

# Md. Khairul Basar

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## EDUCATION

Bachelor of Science in Industrial and Production Engineering,  
Shahjalal University of Science and Technology (SUST), Bangladesh  
CGPA: 3.49 / 4.00

(Feb 2020 – Aug 2025)

## RESEARCH PROFILE

Research-oriented Industrial & Production Engineering graduate with strong interest in Artificial Intelligence and Machine Learning, particularly in data-driven optimization, decision-support systems, and predictive analytics. Experienced in integrating machine learning models with mathematical optimization and simulation to solve real-world industrial and societal problems. Seeking MSc in Computer Science with a focus on AI and ML research.

## RESEARCH INTERESTS

1. **Artificial Intelligence and Machine Learning:** I am interested in developing and applying machine learning and artificial intelligence techniques to solve complex, real-world problems in industrial, transportation, and decision-support systems. My focus includes supervised learning, ensemble methods, and deep learning models for prediction, classification, and pattern discovery using real operational data. I aim to advance data-driven intelligence that supports automated and adaptive decision-making.
2. **Predict-Then-Optimize Frameworks:** My research interest lies in integrating predictive machine learning models with mathematical optimization to create end-to-end decision-support frameworks. I focus on Predict-Then-Optimize pipelines where uncertainty-aware predictions inform downstream optimization models, such as mixed-integer programming and scheduling. This approach enables robust, practical solutions for labor-intensive and resource-constrained systems.
3. **Machine Learning-Based Optimization:** I am interested in combining machine learning with optimization techniques to improve planning, allocation, and scheduling decisions. This includes using ML models to approximate cost functions, estimate parameters, and guide optimization solvers in large-scale or data-driven environments. My goal is to enhance computational efficiency and solution quality in complex optimization problems.
4. **Data-Driven Decision Support Systems:** I aim to design intelligent decision-support systems that leverage data analytics, machine learning, and optimization to assist managers and policymakers. My work emphasizes transforming raw industrial and operational data into actionable insights through predictive modeling, optimization, and visualization tools. These systems are intended to support strategic and operational decision-making in dynamic environments.
5. **Simulation and Smart Industrial Systems:** My interest includes simulation-based modeling of industrial and service systems to evaluate performance under different operational scenarios. I focus on combining discrete-event simulation with data-driven models to analyze system behavior, identify bottlenecks, and test improvement strategies. This research supports the development of smart, adaptive industrial systems aligned with Industry 4.0 principles.

## PUBLICATIONS (WITH ABSTRACTS)

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### 1. Optimizing Worker–Task Allocation in a Fish Processing Factory Using a Predict-Then-Optimize Approach

- ARPN Journal of Engineering and Applied Sciences (Accepted)
- **Abstract:** Most industries in developing countries are highly dependent on tasks that involve human effort. Allocation of manual tasks to workers is thus a very important factor for reducing lead time in labor-dependent industries. The goal of this research lies in improving worker-task allocation in labor-dependent industries using a two-stage Predict-then-Optimize framework. In this study, machine learning was used to predict task completion time for each worker-task pair, and the results gained from the prediction model were then optimized through mixed-integer programming. Task-related data were collected multiple times at different hours of the day from 54 worker samples across 17 distinct tasks, making the dataset size 400. Random Forest, SVM, XGBoost, and ANN were used for prediction, and the optimization problem was formulated using Mixed Integer Programming and solved with the Gurobi optimizer. Random Forest Regressor (RFR) demonstrated the best performance with the lowest MAPE (6.63%) and the highest R<sup>2</sup> score (0.98) for the prediction of task completion times based on demographic features and experience. Using these predictions, task allocation was optimized, cutting total process time by 67.5%—from over 50 minutes to just 16.3 minutes. So, this integrated Predict-then-Optimize framework approach can improve the industrial environment in labor-intensive industries by assisting toplevel management in decision-making about reducing the total task completion time.

### 2. A Bi-Objective Optimization Model for Real-World Task Allocation in RMG Sewing Lines

- 8th IEOM Bangladesh International Conference (**Best Track Paper**)
- **Abstract:** A data-driven approach for task allocation can significantly improve sewing line efficiency by ensuring that the workload is evenly distributed among operators based on their individual skill level and speed, thereby reducing non-productive time and optimizing machine utilization. This balanced allocation minimizes the accumulation of work-in-progress (WIP) at specific stations. Our approach is to develop an optimization model that dynamically assigns tasks to operators, with the objective of minimizing total line completion time and maximizing line efficiency. Our methodology involves collecting real-time performance data (e.g., individual operator efficiency, task processing times) and feeding it into a Heuristic Optimization Algorithm (e.g., based on queueing theory and operator skill matrices). This algorithm dynamically recommends the optimal task assignment to balance the line. Improvement after using this approach is expected to be a significant increase in line efficiency (e.g., 10-15%) and a reduction in production lead time. The implication of this approach is a paradigm shift towards a smart, flexible manufacturing system in the Bangladeshi garment industry, enabling faster response to market demands and enhancing global competitiveness through better resource utilization.

### 3. Data-Driven Prediction and Recommendation of Elective Courses for Master's Students

- 8th IEOM Bangladesh International Conference (Accepted)
- **Abstract:** This study presents a machine learning-based framework designed to predict students' academic performance in elective courses and the resulting impact on other core courses within the same semester. Using data collected from the Department of Geography and Environmental Science, Begum Rokeya University, Rangpur (BRUR), various models—including Logistic Regression, Decision Tree, Support Vector Classification, Naïve Bayes, and Random Forest Classification—were trained and evaluated. The dataset underwent preprocessing, encoding, and correlation analysis using Pearson, Spearman, and Kendall methods to identify inter-course relationships. Among all models, the Random Forest Classification algorithm achieved the highest performance with 78% accuracy, an R<sup>2</sup> score of 0.80, and a MAPE of 22%, effectively capturing nonlinear dependencies between core and elective results. The model successfully predicted both elective course performance and the influence of elective selection on other courses of the same semester. These findings

demonstrate the potential of machine learning for data-driven academic advising, enabling universities to recommend electives that align with students' academic strengths. The framework lays the foundation for developing an automated elective course recommendation system to enhance student performance and decision-making in higher education.

#### 4. Maintaining Lane Discipline Can Reduce the Waiting Time in a Road Intersection: A Simulation Study

- ICERIE 2025 (Published, doi: [https://doi.org/10.2991/978-94-6463-884-4\\_85](https://doi.org/10.2991/978-94-6463-884-4_85))
- **Abstract:** Traffic congestion is now a major issue in Bangladesh, according to the World Traffic Index 2025. Bangladesh has ranked 4<sup>th</sup> in the traffic index among 246 countries in the world. Traffic congestion at non-signalized intersections in Sylhet city has been increased due to narrow width of the roads and inefficient traffic system resulting in an increase in waiting time. Our study focuses on reducing idle time in traffic signals by maintaining lanes for each road at LamaBazar 4-way junction, it's a crucial yet congested traffic junction in Sylhet city. Through field observation, primary data is gathered to determine the various vehicle kinds and their interarrival times. Simulation model that replicates the current traffic situation was developed, and the suggested modifications were tested in Arena simulation software. The existing model, with a single lane for all movements, led to significant congestion and long waiting times. Vehicles in queues experienced increased idle times. The proposed model introduced dedicated turning lanes for left-turning, right-turning, and straight-moving vehicles. The simulation result has shown that introducing dedicated turning lanes for left-turning, right-turning, and straight-moving vehicles significantly impact traffic flow resulting in reducing idle time for traffic at LamaBazar 4-way junction. Overall road segments, the waiting time has been lowered by 50% to 60%. The traffic congestion and dedicated turning lane can be maintained by increasing the effective width of the roads through implementing designated vending zones for hawkers and enforcing strict sidewalk and parking regulations. The findings show that dedicated turning lanes greatly enhance traffic flow.

## Projects

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1. Excel-ChatGPT Integration: Automating Web Scraping & AI Responses with VBA
  - Integrated ChatGPT with Excel VBA to automate web scraping and instant AI responses. Streamlined data extraction and enhanced workflow automation. Technologies: Excel VBA, OpenAI API, Web Scraping
2. Object Detection Safety System for Industrial Machinery
  - Designed an Object Detection System to enhance workplace safety. Prevents machinery-related hazards by identifying risky movements in real time. Technologies: Computer Vision, Arduino
3. Dual-Prediction System for Traffic Density & Vehicle Energy Consumption Using Machine Learning
  - Built a Python-based ML model for real-time traffic density and fuel consumption prediction. Aids in route optimization and fuel efficiency for urban transportation. Technologies: Python (Pandas, Scikit-learn), Machine Learning, Data Science
4. Pre-Assembly Line Analysis and Line Balancing at Walton Hi-Tech Industries Ltd.
  - Conducted a detailed Time Study and Motion Analysis on the refrigerator pre-assembly line. Applied line balancing techniques to identify bottlenecks and redistribute workloads effectively. Achieved a significant improvement in line efficiency and reduced idle time. Technologies: Excel, Line Balancing, Work Study, Industrial Engineering
5. Bottleneck Analysis & Scheduling Optimization at Premium Fish & Agro Ind. Ltd.
  - Conducted a bottleneck analysis of the production floor using data-driven methods. Applied scheduling techniques to reduce delays and increase efficiency. Technologies: Excel, Operations Research, Scheduling Algorithms

## INDUSTRIAL & JOB EXPERIENCE

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### **Intern, Walton Hi-Tech Industries PLC (May 2025)**

- Conducted time study, motion analysis, and line balancing, Applied Lean tools including 5S, Kanban, OEE

### **Remote Employee, Industrial 3D Solutions (Dec 2024 – Jun 2025)**

- Developed Excel-VBA automation tools, Supported laboratory product supply coordination

### **Bangladesh Industrial Technical Assistance Centre (BITAC), Dhaka (12 days)**

- Gained insights into conventional and non-conventional manufacturing processes.

### **Khadim Ceramics, Sylhet (1 day)**

- Acquired exposure to industrial ceramic manufacturing processes.

## TECHNICAL SKILLS

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- **Programming & Data Science:** NumPy, Pandas, Matplotlib, Seaborn, Scikit-learn, TensorFlow, PyTorch, LangChain, CrewAI
- **Machine Learning:** Statistical ML Methods, Deep Learning, NLP, Computer Vision, Graph Neural Networks (GNNs), Agentic Decision-Making, Agentic LLMs, AI Reasoning, RAG
- **Optimization & Simulation:** LP, NLP, MILP, Convex Optimization, Discrete Optimization, Simulation Modeling, Gurobi, Scheduling, Arena Simulation

## CERTIFICATIONS

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- Introduction to Data Science with Python – EDGE Bangladesh
- Introduction to Deep Learning with PyTorch – DataCamp
- Excel/VBA for Creative Problem Solving – University of Colorado Boulder
- Six Sigma White Belt – CSSC

## Achievements

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- Awarded a 60% scholarship for the **ISCEA Prize Case Competition 2024**
- Finalist in **IPE Case Quest 1.0**

## Interests

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Poetry, Chess, Reading, Travelling

## References

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