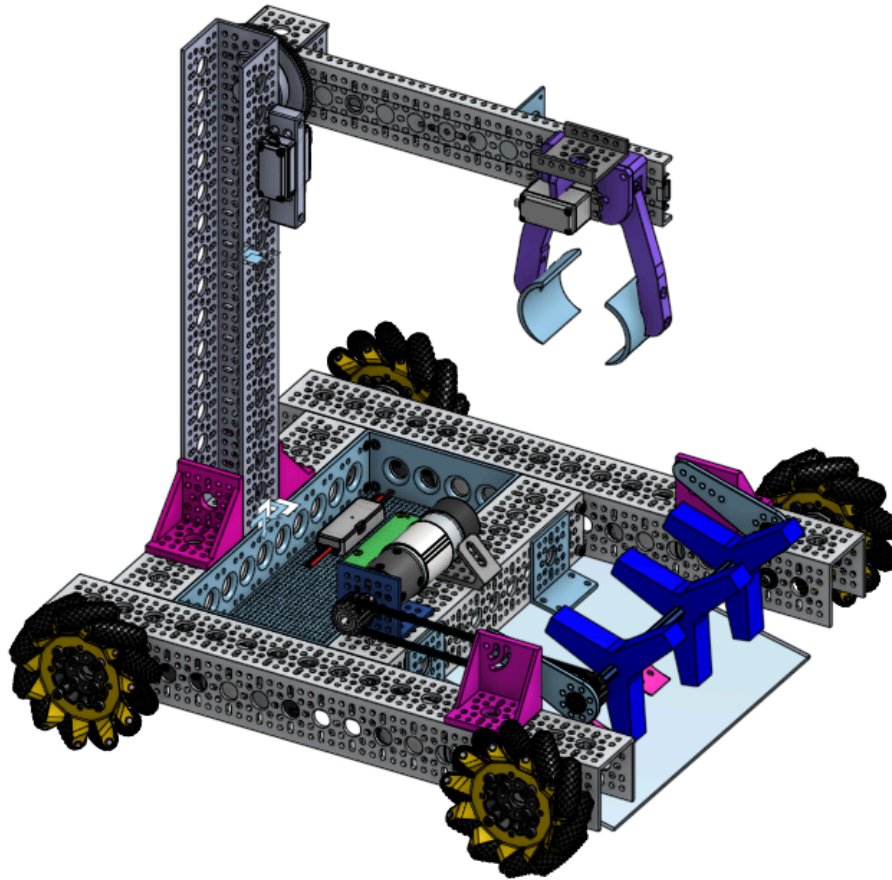




University of Oklahoma
Sooner Competitive Robotics
STORM 2026 Design Report



Pink Blush



Daniel Brown	daniel.p.brown@ou.edu	Team Captain
Noah Zemlin	noah.zemlin@ou.edu	Advisor

Software	Mechanical	Electrical
Antonio Chappell	Elizabeth Knight	Patrick Gallagher
Lane Westmoreland	Josh Kernop	Tyler Afonien
Brenden Richards		

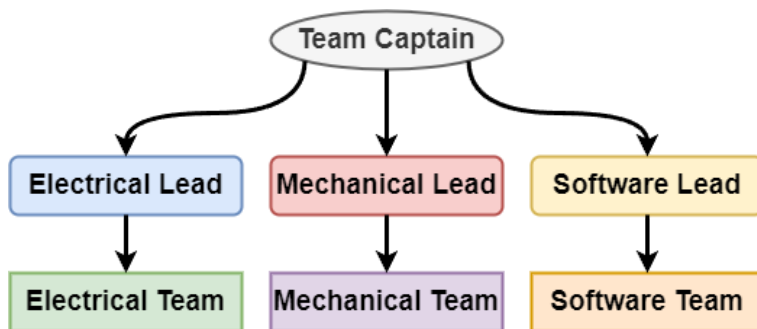
Introduction.....	3
Organization.....	3
High-Level Overview.....	3
Mechanical Design.....	3
Drivetrain.....	3
Jumpstart.....	4
Intake Mechanism.....	4
Battery Scoring Mechanism.....	4
Electrical Design.....	5
Power.....	5
Computer.....	5
Control Board.....	5
Jumpstart the Grid.....	6
Sensors.....	6
Software Design.....	6
Base Station.....	6
Robot.....	7
Computer Vision.....	7
Autonomous.....	7
Safety and Reliability.....	7
Bill of Materials.....	8

Introduction

Sooner Competitive Robotics, representing the University of Oklahoma, is proud to present Pink Blush, the team's entry for the 2026 STORM competition. The university faculty advisors are Noah Zemlin, a radar research engineer, and Dr. Golnaz Habibi, an assistant professor with a research focus on robotics and autonomous vehicles.

Organization

The team is divided into 3 sub-teams: mechanical, electrical, and software. Each sub-team is led by an upperclassman who assists the other team members and underclassmen in completing the tasks at hand while teaching them the relevant skills to do so. Sub-team leads monitor the progress of their sub-teams to ensure tasks are being completed and assist when necessary. Sub-team leads report overall progress to the team captain in order to provide status on the robot's development as well as address any issues noted by the sub-team leads.



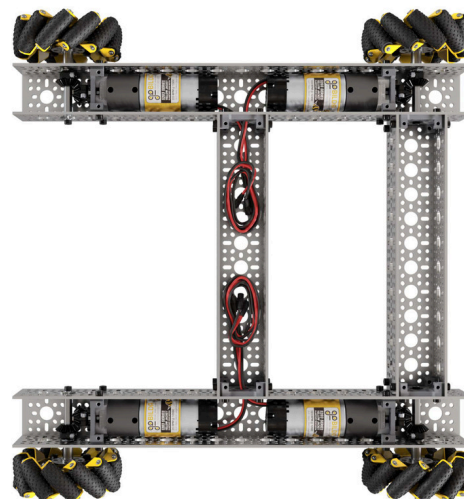
High-Level Overview

Pink Blush is built upon a goBILDA Strafer chassis. An active intake brings Batteries into the robot, and they are picked up and scored by an arm-wrist-claw scoring mechanism. *Pink Blush* has a set of copper tape contacts and a digital potentiometer to complete the Jumpstart task. The electrical system is controlled by a central Raspberry Pi 5, which directs a custom Control PCB using the Raspberry Pi Pico 2 / RP2350 microcontroller. Software on the Raspberry Pi provides localization using computer vision to detect the AprilTags around the field, and sends a camera stream back to the Operator Interface.

Mechanical Design

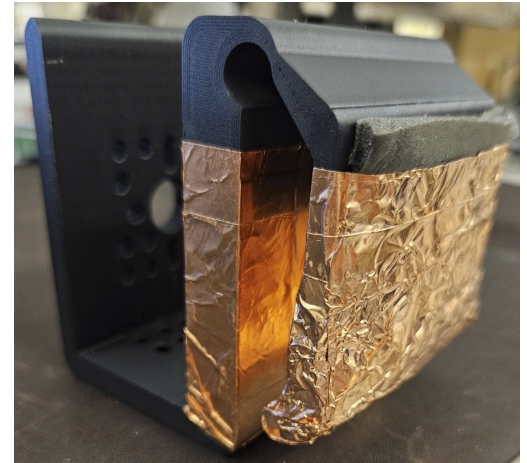
Drivetrain

After the success and experience gained with goBILDA parts last year, the team decided to stick with goBILDA as the primary build system of the robot. Unlike last year, a high-traction drivetrain is unnecessary as there are no inclines, so the team acquired a goBILDA Strafer Chassis. This drivetrain has 4 individually-powered "mecanum" wheels that allow for omnidirectional movement, at the cost of wheel slippage. The precise lineup required to score a battery in this year's game makes the ability to translate the robot left and right very useful.



Jumpstart

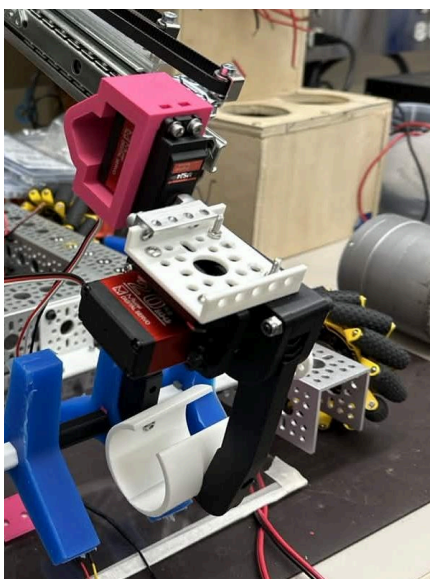
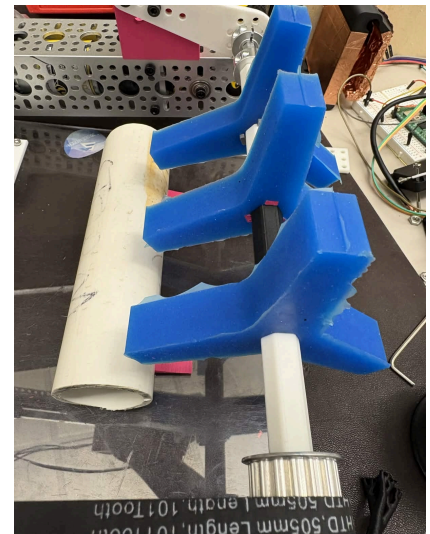
Inspired by pogo pins and leaf spring contacts, the jumpstart mechanism uses a pressure-based design. When the robot presses against a contact pad, the jumpstarter closes a circuit, guaranteeing power delivery regardless of the contact angle and minimizing the risk of accidental short circuits. The implementation uses a 3D printed body with copper tape and foam for electrical contact.



Intake Mechanism

The intake mechanism consists of a single axle with three three-pointed stars made out of silicone rubber that spin to collect batteries. The axle is driven by a 5mm belt that runs to a single 117 RPM goBILDA motor. The floor of the intake is a sheet of sharpened polycarbonate positioned at an angle, with smooth ground clearance. Small, 3D-printed backstops prevent the Battery from exiting the intake once it has been collected.

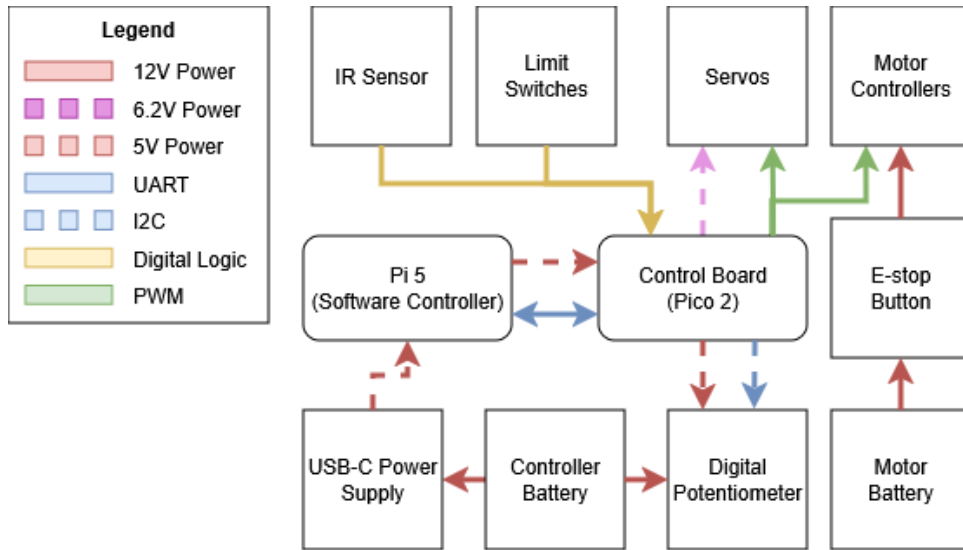
Initial trials were done with custom TPU wheels and six-pointed stars, but these were deemed too stiff. With very low infill and only one wall loop, TPU has a shore durometer rating of 90-95A, which is fairly hard. The final iteration of the intake stars were cast using silicone rubber with a rating of 35A in custom 3D-printed molds, with a sub-structure made from PLA that allows the shaft to turn the stars. Without the PLA sub-structure, the shaft would spin inside the star with the introduction of friction and deformation from contacting the batteries.



Battery Scoring Mechanism

The Battery scoring mechanism consists of a single-axis arm with a linear slide, upon which is mounted a rotatable claw. The battery scoring mechanism is designed to lower into the robot, grab the Battery from the intake area, raise and extend the arm, flip the battery to the left or right of the arm to score in the left or right slots of the Battery Bank, and then release it into the Battery Bank.

Electrical Design



Power

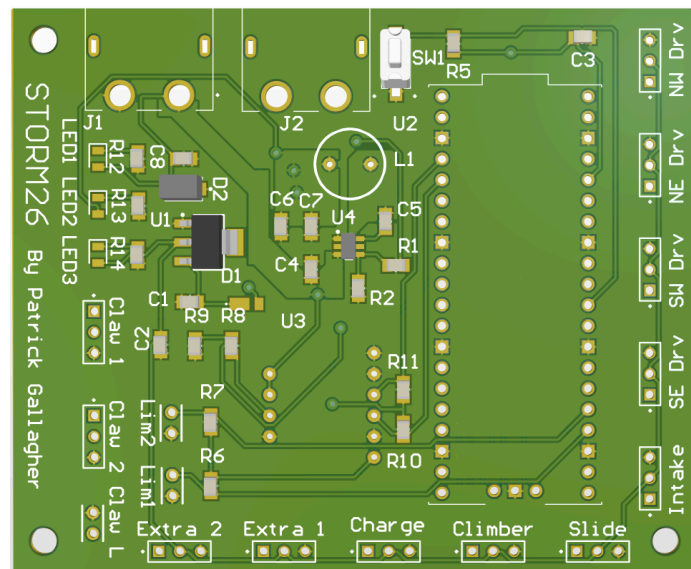
The robot is powered by 2 11.4V, 12-24C Lithium-Polymer batteries, with computation and motor tasks split to each battery to avoid any strong inductive kickback into our sensor and computation systems. The other battery handles everything else: powering the main computer through a USB-C converter, and powering the Control Board through a voltage regulator. The Control Board sends 12V through a buck converter to generate 6.2 volts for servo operation. The Pico is powered over USB, but the rest of the Control Board is powered off the controller battery. Motors are controlled and powered through Spark Mini motor controllers.

Computer

The main computer of the robot that runs all of the robot's software is a Raspberry Pi 5. The Pi 5 was picked because of its speed, to handle the multiple cameras that Pink Blush is running, and its cost-effectiveness and small footprint. A Pi Active Cooler is attached to it to reduce thermal throttling problems encountered last year.

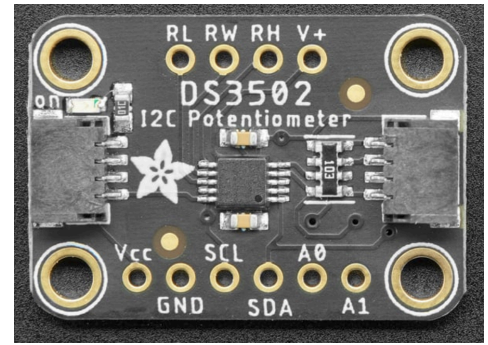
Control Board

The Control Board is the heart of the electrical system and is responsible for controlling the robot. It has ten motor control ports, two servo control ports, and two sensor inputs. Each of the motor ports consists of 5V power, GND, and a connection to a Pico pin. As a result, while these ports are intended for motor control use, they can be repurposed for sensors or servos if needed. The board uses XT-60 connectors for 12V input and the Jumpstart voltage output. Female headers were used to install the Pico2 and the AdaFruit DS3502 to allow easy swapping and reuse of these parts. Firmware was kept deliberately simple and serves mostly as a pass-through for software commands.



Jumpstart the Grid

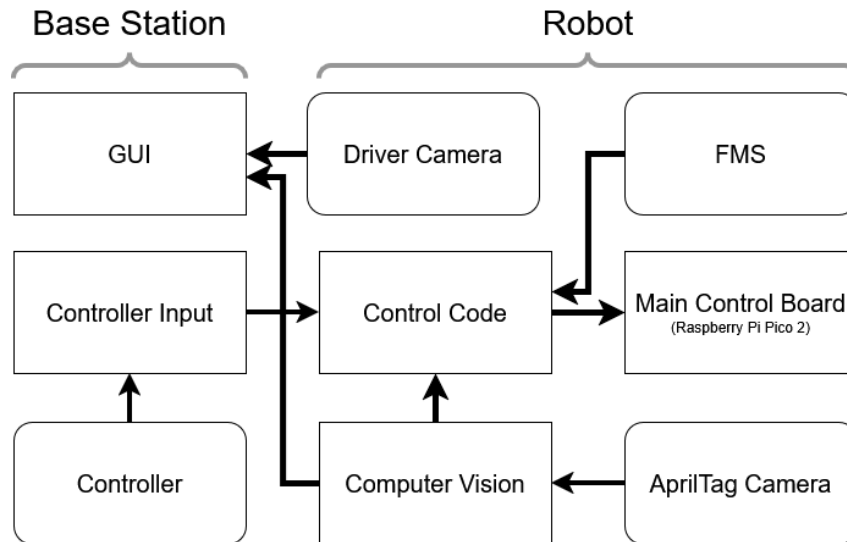
The “Jumpstart the Grid” task requires the robot to supply a specific voltage, being either 2, 4, 6, 8, or 10 volts to the Charging Pad, with a 20mA current limit and +/-0.5V tolerance. We chose a digital potentiometer for its versatility and use. The jumpstart uses the DS3502 digital potentiometer to specify a specific resistance from 0 to 10,000 Ohms, which is utilized in a voltage divider to obtain the specific voltage needed. The firmware on the Control Board adjusts for voltage spikes and dips by reading the voltage through an ADC pin and changing the wiper value on the potentiometer accordingly.



Sensors

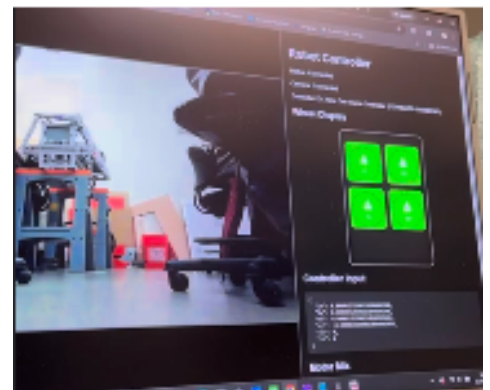
The robot has multiple sensors on it to provide feedback to the robot and operator. The intake has a digital IR line-follower sensor that detects when a battery has been obtained by the robot so that the operator can stop running the intake and start the scoring process. The linear slide on the scoring mechanism includes a limit switch to prevent the robot from extending beyond the maximum size constraint.

Software Design



Base Station

The Base Station is the operator-facing portion of the software system. The Operator controls the robot using a bluetooth or wired Xbox controller, the commands of which the Base Station sends to the Robot. The Base Station also runs the Operator Interface, which displays robot sensor data like the camera stream, robot position, and Battery detector status to the Operator. The Operator Interface also includes buttons to manage the Robot’s state (waiting, autonomous, teleop, etc.) and an autonomous program selector.



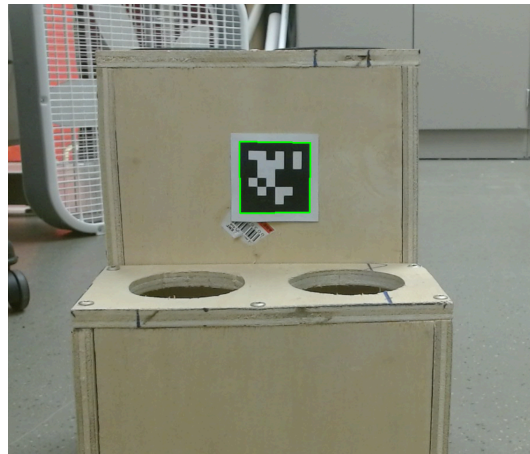
Robot

Starting software on the robot will involve SSH to the PI 5 on the robot. The robot control code can then be started. The PI 5 will connect back to the server using websockets and receive information from the FMS, GUI, and controller input. If no controller is connected, the PI 5 will continuously poll for a controller connection locally as well as from the server.

The PI 5 will receive the messages for controlling different aspects of the robot and convert that information into a usable command. It will then pass that command over USB serial to the Pico for execution. The PI 5 will relay back to the GUI via the server that the command has been given and the current status of the robot.

Computer Vision

Two separate Python programs handle computer vision, both with the widely-used OpenCV library. One captures the driver camera stream and sends it via websocket to the Operator Interface. The other uses the robotpy AprilTag libraries to detect AprilTags in the video stream and then estimate the camera's position and rotation in relation to each visible tag. This data is then compared to the field positions of each AprilTag to generate an estimate of the robot's local field position.



Autonomous

The robot has multiple different autonomous programs that may be selected via the Operator Interface, depending on the strategy for each specific match. The main programs are, in order of increasing risk/reward, a simple drive forwards auto, a one-Battery auto, and a one-Battery Jumpstart auto. The actual program ran each match depends on the strategy for the match, based on our opponent, and relative confidence in scoring Kilojoules vs Batteries.

Safety and Reliability

Pink Blush includes many safety features. A physical emergency stop-button controls power to the motors. Power to the servos and jumpstart is through the Control Board, and the firmware will zero all outputs if a message is not sent to it from the software within a certain timeframe. The same consideration is made in the software for the Loss-of-Signal test, which stops all motors and servos when connection to the Base Station is lost. The control board features diodes, surge protectors, and current-limiting resistors on power sources. Sensors, servos, and motor controllers connections are securely fastened with locking connectors. In terms of reliability, *Pink Blush's* chassis is made out of robust aluminum and steel parts, and is specifically designed for the harshness of robotics competitions. Other parts are 3D-printed out of tough PLA+, and spares and replacement parts are easily manufacturable.

Bill of Materials

All parts used by the robot and the prices and quantity are in the table below. Things like brackets, tensioners, and hardware mounts were designed and 3D-printed to save on costs. Some other components not listed below were recycled from previous builds as well.

Item	Quantity	Unit Cost (USD)	Team Cost*
goBILDA Strafer Chassis Kit	1	\$699.99	\$524.99
goBILDA 2 stage Viper Slide	1	\$119.99	\$89.99
95A TPU Filament	2	\$23.99	\$47.98
5203 Series Yellow Jacket Planetary Gear Motor (19.2:1 Ratio, 24mm Length 8mm REX® Shaft, 312 RPM, 3.3 - 5V Encoder)	1	\$54.99	\$41.24
2000 Series 5-Turn, Dual Mode Servo (25-2, Torque)	1	\$49.99	\$37.49
M4 Screw Kit	1	\$7.99	\$7.99
M4 Nylon Lock Washers	1	\$9.99	\$9.99
2302 Series Aluminum, MOD 0.8, Hub Mount Gear (14mm Bore, 100 Tooth)	1	\$16.09	\$12.07
1103 series L-beam (2 pack)	1	\$2.69	\$2.02
Dual Belt, 5mm HTD Pitch, Set-Screw Pinion Timing Belt Pulley (8mm REX® Bore, 16 Tooth)	2	\$14.99	\$22.49
1120 Series U-Channel (14 Hole, 360mm Length)	1	\$17.99	\$13.49
BBDINO Silicone Mold Making Kit, 30A Liquid Silicon, 38.8 OZ	1	\$28.97	\$28.97
1611 Series Flanged Ball Bearing (8mm REX® ID x 14mm OD, 5mm Thickness) - 2 Pack	3	\$5.99	\$13.48
1516 Series 8mm REX® Standoff (M4 x 0.7mm Threads, 288mm Length) - 4 Pack	1	\$22.99	\$17.24
Pi Cables	2	\$10.00	\$20.00
Adafruit DS3502 I2C Digital 10K Potentiometer Breakout - STEMMA QT / Qwiic	1	\$4.95	\$4.95
Copper Tape	1	\$8.99	\$8.99
REV SPARKmini motor controller	3	\$35.00	\$105.00
Raspberry Pi Active Cooler	1	\$10.95	\$10.95
Total			\$1,019.32

*Note that there is a 25% discount for goBILDA products from the University's account