

# Purdue Momentum Project Lists

Momentum serves as a space where students from **all majors and class years** (freshmen through graduate students) can collaborate on projects in **Engineering, Software, and Finance**. This document lists our current project options along with the key details you'll need to explore and select where you want to contribute.

## Project Pillars

Use the headers below to go straight to the project list of the pillar you're interested in:

- [Finance Projects – Page 2](#)
- [Engineering Projects – Page 4](#)
- [Software Projects – Page 6](#)

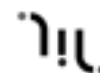
## How Projects Work

- **Student-Proposed:** Projects are created by Directors of each pillar, but students are also encouraged to **submit their own proposals:** ([link here](#)).
- **Open Based on Demand:** Not every listed project may run. Projects open when:
  - A strong Project Manager (PM) candidate applies,
  - Enough members show interest, and
  - Budget and resources allow.
- **Proposals Timeline**
  - For **Fall 2025**, any new proposals close on **Friday, Sept 19** and you must find a team (including PM) to apply.
  - After Sept 19, proposals are added to **Spring 2026**. For these, you don't need a team in advance, we can advertise and recruit with you.
- **Project Info:** Each listing includes: focus, description, skills & tools, timeline, and suggested team size. No prior experience is required, skills will be learned during the project with workshops and team support.

When applying as a **General Member (GM)**:

- Rank your project preferences.
- Indicate if you only want your top choice(s) or are open to others.
- We'll match you based on interest and availability.

**Momentum is your place to build, learn, and propose.** Whether you join an existing project or start your own, this is where ideas turn into action.



# Finance:

## 01. Corporate Valuation & M&A Simulation

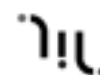
- a. **Focus:** Corporate Finance, Private Equity & IB, Deal Analysis
- b. **Description:** Given a specific industry and current market conditions (e.g., recent M&A activity, regulatory climate, macroeconomic backdrop), teams act as analysts at a private equity firm tasked with identifying the best acquisition target. Each team independently selects a publicly traded company in that industry, conducts a valuation (DCF, comparables, precedent transactions), and develops an investment thesis. The challenge culminates in an “Investment Committee” presentation where teams pitch their deal and compete for approval.  
Can get more specific in terms later on (industry wise, scope, etc.)  
Depending on interest and scale, potential to collaborate with other clubs and make this a bigger event at the end of semester, where all teams present their ideas.
- c. **Expected duration:** 1 semester
- d. **Team size:** multiple teams of ~3-4 students

## 02. Sustainable Investing Portfolio Challenge

- a. **Focus:** ESG & Asset Management
- b. **Description:** Teams construct an ESG-compliant investment portfolio. Analyze ESG scores, carbon intensity data, and sector allocations. Backtest performance against a traditional benchmark to see how returns/risk differ. Students will deliver a portfolio breakdown, backtest performance charts, written analysis of ESG vs. non-ESG tradeoffs.
- c. **Expected duration:** 1 semester
- d. **Team size:** 8-10 students

## 03. Startup Financing Casebook

- a. **Focus:** Venture Capital & Entrepreneurship Finance
- b. **Description:** Over the year, analyze 5–10 early-stage startups (real or simulated), evaluate financing needs, propose fundraising structures, and estimate valuations using VC methods. Students will deliver a compiled casebook, with pitch decks and valuation notes for each startup.
- c. **Expected duration:** 1 semester
- d. **Team size:** 8-10 students

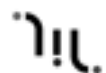


#### 04.Fixed Income Yield Curve & Credit Risk Challenge

- a. **Focus:** Bonds, Credit Analysis, Macroeconomics
- b. **Description:** Teams act as analysts at a fixed-income desk tasked with building a macro-informed bond portfolio. Each group is given historical and current Treasury yield curve data, corporate bond spreads, and macroeconomic indicators (inflation, unemployment, GDP growth). Teams' portfolios are "stress-tested" mid-project based on simulated Fed policy surprises or recession scenarios. They must:
  - Forecast interest rate movements
  - Choose a portfolio allocation across maturities and credit ratings
  - Present both return and risk expectations under different economic scenarios
- Deliverables:**
  - Bond portfolio allocation with justification
  - Yield curve shift simulations and impact analysis
  - Credit risk assessment report
- c. **Expected duration:** 1 semester
- d. **Team size:** 5-7 students

#### 05.(Continuation): Options Pricing and Trading Strategy

- a. **Focus:** Market Analysis, Trading, Quantitative Finance
- b. **Description:** This project explores options pricing through Black-Scholes and Binomial Tree models, analyzes real-world options data (Greeks, implied vs. historical volatility), and develops a simple trading strategy based on volatility or hedging principles. The final deliverables include a pricing tool, data visualizations, a backtested strategy, and a polished report.
- c. **Expected duration:** 1 semester
- d. **Team size:** 4-6 students



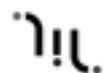
# Engineering:

## 01. Bicycle Energy Harvesting System

- a. **Focus:** Renewable energy, sustainable design, power electronics
- b. **Description:** Develop a small alternator-based system that charges a battery while riding a bicycle, with outputs for USB charging.
- c. **Skills & Tools used:**
  - CAD modeling for mounts and enclosures
  - Electrical system design and rectification
  - Power storage and regulation circuitry
  - Prototyping and mechanical assembly
  - Efficiency testing under real-world conditions
- d. **Expected duration:** 1 semester
- e. **Team size:** 3–5 students

## 02. Portable Low-Cost Wind Turbine

- a. **Focus:** Portable power solutions, renewable energy
- b. **Description:** Create a small, foldable wind turbine capable of charging a USB device. The design will emphasize portability, affordability, and simple assembly, making it suitable for camping, outdoor activities, or emergency uses.
- c. **Skills & Tools used:**
  - CAD modeling for blades and aerodynamic housing
  - Fabrication using PVC and 3D printing
  - DC motor selection and buck converter electronics
  - Basic aerodynamics testing in a controlled airflow (fan wind tunnel)
  - Market research and cost analysis for product feasibility
- d. **Expected duration:** 1 semester
- e. **Team size:** 3–5 students

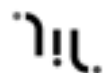


### 03. Modular Assistive Robotic Arm

- a. **Focus:** Biomedical engineering, human-centered design, robotics
- b. **Description:** Design a 3D-printed robotic arm that can assist people with limited mobility in performing basic daily tasks such as picking up objects or pressing buttons
- c. **Skills & Tools used:**
  - CAD modeling (SolidWorks, Fusion 360)
  - 3D printing and assembly
  - Microcontroller programming (Arduino or Raspberry Pi)
  - Basic electronics and motor control
  - Human factors and ergonomic design
- d. **Expected duration:** 1 semester
- e. **Team size:** 5–7 students

### 04. Grand Prix Team: Electric Go-Kart

- a. **Focus:** Automotive engineering, competitive design & manufacturing
- b. **Description:** By being part of the Momentum Grand Prix team, you will be able to work in the design, manufacturing, assembly, testing, and racing of an electric go-kart to participate in Purdue's Annual Grand Prix competition.
- c. **Skills & Tools used:**
  - CAD modeling
  - Manufacturing
  - Electronics & power systems
  - Microcontroller programming
  - Ergonomic/human factors design
  - Mechanical troubleshooting
- d. **Expected duration:** 1 sem
- e. **Team size:** 5–7 students



## 05. Automated Cold Storage Warehouse Optimization

- A. **Focus:** Industrial engineering, logistics, operations research, simulation modeling
- B. **Description:** Design and optimize a fully automated cold storage warehouse for perishable food distribution. The project involves creating an efficient layout, selecting equipment (robots, conveyors, picking arms, refrigeration units), and simulating warehouse operations to balance cost, throughput, and energy efficiency while staying within budget.
- C. **Skills & Tools used:**
  - CAD modeling & layout design (AutoCAD, SolidWorks, FlexSim, AnyLogic)
  - Discrete-event simulation & optimization
  - Data analysis & KPI tracking (throughput, costs, efficiency)
  - Operations research & supply chain modeling
  - Team-based problem solving and tradeoff analysis
- D. **Expected duration:** 1 semester (10–12 weeks)
- E. **Team size:** 5–7 students

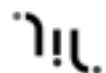
# Software:

## 01. CodeTutor AI

- a. **Focus:** Educational Technology, AI, Software Development Support
- b. **Description:** An AI-powered debugging assistant that explains compiler/runtime errors in plain English, suggests targeted fixes, and teaches related programming concepts for long-term learning. It aims to help both beginner and intermediate programmers understand why their code fails while providing resources to improve their skills.
- c. **Skills & Tools used:**
  - Python, Node.js
  - Large Language Model APIs
  - VS Code Extension API
  - Docker and WebSockets
  - Frontend development (React.js)
- d. **Expected duration:** 1 semester
- e. **Team size:** 4–6 students

## 02. MeetMind: AI Meeting Companion

- a. **Focus:** Productivity, Natural Language Processing, Collaboration Tools
- b. **Description:** A meeting assistant that transcribes conversations in real time, extracts key points, detects sentiment, and creates actionable summaries. It integrates with tools like Slack, Trello, and Google Calendar to automatically log action items and reminders, streamlining post-meeting workflows.
- c. **Skills & Tools used:**
  - React.js, Flask/FastAPI
  - Speech-to-Text APIs
  - Transformer-based sentiment analysis
  - Google Workspace & Slack API integrations
- d. **Expected duration:** 1 semester
- e. **Team size:** 4–6 students



### 03. TimeSense: Deep Work Analytics Tool

- a. **Focus:** Productivity, Behavioral Analytics
- b. **Description:** A desktop application that tracks app usage and activity patterns to detect when users are most focused, recommends optimal work/break cycles, and provides weekly productivity insights. Designed to help individuals and teams build sustainable, high-performance work habits.
- c. **Skills & Tools used:**
  - Electron.js desktop app framework
  - Python for data processing
  - SQLite for local storage
  - Activity recognition APIs
  - Data visualization libraries
- d. **Expected duration:** 1 semester
- e. **Team size:** 3–5 students

### 04. StockScope: Interactive Stock & ETF Explorer

- a. **Focus:** FinTech, Data Visualization, AI Analytics
- b. **Description:** A web-based dashboard that integrates fundamental, technical, and sentiment data to help investors make informed decisions. It offers AI-generated investment summaries, real-time stock charts, and overlays for technical indicators like MACD, RSI, and Bollinger Bands.
- c. **Skills & Tools used:**
  - React.js frontend
  - Flask backend
  - Alpha Vantage & Yahoo Finance APIs
  - NLP for sentiment analysis
  - Plotly/D3.js for interactive charting
- d. **Expected duration:** 1 semester
- e. **Team size:** 4–6 students

#### 05. CareerLens: AI Job & Skill Matcher

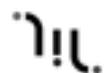
- a. **Focus:** Career Tech, AI, Data Analytics
- b. **Description:** A platform that analyzes a user's resume, LinkedIn profile, and current skill set, then matches them with tailored job postings and suggests upskilling paths. AI detects skill gaps for target roles and recommends relevant online courses, certifications, and networking opportunities.
- c. **Skills & Tools used:**
  - MERN stack (MongoDB, Express, React, Node.js)
  - LinkedIn & job board API integrations (Indeed, Adzuna)
  - LLM APIs for resume parsing and skill gap analysis
  - Data visualization for skill maps
- d. **Expected duration:** 1 semester
- e. **Team size:** 4–6 students

#### 06. Algorithm Visualizer

- a. **Focus:** Education Technology, Algorithms, Data Structures, Visualization
- b. **Description:** A web-based platform where students can visualize algorithms and data structures in action. Users can step through sorting, searching, graph, and dynamic programming algorithms with interactive animations, inspect memory/state changes, and modify inputs to see real-time effects. Designed to help CS students understand core concepts and debug logic visually.
- c. **Skills & Tools used:**
  - React.js frontend for interactive visualizations
  - Python/Node.js backend for algorithm simulation
  - D3.js for animation
  - User accounts & progress tracking
- d. **Expected duration:** 1 semester
- e. **Team size:** 4–6 students

#### 07. ACE Food Pantry Full-Stack Web Application

- [Project description in next page]



# Momentum - ACE Food Pantry Collab Project

## Software Pillar

**Focus:** Full-Stack Web Development, Applied Machine Learning, Community Impact

### The Project

The **ACE Campus Food Pantry** is a resource on campus that makes food and essential household items more accessible to Purdue students, faculty, and staff in need. They serve hundreds of clients each week, but their operations are slowed down by tedious manual tasks such as filling out paper logs and scheduling appointments via email. This wastes valuable volunteer time and limits ACE's ability to scale its impact.

Our mission is to build a **full-stack web application** that modernizes the pantry's operations and helps them serve visitors more efficiently. The platform will include:

- **Appointment Booking Portal** — a form page through which clients can book an appointment in seconds, eliminating back-and-forth emails
- **Admin Dashboard** — a secure interface for staff to approve and manage appointments, track check-ins and check-outs, and handle client data
- **Forecasting Model** — a machine learning model that predicts visitor demand for upcoming weeks based on historical trends and factors such as weather and exam periods, allowing for smarter scheduling decisions to be made

This project is a rare opportunity to experience the full software lifecycle: gathering requirements from stakeholders, designing and building the platform, deploying it to the cloud, and training staff to use it. You'll get hands-on experience with **industry-level software tools, system design, and product management** that top tech companies expect from their engineers. Beginners are welcome — you'll learn as part of a supportive team!

### Skills & Tools

- **Frontend and Backend:** Next.js, TailwindCSS
- **Database:** PostgreSQL
- **Machine Learning:** Python (Pandas, Scikit-learn)

**Expected Duration and Team Size:** 1 semester, 4-6 students

