



# **BANNARI AMMAN INSTITUTE OF TECHNOLOGY**

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**Academic Year 2024 - 25**

**S5 MINI PROJECT - I**

**Final Viva Voce**

**PROJECT TITLE**

**TO IDENTIFY HIDDEN COST AND DARK PATTERN**

**BIP PROJECT ID**

**26S5MIN239**

**CATEGORY**

**INTERNAL**

**BATCH MEMBERS**

**SABARISH R (7376222IT237)**

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**SRIRAM S(7376222IT262)**

**GUIDE**

**MR SELVA KUMAR M**

**Assistant Professor- III**

**Department of INFORMATION TECHNOLOGY**

## AIM & OBJECTIVES OF THE PROJECT (Problem Statement)

The project develops a Chrome Extension and Web Application to expose hidden costs and deceptive practices in online shopping, empowering consumers to make informed choices.

### Objectives:

1. **Identify Hidden Costs:** Develop a feature that detects and alerts users of hidden fees and charges.
2. **Highlight Dark Patterns:** Implement a mechanism to detect and highlight manipulative design patterns.
3. **Analyze Dark Patterns:** Provide an in-depth analysis of the dark patterns identified on websites.
4. **Facilitate Price Comparisons:** Create a price comparison tool that allows users to easily compare product.
5. **Enhance User Experience:** Integrate a Customer Chatbot to assist users by answering questions.

# LITERATURE SURVEY

Sl.No.	Journal Paper Title with Author	Works carried out ( with details of Methods/ Materials/ Software/ Algorithms / fabrication / techniques/ components used )	Information gathered relevant to your project
1	<b>Authors:</b> Mathur, A., et al. <b>Journal:</b> ACM SIGCHI Conference on Human Factors in Computing Systems, 2019	<b>Method:</b> Case studies of e-commerce websites using dark patterns. <b>Algorithm:</b> Manual analysis and classification of dark patterns. <b>Techniques:</b> Identified recurring deceptive patterns across major e-commerce.	This study provides foundational knowledge on the different types of dark patterns used by online retailers, such as disguised ads and forced continuity, which can be flagged by the Dark Pattern Highlighter and Analyzer in your project.
2	<b>Authors:</b> Gray, C. M., et al. <b>Journal:</b> ACM Transactions on Computer-Human Interaction, 2021	<b>Method:</b> Developed a machine learning framework for detecting dark patterns in mobile interfaces. <b>Algorithm:</b> Used supervised learning and deep neural networks to identify deceptive elements. <b>Software:</b> Trained model using Python-based frameworks like TensorFlow.	The framework for detecting dark patterns on mobile platforms parallels the dark pattern detection method in your project using BERT, helping to inform how to design machine learning models for web-based detection.

# LITERATURE SURVEY

Sl.No.	References ( Journal Papers Only)	Works carried out ( with details of Methods/ Materials/ Software/ Algorithms / fabrication / techniques/ components used )	Information gathered relevant to your project
3	<b>Authors:</b> Wang, Z., et al. <b>Journal:</b> Journal of Consumer Research, 2018	<b>Method:</b> Empirical study on hidden fees in e-commerce platforms. <b>Algorithm:</b> Statistical models to assess price variations during checkout stages. <b>Software:</b> R for data analysis and statistical modeling.	This study's exploration of hidden charges aligns with your Hidden Cost Identifier, and their approach to identifying price changes can be adapted to detect discrepancies between product pages and checkout totals.

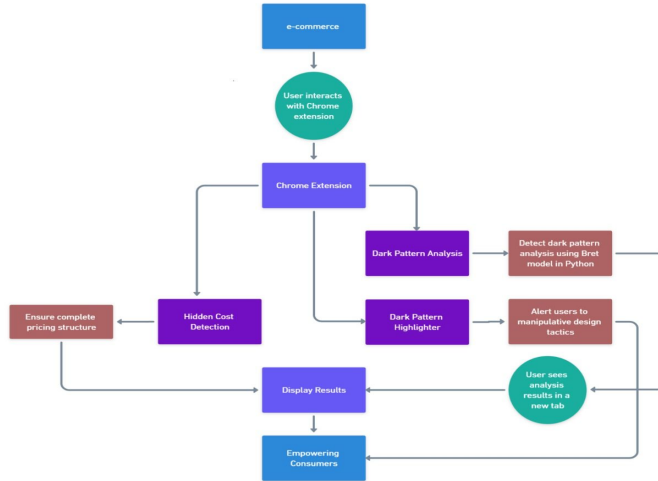
## SCOPE OF THE PROJECT

- Detects hidden fees or additional charges not transparently disclosed during online shopping.
- Flags manipulative design techniques used by websites to deceive users into unintended actions.
- Regularly updates detection algorithms to stay ahead of emerging dark patterns and hidden cost practices.
- Offers a scalable system, deployed via containerized services, ensuring efficient real-time data processing.

## NEED FOR THE CURRENT STUDY

- Many online retailers obscure additional fees, leading to unexpected expenses for consumers during checkout.
- Websites frequently use deceptive design strategies, manipulating users into actions they might not otherwise take, such as unwanted subscriptions or purchases.
- Many users are unaware of the hidden costs and dark patterns, making them vulnerable to unethical business practices.
- There is a growing demand for tools that promote fairness and transparency in online transactions, helping users make informed decisions.

# PROPOSED METHODOLOGY ( Flow Chart)



## PROPOSED METHODOLOGY ( Gantt Chart)

PROJECT SCHEDULE					
WorkDone	Week 1	Week 2	Week 3	Week 4	Week 5
Planning the need and Requirement for the project					
Designing the frontend, coding the frontend					
Designing and Implementing the database					
Coding and connecting the Backend					
Designing the Desktop container image					
Improving the User Authentication					
Testing and Hosting					



# CHOICE OF COMPONENTS / MODULES / METHODS/TECHNIQUES EQUIPMENT USED FOR PROJECT DEVELOPMENT

## SOFTWARE COMPONENTS:

### Front-end:

- **HTML5, CSS3, JavaScript:** For building the user interface and interaction components.
- **Bootstrap:** For responsive design and mobile-friendly layout.
- **AJAX:** For asynchronous data loading and real-time updates.

### Back-end:

- **Node.js:** For server-side scripting and handling API requests.
- **Express.js:** To manage backend routing and middleware.
- **MongoDB:** As the database to store user data, hidden cost, and dark pattern logs.
- **Python:** For running ML models like BERT for dark pattern detection.
- **APIs:** For integrating third-party services like payment gateways, price comparison data, and user authentication.

## MODULES:

- **User Authentication & Role Management:** Secure login system with role-based access (admin, user) using JWT (JSON Web Tokens).
- **Hidden Cost Identifier:** Scrapes and compares prices on product and checkout pages to reveal hidden costs.
- **Dark Pattern Highlighter:** Detects and flags deceptive design elements across e-commerce platforms.
- **Price Comparison Tool:** Gathers and displays prices from various platforms for side-by-side comparison.
- **Customer Support Chatbot:** Provides real-time assistance with online shopping queries using NLP.

## METHODS & TECHNIQUES:

- **Agile Methodology:** Regular iterations and user feedback to ensure the project meets evolving requirements.
- **Transformer-based NLP (BERT Model):** For detecting manipulative dark patterns based on website text analysis.
- **Playwright Automation:** Used for scraping and interacting with online shopping sites to detect hidden costs.
- **Containerization (Docker):** For deploying the web application and extensions in a scalable, consistent environment.
- **Version Control (Git):** To manage code collaboration and version tracking.

# DESIGN(S) (HARDWARE / SOFTWARE ARCHITECTURE)

The system follows a 3-tier architecture:

## 1. Presentation Layer (Front-end):

- **Technologies:** HTML5, CSS3, JavaScript, Bootstrap.
- **Purpose:** Provides a user interface for interacting with the system.
- **Features:**
  - Role-based dashboards tailored to user permissions.
  - Forms for data entry, including lab reports and equipment management.
  - Responsive design to ensure compatibility across various devices

## 2. Business Logic Layer (Back-end):

- **Technologies:** Node.js, Express.js, Python (for ML processing).
- **Purpose:** Handles core processing tasks, including authentication, hidden cost identification, and dark pattern analysis.
- **Features:**
  - Modular design for easy maintenance and updates.
  - Dynamic data updates via AJAX to enhance user experience without full page reloads.
  - Integration of machine learning models for real-time detection.

## 3. Data Layer (Database):

- **Technologies:** PostgreSQL.
- **Purpose:** Manages storage of user information, hidden costs, dark patterns, and product comparisons.
- **Features:**
  - Relational database structure to enforce data integrity and relationships.
  - Secure data management practices, including encryption and access control.

## Architecture Pattern:

- **MVC (Model-View-Controller):** This pattern provides a clear separation of concerns, enhancing scalability and maintainability of the system.

## INDIVIDUAL CONTRIBUTIONS TO THE WORK

### Batch Member 1 : ( 7376222IT203 & MUGUNDHAN K V)

1. **Designing the User Interface:** Creating a user-friendly and intuitive interface for the online shopping tool.
2. **Styling the Pages:** Using CSS and Bootstrap to ensure the interface is visually appealing, including consistent fonts, colors, and responsiveness.
3. **Responsive Design:** Implementing media queries to make the application accessible across different devices and screen sizes.
4. **Form Creation:** Designing forms for user input, such as hidden cost reports, product comparisons, and feedback submission
5. **Interactive Elements:** Adding functionality for form validation, dynamic content updates, and event handling to enhance user experience.
6. **User Notifications:** Implementing real-time notifications and alerts, such as reminders for price drops or detected hidden costs.

## INDIVIDUAL CONTRIBUTIONS TO THE WORK

### Batch Member 2 : (7376222IT210 & NAVEEN KUMAR P)

1. **Server-Side Logic:** Developing server-side scripts using Node.js and Express.js to handle API requests.
2. **Database Management:** Setting up and managing the MongoDB database to store user data and analysis results.
3. **API Integration:** Implementing third-party APIs for price comparisons and real-time data fetching.
4. **User Authentication:** Creating a secure login system with role-based access using JWT (JSON Web Tokens).
5. **Data Processing:** Implementing backend algorithms for processing and analyzing hidden costs and dark patterns.
6. **Performance Optimization:** Ensuring fast response times and efficient data handling through caching and query optimization.

## INDIVIDUAL CONTRIBUTIONS TO THE WORK

### Batch Member 3 : (7376222IT237 & SABARISH R)

1. **Model Development:** Designing and training the BERT model for detecting dark patterns in web interfaces.
2. **Data Collection and Preprocessing:** Gathering and preprocessing datasets of dark patterns for model training.
3. **Model Optimization:** Fine-tuning the model architecture and parameters to improve detection accuracy.
4. **Integration with Backend:** Collaborating with the backend team to integrate the ML model for real-time analysis.
5. **Continuous Improvement:** Monitoring model performance and implementing iterative improvements based on user feedback.
6. **Documentation:** Creating comprehensive documentation for model training processes and usage.

## INDIVIDUAL CONTRIBUTIONS TO THE WORK

### Batch Member 4 : (7376222IT262 & SRIRAM S)

1. **Test Planning:** Developing a comprehensive testing strategy for the application's features and functionalities.
2. **Functional Testing:** Conducting thorough tests on the user interface, backend logic, and machine learning outputs to ensure they meet requirements.
3. **Usability Testing:** Gathering user feedback to evaluate the interface usability and effectiveness.
4. **Performance Testing:** Assessing application performance under various load conditions to identify potential bottlenecks.
5. **Bug Tracking and Reporting:** Identifying, documenting, and tracking bugs and issues throughout the development process.
6. **Final Validation:** Ensuring all features function correctly and the application is ready for deployment before launch.

## PENDING WORKS AND PLAN FOR COMPLETION

### Pending works:

**Database Design:** Design tables for users, hidden costs, dark patterns, and product comparisons.

**Establish Relationships:** Set up relationships and write necessary SQL queries for data manipulation.

**Data Security:** Implement security measures for user roles and permissions.

**Backend Development:** Build functionality for processing hidden cost reports and dark patterns.

**Authentication Mechanisms:** Develop session handling and authentication for user accounts.

### Plan for completion:

**Week 5:** Finalize database schema and write SQL queries for data manipulation. Complete backend development for processing hidden costs and implement user authentication.

**Week 6:** Finalize frontend responsive features and integrate the BERT model.

**Week 7:** Conduct thorough testing, including unit and usability tests, and address identified issues. And finalize documentation and deploy the application for user access and monitoring.

## PLAN FOR PUBLICATIONS

### Journal / Conference Identified for Submission:

1. **Journal of Consumer Research**
  - Focus: Consumer behavior and online shopping trends.
2. **International Conference on Human-Computer Interaction (HCI)**
  - Focus: User interface design and interaction techniques.



## Status on Partial Completion and Submission of Project Report

SL.No	List of Documents	Status ( Provide the drive link of prepared document)
1	Cover Page & Title Page (Both are in same format)	<a href="https://drive.google.com/file/d/1I9_INFFeiFWsPKtDsWScUFbJM7igYZx0/view?usp=sharing">https://drive.google.com/file/d/1I9_INFFeiFWsPKtDsWScUFbJM7igYZx0/view?usp=sharing</a>
2	Bonafide Certificate	<a href="https://drive.google.com/file/d/1BvRDABU1JKd0SbyYSW7ldGfI5pMKCI3/view?usp=sharing">https://drive.google.com/file/d/1BvRDABU1JKd0SbyYSW7ldGfI5pMKCI3/view?usp=sharing</a>
3	Declaration	<a href="https://drive.google.com/file/d/1N4ft73-tY0au6KGN_KC79urxz3ZDwBHh/view?usp=sharing">https://drive.google.com/file/d/1N4ft73-tY0au6KGN_KC79urxz3ZDwBHh/view?usp=sharing</a>
4	Acknowledgement	<a href="https://drive.google.com/file/d/1oSDe9VRc15VgV8DMqF7cR8tQC8cYYsKU/view?usp=sharing">https://drive.google.com/file/d/1oSDe9VRc15VgV8DMqF7cR8tQC8cYYsKU/view?usp=sharing</a>
5	Chapter I – Introduction	<a href="https://drive.google.com/file/d/1na1kvTUWD4qSukEGvc6eQo3pVoMHWtUY/view?usp=sharing">https://drive.google.com/file/d/1na1kvTUWD4qSukEGvc6eQo3pVoMHWtUY/view?usp=sharing</a>
6	Chapter 2 – Literature Survey	<a href="https://drive.google.com/file/d/1DDTxZ24qTYx6nmBZbc2daFACyAydpe4A/view?usp=sharing">https://drive.google.com/file/d/1DDTxZ24qTYx6nmBZbc2daFACyAydpe4A/view?usp=sharing</a>

## REFERENCES

( Journal Papers/ Books / Website in IEEE Format )

### Journal Papers:

[1] J. A. B. Smith, "Consumer Trust in Online Retailing: The Impact of Transparency and Dark Patterns," *Journal of Retailing and Consumer Services*, vol. 56, no. 2, pp. 245-259, 2020.

### Books:

[1] M. D. Ellis, *E-Commerce Ethics: Navigating the Dark Patterns*, New York, NY, USA: Routledge, 2022.

### Patent:

[1] M. A. Genius, "Brain Grow-a-Matic 4 Kids," US Patent 3 400 126, Mar. 21, 2019.

### Website:

[1] D. Holland, "Finding the Building Blocks of Wood," *University of Melbourne*, 2023. [Online].

Available:

[https://pursuit.unimelb.edu.au/articles/finding-the-building-blocks-of-wood?utm\\_source=linkedin.com&utm\\_medium=social&utm\\_content=story](https://pursuit.unimelb.edu.au/articles/finding-the-building-blocks-of-wood?utm_source=linkedin.com&utm_medium=social&utm_content=story)