Software & Technology

Juggernaut

Operations Behind Its Design Thinking

VEX 95071X — Extremity; 📍 Saratoga, California
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Special Thanks to Christopher Fagiani, VP of Engineering

Oracle's Rationale

Born in 1977, Oracle rose to disrupt the world from its **innovative database software platforms** and **cloud computing solutions**. Oracle's influence **extends** beyond conventional corporate boundaries, reaching **STEM communities** and **VEX Robotics Competition (VRC)**, making it a subject of fascination as its beginnings resonated with us in a place that we call home.

We discovered Oracle's underlying impact, as its **ownership of Java**, serves as a **cornerstone for smooth transitions into C and C++ — essential skill sets for VRC** and broader coding documentation.

As we evolved to be aspiring mechanical and software engineers over our years in VRC, **Oracle's influence on us became evident.** Our journey with Java provided us with a solid foundation and **facilitated seamless transitions** into C++. We **excelled** in applying our knowledge to craft **advanced VRC methods** like localization on custom-made odometry and spline arc movements + creating field-position tracking on the V5 brain for debugging purposes.

Oracle upholding long-term **ESG** principles intrigued us. Oracle runs certification programs, **empowering individuals to become Java certified,** and Kai passing these significantly enhanced his programming skillset to craft said algorithms above.

The fascinating journey and widespread impact of this corporation intrigued us more. We **met with Christopher Fagiani**, VP of Engineering, to inquire about how Oracle uses the design process and poured through workbooks published with diagrams of the Design Thinking process.

Figure 1.1: Meeting with Christopher Fagiani

Engineering Design Process

"True solutions to end goals is the process of approaching it. Begin with a problem. Break it into reasonable chunks and define a clear goal to achieve. Have a standardized approach, build modular and simple tests to iterate as you learn from them" — Fagiani.

The essence of PLTW's engineering design process is problem-solving and critical thinking. Whether it be generating 'ingenious' ideas for robot mechanisms or developing frontend and backend products, the design process is central to efficiency. Oracle's workers implement the process design pillar, which "adapts, implements, and defines the business and technical processes." In Figure 2.1, Oracle employs various design thinking frameworks, detailing manufacturing flow stressing defined set deliverables. The design process notes similar steps in defining and evaluating prototypes. Both encompass the same pathway to success, allowing for iterations for maximized product success.

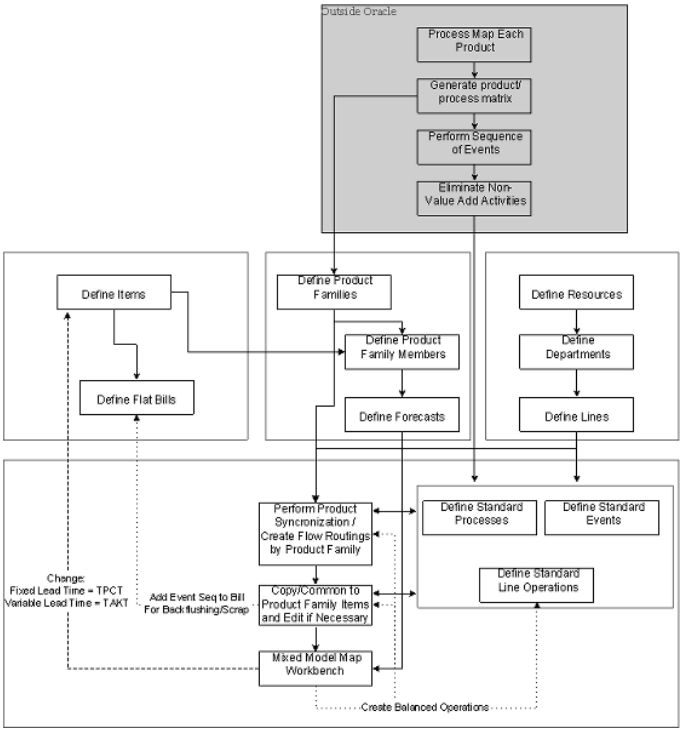


Figure 2.1: *Oracle's Manufacturing Flow Diagram*

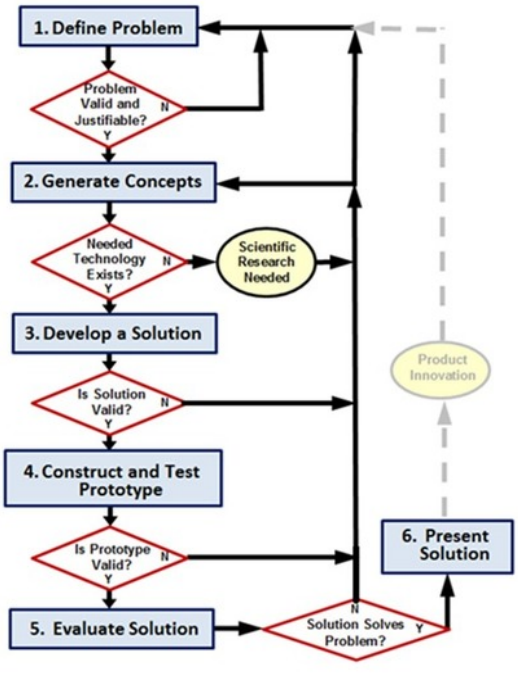
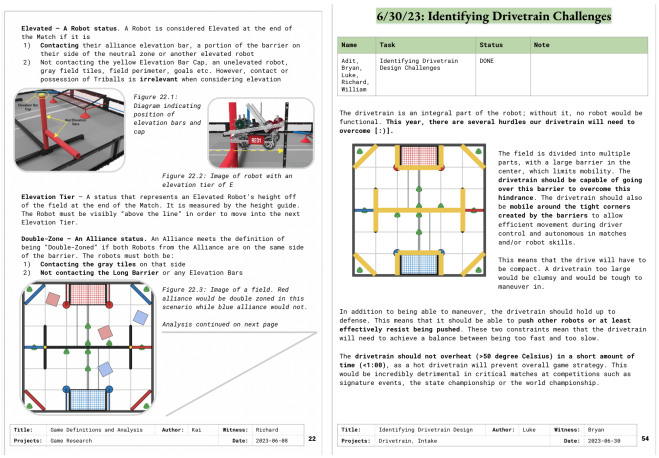


Figure 2.2: *PLTW Engineering Design Process*

Identify Objectives & Opportunities

"Pick niches and distinguish yourself. We [Oracle] target different sized workloads with data centers to run well and make good business. Identify targeted industries, always drive and pride in what you do" — Fagiani.

Facing specific objectives, teams must generate ideas and strategies. Over Under presented challenges of scoring triballs into goals and balancing on hang poles. Oracle underscores the importance of condensing main ideas into bite-sized mechanisms and feasible tasks. This approach allows team members to tackle specific responsibilities within the team structure. For us, we conducted extensive analysis and condensed mechanisms to fit criteria and constraints presented.



6/30/23: Identifying Drivetrain Challenges

Name	Task	Status	Note
Adit, Bryan, Luke, Richard, William	Identifying Drivetrain Design Challenges	DONE	

The drivetrain is an integral part of the robot; without it, no robot would be functional. **This year, there are several hurdles our drivetrain will need to overcome [:)].**

The field is divided into multiple parts, with a large barrier in the center, which limits mobility. The **drivetrain should be capable of going over this barrier to overcome this hindrance.** The drivetrain should also be **mobile around the tight corners created by the barriers** to allow efficient movement during driver control and autonomous in matches and/or robot skills.

This means that the drive will have to be compact. A drivetrain too large would be clumsy and would be tough to maneuver in.

In addition to being able to maneuver, the drivetrain should hold up to defense. This means that it should be able to **push other robots or at least effectively resist being pushed.** These two constraints mean that the drivetrain will need to achieve a balance between being too fast and too slow.

The **drivetrain should not overheat (>50 degree Celsius) in a short amount of time (<1:00)**, as a hot drivetrain will prevent overall game strategy. This would be incredibly detrimental in critical matches at competitions such as signature events, the state championship or the world championship.

Figure 3.1 & 3.2: 95071X's Engineering Notebook

Oracle's Problem Management sector identifies and addresses the root cause of incidents, followed by actions to improve/correct the situation. Incidents are elevated to problem records and the closure of a problem record results in the closure of all associated incidents, demonstrating definitions in set problems.

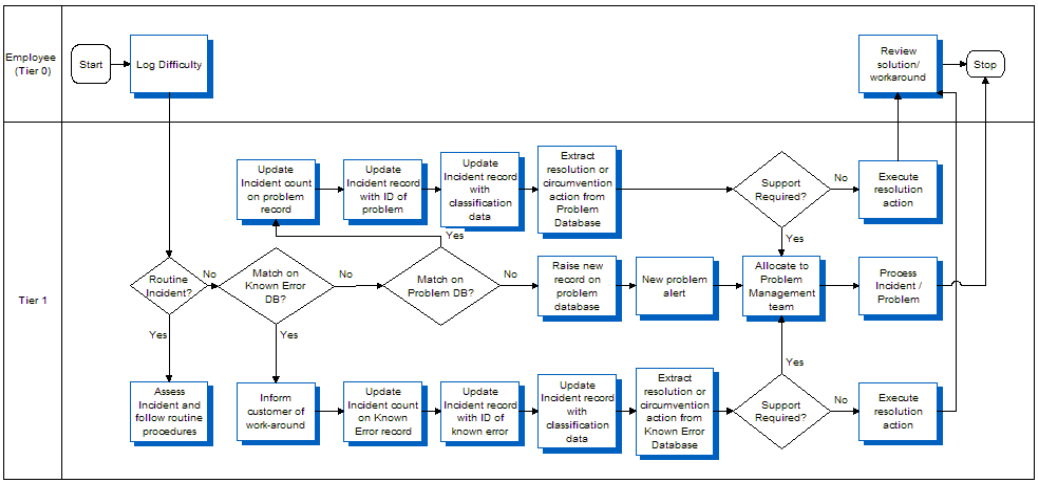


Figure 3.1: Oracle's Problem Identification & Management

Plan & Develop Selected Design Solutions

We systematically generated ideas and rigorously assessed them through decision matrices. Our evaluation process considered defined criteria like torque, power, feasibility and other relevant factors. Some innovative concepts were inspired by emerging trends and discovered through secondary research on examining veteran VRC teams from their work.

Oracle further builds upon this concept by emphasizing trends. Similarly, in planning our designs construction, we leverage Onshape's collaborative and computer-friendly CAD platform. Following the methods of Oracle engineers using the visual and declarative cloud environment for mobile and web applications, we validate our ideas and simulate mates for robot construction.

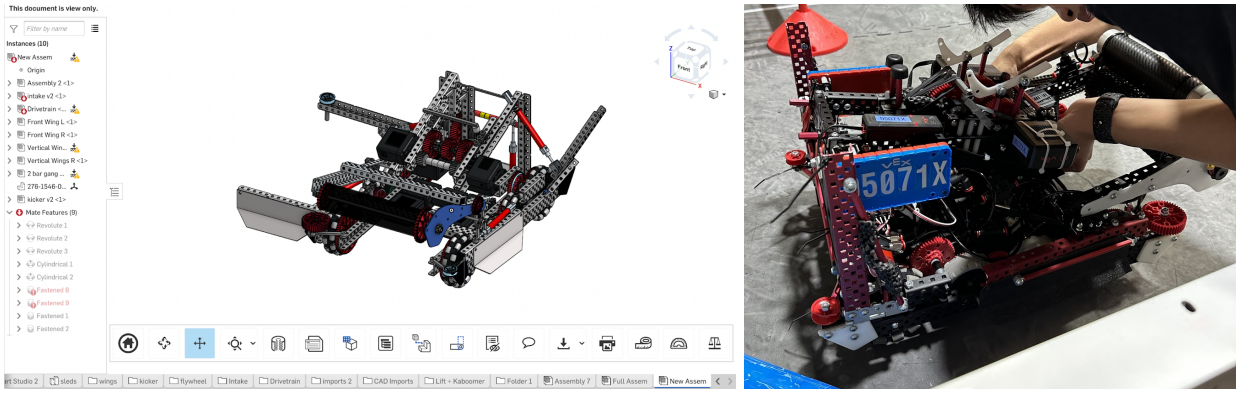


Figure 4.1 & 4.2: 95071X's Third Robot Iteration in CAD & at Competition

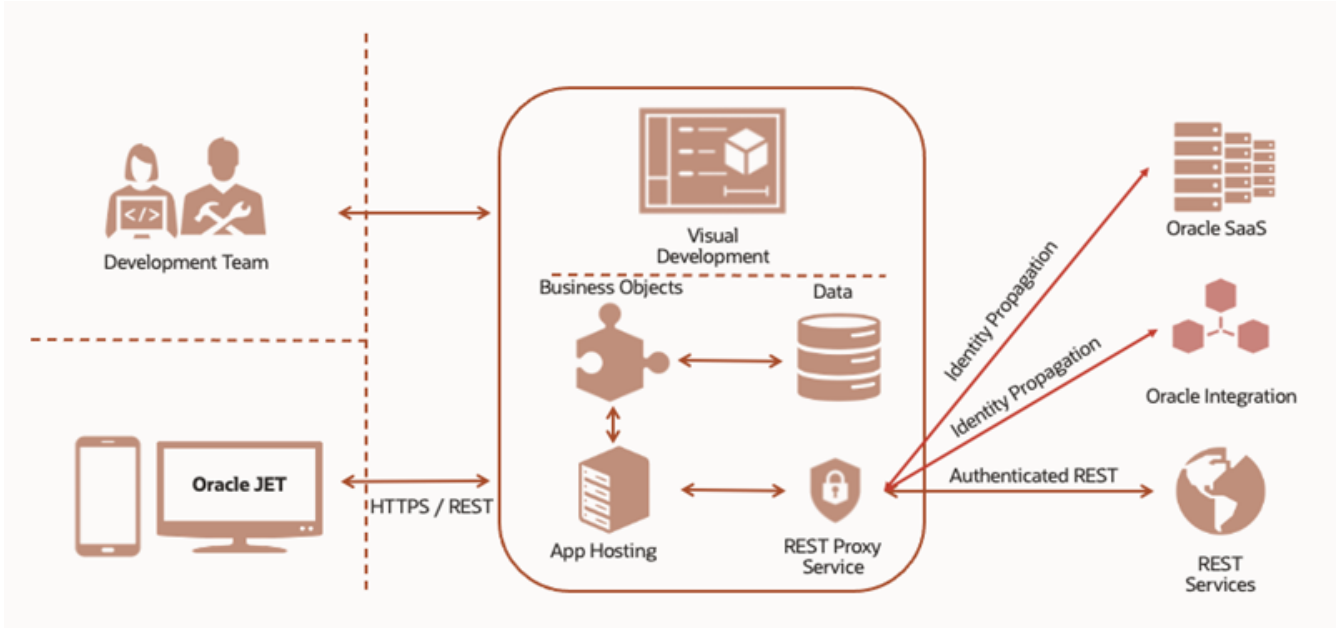
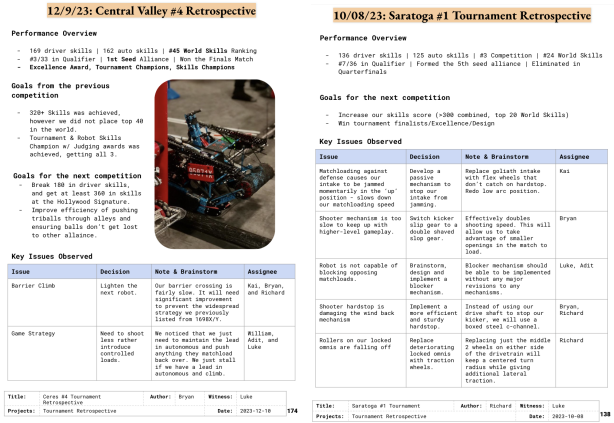


Figure 4.2: Oracle's Visual Builder

Improving by Iterating Through Feedback Loops

Redesigning our robot is crucial to staying competitive in Over Under. The game strategy evolves, and we gather feedback from competitions and scrimmages bringing in middle school teams to assess the effectiveness of our designs. This iterative process sends us back in design process, allowing for constant refinement of our robot for optimal performance, all documented in Engineering Notebook.



12/9/23: Central Valley #4 Retrospective

Performance Overview

- 169 driver skills | 162 auto skills | **#45 World Skills** Ranking
- #3/33 in Qualifier | **1st Seed** Alliance | Won the Finals Match
- **Excellence Award, Tournament Champions, Skills Champions**

Goals from the previous competition

- 320+ Skills was achieved, however we did not place top 40 in the world.
- Tournament & Robot Skills Champion w/ Judging awards was achieved, getting all 3.

Goals for the next competition

- Break 180 in driver skills, and get at least 360 in skills at the Hollywood Signature.
- Improve efficiency of pushing triballs through alleys and ensuring balls don't get lost to other alliance.

Key Issues Observed

Issue	Decision	Note & Brainstorm	Assignee
Barrier Climb	Lighten the next robot.	Our barrier crossing is fairly slow. It will need significant improvement to prevent the widespread strategy we previously listed from 1698X/Y.	Kai, Bryan, and Richard
Game Strategy	Need to shoot less rather introduce controlled loads.	We noticed that we just need to maintain the lead in autonomous and push anything they matchload back over. We just stall if we have a lead in autonomous and climb.	William, Adit, and Luke

Title: Cores #4 Tournament Retrospective | Author: Bryan | Witness: Luke
Projects: Tournament Retrospective | Date: 2023-12-10 | 174

10/08/23: Saratoga #1 Tournament Retrospective

Performance Overview

- 136 driver skills | 125 auto skills | #3 Competition | #24 World Skills
- #7/36 in Qualifier | Formed the 5th seed alliance | Eliminated in Quarterfinals

Goals for the next competition

- Increase our skills score (>300 combined, top 20 World Skills)
- Win tournament finalists/Excellence/Design

Key Issues Observed

Issue	Decision	Note & Brainstorm	Assignee
Matchloading against defense causes our intake to be jammed momentarily in the 'up' position -> slows down our matchloading speed	Develop a passive mechanism to stop our intake from jamming.	Replace goliath intake with flex wheels that don't catch on hardstop. Redo low arc position.	Kai
Shooter mechanism is too slow to keep up with higher-level gameplay.	Switch kicker slip gear to a double shaved slop gear.	Effectively doubles shooting speed. This will allow us to take advantage of smaller openings in the match to load.	Bryan
Robot is not capable of blocking opposing matchloads.	Brainstorm, design and implement a blocker mechanism.	Blocker mechanism should be able to be implemented without any major revisions to any mechanisms.	Luke, Adit
Shooter hardstop is damaging the wind back mechanism	Implement a more efficient and sturdy hardstop.	Instead of using our drive shaft to stop our kicker, we will use a boxed steel c-channel.	Bryan, Richard
Rollers on our locked omnis are falling off	Replace deteriorating locked omnis with traction wheels.	Replacing just the middle 2 wheels on either side of the drivetrain will keep a centered turn radius while giving additional lateral traction.	Richard

Title: Saratoga #1 Tournament | Author: Richard | Witness: Luke
Projects: Tournament Retrospective | Date: 2023-10-08 | 138

Figure 5.1 & 5.2: 95071X's Engineering Notebook

Oracle's exemplar feedback loop is more complicated yet similar. Its Platform Developer's Guide goes to documents receiving feedback "directly from customers, from the agents handling the call, from operational systems that handle service, fulfillment/billing, or even from batch processes."

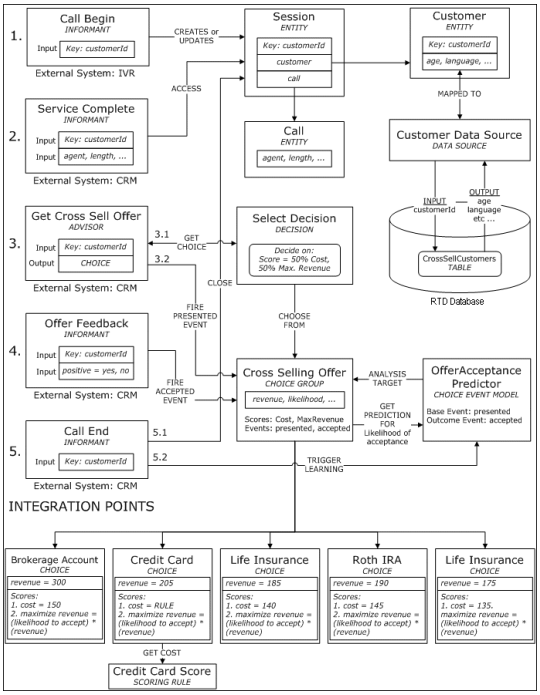


Figure 5.3: Oracle's Closing Feedback Loop

Career Readiness — VEX Robotics Core DNA

"Progressing our last year in VEX, we've developed and strengthened engineering skill sets for the workforce and beyond " — seniors Kai & William.

VEX Robotics' specialty lies in the **development of its students** to be **ready for careers**. Effective **communication** maximizes team's design thinking potential as judges work to increase a student's ability to communicate constructed ideas and solutions. William has passed interviews to land internships at companies. Furthermore, VEX taught us that generating ideas and managing workflow are crucial steps in bringing concepts to life, utilizing Gantt charts, Onshape, and Autodesk CAD to conquer limited resources.

Oracle further instilled in us the value of teamwork, holding team meetings with a **blameless approach** to raise **morale** — this toxicity is common among VRC teams. Fagiani notes understanding the root cause of problems, as his subteams of 8-10 members meet three times a week or daily standups depending on the project lifecycle. Engineering groups' time isn't wasted, rather representatives from each standpoint pair up and work through things together.

We've **implemented this process in weekly meetings**. Richard and Bryan as **hardware club leaders** mentors teams, **building foundational knowledge**; Luke, **programmer leader**, answers code-related queries; We all mentor local middle and elementary school VRC Teams weekly, directly **paralleling Oracle's workforce environment.** Together, we create a worldwide community of leaders, one nut and bolt at a time with knowledge from VEX Robotics.

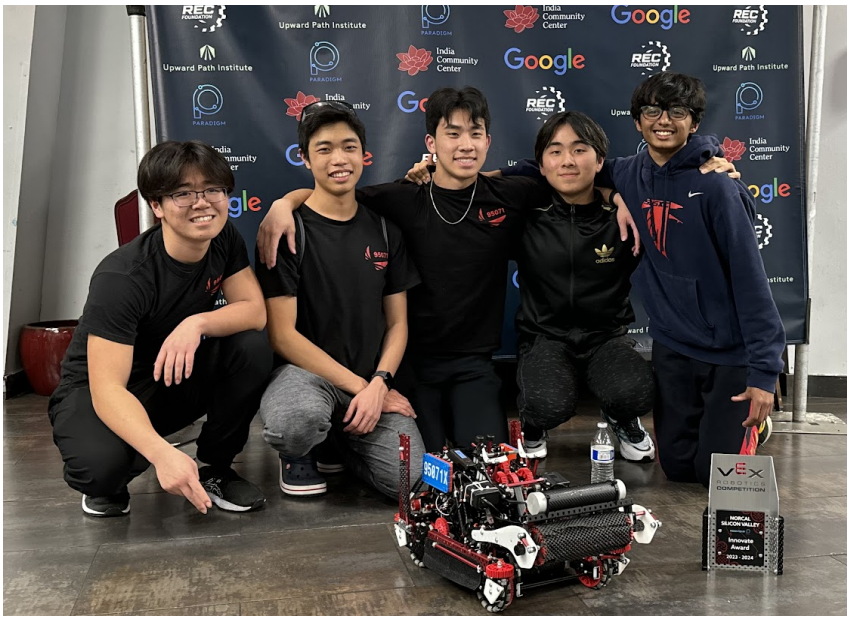


Figure 6.1: Team Photo