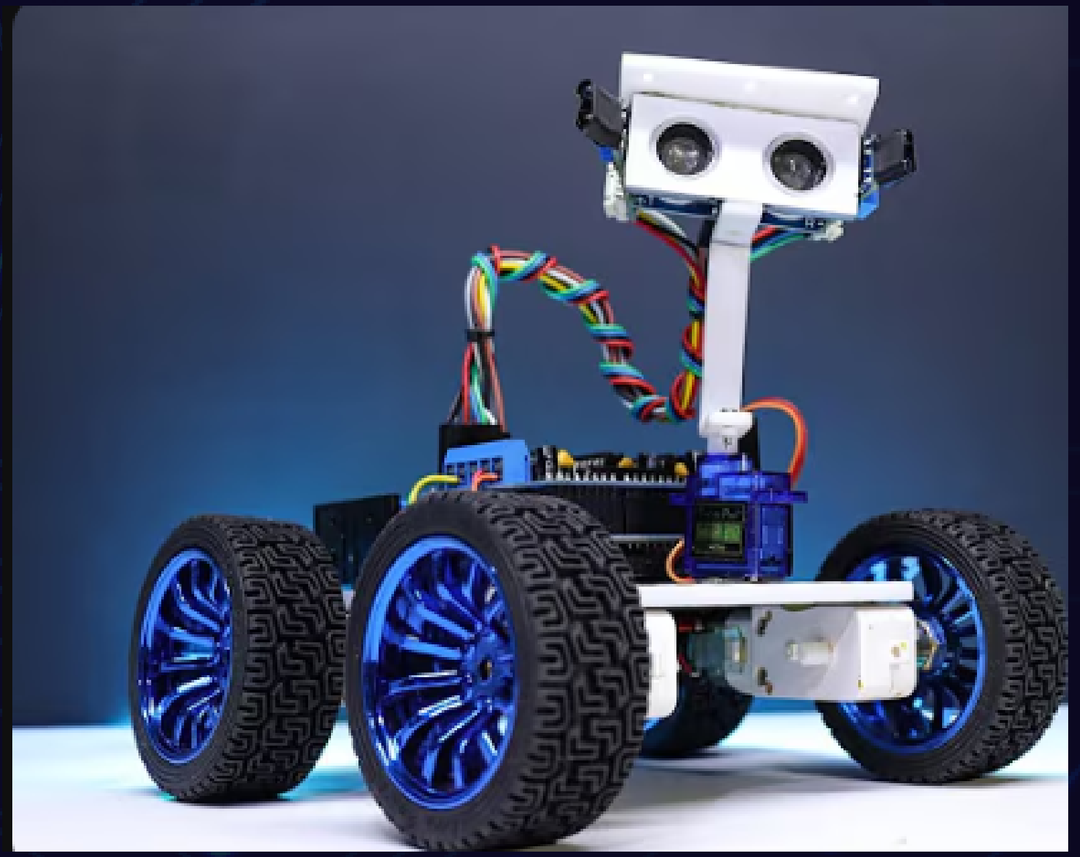
Finding the ball: `The first step here for the ball collecting robot is finding the ball. To find the ball, we turn the car to right by some small angle repeatedly until the ultrasonic sensor finds an object/ ball within the specified range. The range is specified because the ultrasonic sensor may sense the obstacle too far away too. The car turns right when the both left wheels move in forward direction and both left wheels move in backward direction. The wheels are powered by DC motors which are controlled by L293D motor driver shield.

02

Approaching the ball: Once the ball is within the specified range, the car moves towards the ball. The car moves forward when all the wheels turn in forward direction.

03

Collecting the ball: Once the car has reached near the ball, the car stops and collects the ball using the flap powered by the servo motor. The above steps are followed on loop until they collect all the balls in the specified range.



CHALLENGES FACED

1. POWER MANAGEMENT CHALLENGE: AS THE ROBOT USES MOTORS AND SENSORS, POWER CONSUMPTION COULD BE HIGH, ESPECIALLY WITH 9V BATTERIES, WHICH ARE NOT IDEAL FOR MOTOR-DRIVEN PROJECTS. YOUR BATTERY LIFE MIGHT BE LIMITED, AND THE ROBOT COULD LOSE POWER DURING EXTENDED OPERATION.

SOLUTION: CONSIDER USING MORE POWERFUL BATTERIES (E.G., LIPO, LI-ION) OR A DEDICATED POWER SUPPLY TO ENSURE LONGER RUNTIME AND SUFFICIENT CURRENT FOR THE MOTORS AND SENSORS.

2. MOTOR CONTROL & PRECISION CHALLENGE: YOUR MOTORS MAY NOT ALWAYS RUN AT A CONSISTENT SPEED DUE TO VOLTAGE DROPS, MOTOR WEAR, OR VARIATIONS IN THE ENVIRONMENT. THIS CAN AFFECT THE ROBOT'S ABILITY TO NAVIGATE AND ALIGN PROPERLY WITH THE BALLS.

SOLUTION: IMPLEMENT A PID (PROPORTIONAL, INTEGRAL, DERIVATIVE) CONTROLLER FOR SMOOTHER, MORE PRECISE MOVEMENT CONTROL, OR FINE-TUNE THE MOTOR SPEED IN THE CODE.

CHALLENGES FACED

3. OBSTACLE DETECTION CHALLENGE: THE ULTRASONIC SENSOR MAY STRUGGLE WITH DETECTING BALLS, ESPECIALLY IF THEY ARE SMALL OR HAVE IRREGULAR SHAPES. THE SENSOR COULD ALSO HAVE LIMITED RANGE OR DIFFICULTY DETECTING OBJECTS IN CLUTTERED ENVIRONMENTS.

SOLUTION: ADD MORE SENSORS (E.G., INFRARED SENSORS, A CAMERA-BASED VISION SYSTEM) FOR BETTER ACCURACY AND RANGE IN DETECTING OBJECTS

4. BALL PICKUP MECHANISM CHALLENGE: THE SERVO-CONTROLLED FLAP MAY NOT BE QUICK OR CONSISTENT ENOUGH TO PICK UP BALLS EFFICIENTLY, ESPECIALLY IF THEY ARE FAST-MOVING OR IN A RANDOM CONFIGURATION

SOLUTION: IMPROVE THE FLAP DESIGN OR USE A MORE EFFICIENT ACTUATOR SYSTEM (E.G., A ROTATING CONVEYOR BELT, SUCTION SYSTEM, OR A ROBOTIC ARM) TO COLLECT THE BALLS MORE RELIABLY.

CHALLENGES FACED

5. NAVIGATION IN DYNAMIC ENVIRONMENTS CHALLENGES: THE ROBOT MAY FACE DIFFICULTY NAVIGATING IN DYNAMIC ENVIRONMENTS WHERE BALLS MOVE, OR OBJECTS ARE CONSTANTLY SHIFTING. FOR INSTANCE, IF THE ROBOT IS INTERACTING WITH MULTIPLE BALLS AT ONCE, OR IF THE SURFACE IS UNEVEN, IT MAY STRUGGLE WITH MOVEMENT AND BALL COLLECTION.

SOLUTION: INCORPORATE MORE ADVANCED NAVIGATION ALGORITHMS, SUCH AS SIMULTANEOUS LOCALIZATION AND MAPPING (SLAM), AND ADD MULTIPLE SENSORS TO BETTER TRACK THE ROBOT'S LOCATION AND THE BALL'S POSITION.

6. OVERHEATING AND WEAR AND TEAR CHALLENGE: CONTINUOUS MOVEMENT AND MOTOR OPERATION COULD LEAD TO OVERHEATING OR MECHANICAL WEAR AND TEAR, AFFECTING LONG-TERM PERFORMANCE.
CHALLENGE:

SOLUTION: USE HEAT DISSIPATION MECHANISMS, SUCH AS HEAT SINKS OR COOLING FANS, AND CHOOSE MORE DURABLE MOTORS OR COMPONENTS THAT CAN HANDLE EXTENDED USE.

ADVANCEMENTS

1. WIRELESS COMMUNICATION & CLOUD INTEGRATION DEVELOPMENT: IMPLEMENT WI-FI OR BLUETOOTH COMMUNICATION TO SEND REAL-TIME DATA (E.G., BATTERY STATUS, COLLECTION PROGRESS, SENSOR READINGS) TO A REMOTE SYSTEM OR SMARTPHONE. ADDITIONALLY, INTEGRATE WITH CLOUD SERVICES TO ANALYZE THE ROBOT'S PERFORMANCE AND IMPROVE FUTURE OPERATIONS.

2.SWARM ROBOTICS (MULTIPLE ROBOTS WORKING TOGETHER) DEVELOPMENT: IF YOU WANT TO SCALE YOUR PROJECT, CONSIDER SWARM ROBOTICS WHERE MULTIPLE ROBOTS WORK TOGETHER TO COLLECT BALLS IN A SHARED ENVIRONMENT. THEY COULD COMMUNICATE AND COORDINATE THEIR MOVEMENT TO OPTIMIZE COVERAGE.

3. SELF-CHARGING STATION DEVELOPMENT:: EQUIP THE ROBOT WITH THE CAPABILITY TO AUTONOMOUSLY RETURN TO A DOCKING STATION FOR CHARGING WHEN THE BATTERY IS LOW.

4. AUTONOMOUS OBSTACLE AVOIDANCE DEVELOPMENT: IMPLEMENT AUTONOMOUS OBSTACLE AVOIDANCE USING ADVANCED SENSORS LIKE LIDAR OR INFRARED SENSORS. THE ROBOT COULD AVOID COLLISIONS AND NAVIGATE AROUND DYNAMIC OBSTACLES (SUCH AS FURNITURE OR MOVING OBJECTS).

ADVANCEMENTS

5.**VOICE CONTROL INTEGRATION DEVELOPMENT:** INTEGRATE VOICE RECOGNITION TECHNOLOGY TO CONTROL THE ROBOT VIA VOICE COMMANDS USING PLATFORMS LIKE GOOGLE ASSISTANT OR AMAZON ALEXA.

6.INTERACTIVE HUMAN-ROBOT INTERACTION (HRI) DEEVLEOPMENT: ADD INTERACTIVE CAPABILITIES SUCH AS LED DISPLAYS OR VOICE FEEDBACK TO COMMUNICATE WITH USERS. THE ROBOT COULD PROVIDE FEEDBACK ON ITS STATUS (E.G., HOW MANY BALLS IT HAS COLLECTED) OR RESPOND TO BASIC COMMANDS.

ABOUT US G_41

01 ALLU RANJITH KUMAR
2023EEB1181

02 ALLAM PRANAY
2023EEB1180

03 GUKANTI JAYADITYA
2023EEB1202

04 VANKADARI BHANU VARSHITH
2023EEB1250

05 PAVAN G
2023EPB1274

THANK YOU