

**CalibrEx: A Web and Mobile Platform for Accuro Inc., Distributor of Beamex, Utilizing  
Collaborative Filtering for Personalized Product Recommendations**

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## Chapter 1

### Introduction

In the niche subject of industrial calibration, it is important that distributors and customers communicate effectively to ensure that the clients are offered support on time and access to equipment that is of good quality and fit to their requirements. Accuro Inc. is a stockist of Beamex calibration products and its current challenge is to offer its customers (both enterprises and technicians) a convenient online means of reaching the company directly. This hurdle is further compounded by the quickening pace of the digitalization of data and product catalogs as clients find it challenging to wade through the constantly increasing complexities of their choices to find ways of solving their unique needs according to Ahmed and Letta (2023). In an effort to eliminate such problems, CalibrEx is suggested as a web and mobile interface, which will enable direct contact with users and Accuro Inc., whereas there will also be personalised product suggestions as part of the site to provide a better user-experience and engagement.

The main aim of CalibrEx is to design its solutions so they offer customers a simple and easily understandable interface where they can communicate with Accuro Inc. over web and mobile platforms in the simplest way to make inquiries, requests concerning their support, and products related communication. As an add-on, the platform will use the collaborative filtering techniques to provide the Beamex product recommendations that will assist customers in finding personalized equipment based on their preferences and the needs of the operation. Specifically, recommender systems, especially that are built using collaborative filtering techniques, have been used in different application areas to infer user preferences by examining user-item relationships, usually ratings or purchase log data according to Ahmed and Letta (2023). By way of example, Karabila et al. (2023) revealed higher accuracies of recommendation, in

e-commerce, by merging sentiment analysis and collaborative filtering, recording reduced values of Mean Absolute Error (MAE) and Root Mean Squared Error (RMSE), with optimization of user- and item-based strategies adopted. Likewise, Ahmed and Letta, (2023) addressed the cold start challenge in the library book-recommendation with improved matrix factorization with 85 % accuracy using Singular Value Decomposition (SVD). Also, Mandalapu et al. (2023) proposed a Chimp based Deep Neural Collaborative Filtering (CbDNCF) model, stating the accuracy of product recommendations to be 97.7 percent accuracy, a combination of deep neural networks and collaborative filtering.

According to these studies, collaborative filtering offers an advantage of flexibility and efficiency in providing personalized recommendations especially with the added capacity of more advanced methods such as neural networks or hyper parameter tuning. Nevertheless, they are not widely used in the narrow sphere of industry, including calibration devices supply. CalibrEx improves this loophole by focusing on ease of contact between the customers and the capability of incorporating collaborative filtering as an added feature to offer value added suggestions. Offering the direct communication channel and adding to it the personal recommendations depending on the user ratings and product specs, CalibrEx will promote the increased customer satisfaction and facilitate the decision-making process, as well as foster the relationship between the company and its clients, i.e. brand Accuro Inc. This introduction presents the motivation, the theoretical basis, and objectives of CalibrEx so that the paper will eventually establish a platform that can be used between practical communication needs and the new technology of a recommender system.

## **Background of the Study**

The mass spread of digital product catalogs and the growing sophistication of industrial machinery have had much to do with changing customer relationships with the distributors in such specific fields of industry as calibration. Accuro Inc., a distributor of Beamex calibration products, is struggling to make available smooth communication lines to its various customers who consist of technicians, engineers and industrial companies. According to Ahmed and Letta (2023), the informational state of the world is overwhelming and ensures that customers cannot sift through long lists of products and find equipment that fits their expectations due to an excess of digital information causing an information overload. Also, the lack of a specific system to connect directly and efficiently with Accuro Inc. prevents the quick form of support, thus, such a scenario can result in growing frustration and low customer interaction.

There are some factors that power this communique and navigation problem. Technical nature of the calibration industry means that their customers need easy access to detailed product information and use of expert advice, however, its traditional channels such as email or telephone based request may simply not be fast or friendly enough to meet the expectations of modern customers. Also, a large number of products offered by Beamex and the diversity of their specifications cause complications in the decision-making process, especially among limited technical customers [Karabila et al., 2023]. Integrated user-friendly platforms can also streamline the process further as customers find it very hard to interact with the distributors or find applicable goods efficiently. By not correcting the situation, Accuro Inc. will be facing reduced customers and loss of business opportunities in a highly competitive environment.

Effective communication between the customer and distributors is a huge loss because in the industrial markets free flow of communication and product discovery is paramount in building trust and loyalty between the customer and distributor. The interactions do not only constitute a transaction process but a belief in fulfilling the technical and operational demands of the customers [Ahmed and Letta, 2023]. This relationship is jeopardized by the increasing use of broken channels of communication and catalog standardization of products which can easily intimidate new and relatively inexperienced clients with unfamiliar technical information. Otherwise, this disparity can undermine the strength of Accuro Inc. as a Beamex distributor and be able to serve various customer needs with an appropriate magnitude.

The digital platforms provide hopeful solutions to the gap. Recommender systems and especially collaborative filtering-based recommender systems have demonstrated a strong potential in improving user experience due to the fact that the recommendation algorithms learn the behavior and preferences of a user and thus serve him/her with personalized suggestions in order to propose a specific product to a user [Mandalapu et al., 2023]. Take the case of Karabila et al. (2023) that enhanced e-commerce proposals by combining collaborative filtering with the sentiment analysis approach and minimized the error rates under the corrected algorithms. On a comparable note, other researchers built a Deep Neural Collaborative Filtering model made on a Chimp framework, achieving an accuracy of producing products of 97.7 percent (Mandalapu et al., 2023). In a manner of speaking, CalibrEx, a proposed web and mobile platform will specifically solve the problems of Accuro Inc. since it will focus not only on directly engaging with customers but also in making it convenient and easily understandable, as well as including collaborative filtering as a feature to provide recommendations of Beamex products based on

specifications of the products. This will aim at increasing customer interaction, simplified decision-making process and maintaining Accuro Inc. promise of excellence service in the area of calibration.

## **Project Objectives**

The main goal is to develop an intuitive and accessible web and mobile platform, *CalibrEx*, that enables seamless customer contact with Accuro Inc., a distributor of Beamex calibration products, while incorporating a collaborative filtering algorithm to provide personalized product recommendations.

In particular, it aims to:

1. Design a user-friendly web and mobile application featuring communication tools, such as inquiry forms, and support tickets, to facilitate direct and efficient interactions between customers and Accuro Inc., ensuring timely responses to inquiries and technical support needs.
2. Implement a collaborative filtering algorithm, inspired by advanced techniques such as matrix factorization and deep neural collaborative filtering, to deliver personalized Beamex product recommendations based on user ratings, purchase histories, and product specifications, enhancing customer engagement and decision-making.
3. Evaluate the platform against ISO/IEC 25010 standards to assess CalibrEx's Functional Suitability, Performance Efficiency, Compatibility, Usability, Reliability, Security, Maintainability, and Portability, ensuring a high-quality user experience and system performance.

## Significance of the Study

In line with this, the CalibrEx project will seek to share its results and impact to the different stakeholders of the calibration business and other adjacent industries, and these are:

- **Accuro Inc. Staff and Management:** Can use the platform to simplify the interaction with customers, increase response rate and product findability that will result in customer satisfaction and business expansion.
- **Technicians, Engineers, and Industrial Firms (Beamex Customers):** Will have a convenient platform where they can communicate effectively with Accuro Inc., they will be able to receive personalized product recommendations to facilitate effective purchase decisions within a shorter time.
- **Potential Developers of Industrial Platforms:** Have an opportunity in the future to refer to the development process and conclusions made about CalibrEx and the amazing people who founded it and created it in order to develop user-friendly platforms where communication and personalization capabilities are combined to promote innovation in less popular industrial industries.
- **Future Researchers:** Could be tempted to expand the findings of this study to consider more sophisticated features of recommender systems, including specific approaches of science methodology, namely, hybrid collaborative filtering or sentiment analysis, and their industrial application, which would add such evaluations to the scholarly literature on digital transformation.

## Scope of the Study

This study focuses on:

- **Login and Sign Up Module. (web and mobile)**
  - **Sign Up Functionality:** Users can create an account by entering full name, email address, phone number, company name, password, and confirming the password, with a "Create Account" button to submit the details.
  - **Login Functionality:** Users can log in by providing email address, and password, with a "Sign In" button to access the app, along with options for "Don't have an account? Sign up" and "Forgot your password?" for account recovery
- **Landing Page Module. (web and mobile)**
  - This module serves as the primary entry point to the Accuro site, where the core business of the company, which is to supply the best measurement and calibration instruments in industrial applications, is presented. It has a graphically appealing banner section that has an easy-to-use call-to-action button (Explore Products) and it provides an introduction to the mission and services of the company. The page offers simple navigation via the top navigation which links the users to the main sections the Products, the About, Contact, Book Meeting, and User Profile.

- **About Us Module. (web and mobile)**

- The module offers the description of Accuro identity, mission, and expertise in instrumentation and calibration solutions. The Our Company section has emphasized the fact that Accuro specializes in the Beamex products and the importance that it attaches to accuracy, reliability and customer satisfaction. It puts stress on how the company is committed to developing long term relationships with its clients by training, maintenance and support services.

- **Product Module. (web and mobile)**

- Using this module a user can search a great variety of Beamex calibration products, each having its own picture, category tag, approximate price scale, and main characteristics. It has other functions like a search box, category filter and currency switch which allows the user to change the currency to either PHP or USD to find convenience in pricing. Both products are characterized by the use of the Add to Cart and Details buttons allowing one to easily purchase or read more information. A cart icon is located on the right-hand bottom of the screen that displays the quantity of the items added.

- **Contact Us Module (web and mobile)**

- This module enables the customer of Accuro Inc. to contact the company with ease to enquire, support or give feedback. It also has a contact section where the user can provide his/her first and last name, email address, phone number, company, and subject, and place a message in the text box after which he can send it via the send message button. On the right hand side of the page, the contacts of the company are listed such as phone, email, office location with working hours. A installed Google map would also be given to enable the user to find it easy to locate the office.

- **Book Meeting Module (web and mobile)**

- This module enables a user to book an appointment with Accuro Inc. to demonstrate its product, consult or discuss its services. Users will be allowed to choose their preferred date and the time slot they can do the meeting, their company name, contact information, the purpose of the meeting, location, and product or service of interest. After making a request to hold a meeting, an automatic mail to the email address that the user has registered receives a confirmation, and a downloading of the receipt can also be done.
  - **Meeting Request Receipt:** This contains information about the booking identification, meeting date and time, reason, place, contact and a list of requested goods or services. The receipt also shows the estimated price of requested items and it is used to prove that the items are booked.

- **Admin Login Module (Web)**

- This module grants access to the dashboard of the module with the help of authorized users. It has a section where one input an email address and password, and a Sign In button to post the credentials. There is also an option of a forgotten password. account recovery link and a link to go back to the main site.

- **Admin Profile Management Module (Web)**

- The module enables the administrators to revise their personal and professional information. It includes an option to post profile picture with a camera icon (not exceeding 2MB of JPG, PNG, GIF files), as well as a chance to edit such information as full name, email address, phone number, and company name. Any change is saved with a button marked Save Changes, and the user can discard changes with the button marked Cancel, which encourages user customization and accuracy of the data.

- **User Dashboard Module (Web)**

- The module is a customized guide to registered users and presents reservation-related statistics, including Total Bookings, Pending, Completed, and Cancelled (which is 0 in the default set-up). It has a dropdown to filter All Bookings and a Refresh button to refresh the information and a central panel that states No bookings yet with a button to create a new booking to ensure one can easily monitor and handle personal bookings.

- **Admin Dashboard List View Module (Web)**
  - This module provides an in-depth table of booking management with columns of ID, Date and Time, Company, contact, purpose, status (e.g. pending, cancelled, confirmed) and actions (view, edit, delete). It allows searching by company or contact, filter by all statuses, and a Reset button to remove filters, and has an addition button, + New Booking, used to add entries. This allows the administrators to manage, update and arrange meetings requests effectively and there is the pagination of managing multiple records.
  
- **Admin Dashboard Calendar View Module (Web)**
  - This module shows a visual calendar interface of October 2025 (or the month of choice) with colored blocks representing a booking, where the booking is pending (yellow), confirmed (green), software training (orange). It also has next/previous month navigation, month/week/day views and tooltips with company, purpose and time. Company or contact search, status filter, a reset button and + New Booking button improve scheduling management and avoid conflict.
  
- **Transaction Logs Module (Web)**
  - The module is a tracking of the completed or pending transactions regarding bookings, represented in a table with columns of ID, Date and Time, Company, Status (e.g., Pending, Cancelled, Confirmed), Completion (e.g., Pending), Conclusion/Notes (e.g., No conclusion recorded) and Actions (View Details). It has both search by company or

contact and filters by all status and all meetings, a reset button, and + New Booking, which is an integration that enables the admins to check the transaction history and hold the booker accountable.

- **Activity Logs Module (Web)**

- All system activities are recorded in this module in table form, with the following fields; Timestamp, User (e.g., Admin User, Migeru Bunyi), Action (e.g., LOGIN, BOOKINGCREATED, BOOKINGCANCELLED), Resource (e.g., auth, booking), Details (e.g., "User logged in:admin@accuro.com.ph), and IP Address. Advanced auditing, compliance monitoring and troubleshooting is facilitated by Filters by resource type (All Types), Filters by action (e.g., LOGIN, USER\_CREATED) and search functionality.

- **Reviews Module (Web)**

- This module deals with the reviews and testimonials of the customers, and the filters are Approval Status (All Reviews) and Rating (All Ratings). Every review has a star rating (i.e., 5 stars), name of reviewer and company, date, review text (i.e., in Filipino) and status (i.e., Approved, Public). Unapprove and delete action buttons can be used to moderate the feedback so that admins can curate feedback, react to customer feelings, and control the quality.

## Delimitation of the Study

- **Limited platform only:** Developing *CalibrEx* exclusively as a web and mobile application, excluding other platforms like desktop software or IoT-based interfaces.
- **Specific communication tools:** Focusing on inquiry forms and support tickets, excluding other features like video conferencing or social media integration.
- **Single recommendation approach:** Implementing only a collaborative filtering algorithm for personalized recommendations, excluding other techniques like content-based filtering or hybrid models incorporating sentiment analysis.
- **Evaluation framework:** Assessing only ISO/IEC 25010 standards, excluding other metrics like advanced user engagement analytics or real-time performance monitoring.
- **Product focus:** Covering only Beamex calibration products distributed by Accuro Inc., excluding other calibration brands or non-calibration equipment.
- **Target demographic:** Primarily targeting Beamex customers (technicians, engineers, and industrial firms) with limited focus on non-technical users or younger/older audiences.

## Chapter 2

### Theoretical Framework

This chapter presents a comprehensive review of related studies, projects, and research that inform the development of *CalibrEx*. It focuses on literature and concepts aligned with the project's objectives, particularly the creation of a web and mobile platform for seamless customer communication and the integration of personalized product recommendations through a collaborative filtering algorithm. Additionally, this chapter includes the conceptual framework, system architecture, and definition of terms to provide a holistic understanding of the project's theoretical foundation.

### Review of Related Literature and Studies

The fast growth of digital information has posed important problems of dealing with the information overload, especially in the narrower fields like the industrial calibration equipment investor. Recommender systems based on collaborative filtering (CF) and other new-fangled methods have developed as essential to overcome those challenges by giving individual suggestions. This review draws conclusions about the existing research on the topic of CF-based recommender systems in terms of their application in the field of product recommendations and is related to the development of CalibrEx, a web and mobile product of one of the Accuro Inc. distributors of Beamex products.

The collaborative filtering has extensively been discussed as the means to predict user preference using the past data. An inductive approach through use of singular value

decomposition (SVD)-based matrix factorization was proposed by Ahmed and Letta (2023) in solving cold start problem in recommending books in a university library, where authors achieved an accuracy of 85% with a best RMSE of 0.1623. This paper has demonstrated the superior performance of the SVD when dealing with a sparse dataset which is one of the possibilities CalibrEx should consider due to the niche market of calibration tools. Just as CalibrEx, Mandalapu et al., (2024) put forward a Chimp-based Deep Neural Collaborative Filtering (CbDNCF) model as well, achieving an accuracy of 97.7 with an error rate of 0.02, proving the future use of neural techniques in large volumes of data, possibly increasing the scalability of CalibrEx.

Comparative studies of CF techniques show that the performance differs on the datasets. In it, a comparative analysis of SVD and K-nearest neighbor (KNN) was made, with SVD outperforming KNN at lower RMSE (0.1623 vs. 1.0535), which also demonstrates the significance of latent factor models to achieve accuracy. Mandalapu et al. (2024) combined deep neural networks with CF, which helped mitigate the drawbacks of the simpler models when applied to considerably large datasets and proposed that the hybrid framework might enhance the CalibrEx recommendation accuracy to meet the various requirements of users. Also, Afoudi et al. (2021) modified content-based filtering by coupling it with artificial neural networks, which means that the method proposed to is effective in reducing the drawbacks of CF, a strategy that may be applied to CalibrEx so that the latter takes into consideration product characteristics.

The use of recommender systems has been implemented in broad areas where they are partly applicable in the industrial setup. Identifying the challenges of student orientation in search of documents in large repositories (as cited in Ahmed and Letta, 2023), the authors

regarded the importance of technicians to choose the adequate calibration tools to face.

Mandalapu et al. (2024) had used a book dataset to test their model but in the methodology, using industrial products is possible and thus possible to implement CalibrEx. Cui et al. (2020) addressed the problem of CF in the context of Internet of Things (IoT), hypothesizing on making personalized recommendations that may be used to inform CalibrEx as it is connected to smart calibration devices.

The typical trouble is the cold start problem and data sparsity. The spreading issue of cold starts was also considered by Ahmed and Letta (2023) who proposed to resort to hyperparameter tuning, which can be replicated by CalibrEx in regards to newcomers. Mandalapu et al. (2024) focused on preprocessing in order to minimize the noise which may improve the quality of data in the context of CalibrEx product ratings. The further study implied by the authors (Ahmed and Letta, 2023) may involve incorporation of demographic information and implicit responses, which may further elaborate on the recommendations issued by CalibrEx based on the role of users (college students, engineers, managers, etc.) and their usage habits.

The existing literature emphasizes the effectiveness of CF and especially SVD and hybrid neural models in providing the individual recommendations. In case of CalibrEx, SVD accuracy adjustment, deep learning scalability, and cold start via data preprocessing and extra data sets could be used to streamline its platform. These facts, based on research published until June 2023, will be used as a base in order to create a robust recommendation system that suits the needs of Accuro Inc.

The findings of Ko et al. (2022) can be used to support this statement regarding collaborative filtering (CF) in e-commerce, furthering the fact that it was proven by the

item-based CF by Amazon, which is in line with the mission of CalibrEx, as it aims to provide more personalized Beamex products to industrial users and users. The explanations of CF issues presented in the paper are especially applicable to the niche calibration market that CalibrEx has to offer, where the user data can be scarce at first. To this end the solution proposed by Ko et al. in their discussion of hybrid systems by integrating CF and content based filtering is a possible approach CalibrEx can take to include metadata of new products (e.g. calibration specs) to new user or new product. What is more, the assessment indicators of the paper like Precision, Recall and AUC created a model to measure the accuracy of CalibrEx recommendations regarding user requirements in the calibration industry. Applying the experience of Ko et al. in understanding the use of e-commerce, CalibrEx will be able to increase the involvement of users and stimulate their sales of specialized equipment, as in the case with Amazon.

The study by Liu et al. (2022) serves as a strong foundation to improve the collaborative filtering (CF) system of CalibrEx to incorporate review feature learning with matrix factorization (MF) since the objectives of the project include the provision of personalized recommendations of Beamex products. Their solution involves the incorporation of onefold review processing and sparsity constraints to overcome data sparsity that is essential and encountered in the specialty market of calibration where interaction with the user is lesser. Testimonial texts (e.g. technician feedback on the performance of a calibrator) can be included to CalibrEx to implement refashioned user preferences to enhance accuracy of recommendation. The early stage of the proposed method that can run faster by 16.2% to 71.7%, compared to other models, such as DeepCoNN, explains the necessity of CalibrEx to have scalable and real-time suggestions on its mobile and web platforms. Moreover, the RMSE and MAE indicators used in the paper can be defined as a stable framework that allows assessing the quality of CalibrEx performance and

seek to make recommendations that can be addressed by industrial users. Based on the e-commerce applications of the study, CalibrEx has an opportunity to utilize the guidelines presented through reviews to minimize the churn and stimulate sales of specialized calibration equipment.

The multiple case study of cross-platform mobile app development in the four industrial software companies provided by Zohud and Zein (2021) will help in designing Flutter-based system CalibrEx to offer customized Beamex products. The paper points out the experience of developers, budget of the clients, and the needs of the app among the main aspects of preferring frameworks, such as React Native and Ionic, which confirms the decision of CalibrEx to use Flutter, as the team has the necessary knowledge in working with this tool. Hardware API access and not supporting the community libraries are the challenges found during the study, and both are applicable in CalibrEx, as integrating to calibration-specific hardware can require the use of native modules. Automation being costly implies that manual testing is likely to be done at CalibrEx in the future, with the integration tests adopted in Flutter as the number of tests increases. The fact that common codebases facilitated maintenance highlighted in the paper upholds the objective of CalibrEx to develop the updates efficiently across the web and the mobile system to deliver a positive user experience to minimize customer churn in their calibration industry.

Feyissa (2021) provides an in-depth insight into the challenges of calibration services pertaining to the national metrology institute of Ethiopia (NMIE), and its assistance in the CalibrEx CF-based platform used to suggest products related to Beamex. The mixed-methods study discloses that the calibration services provided by NMIE are helpful in industrial

performance (e.g., reduction of waste, quality enhancement, etc.), and the following impediments are identified: insufficient utilization of equipment (mean: 3.36), high failure rates (mean: 2.93), and insufficient personnel capacity (mean: 3.02). Poor stakeholder participation, especially in the consultation exercise, further compromises the delivery of services and this demand, which has seen an increased number of equipment (29,889 equipment in 2019/20), is exceeding capacity. Such findings confirm the strategy of CalibrEx to have a recommendation of Beamex reliable and easy-to-use equipment to solve problems of equipment and personnel, and CF strategy helps to increase stakeholder confidence in individual recommendations. CalibrEx also helps Beamex achieve its mission to decrease its customer churn and improve sales within the calibration sector through the mediation of the gap in demand experienced in NMIE.

The article is devoted to g:Profiler-powerful, easy-to-use web-based package of tools intended to perform functional enrichment analysis and gene identifier mapping, which has been widely used in biological and medical studies since 2007. It combines many databases, such as Gene Ontology (GO), KEGG, TRANSFAC, as explained by Kolberg et al. (2023) in Nucleic Acids Research to provide extensive results on a gene list and is compatible with 849 species, including the parasite and vertebrate families. The tool uses cumulative hypergeometric tests and multiple testing corrections ( g:SCS, Bonferroni, or Benjamini-Hochberg ) to reveal the enriched biological processes, pathways and molecular mechanisms and provides features such as the availability of custom statistical backgrounds, and sorted queries in the analysis. It is more inter-operable by use of g:Convert to map identifiers across Ensembl and g:Orth which maps orthologs across species. Of special note is the GMT Helper toolkit which allows users to create and validate custom Gene Matrix Transpose (GMT) files when novel organisms or alternative annotations, like EMBL-EBI QuickGO, are used. g:Profiler also introduces a two-stage

algorithm that filters the set of GO enrichments to show driver terms with an interactive graph view, which puts significant terms in perspective within the GO hierarchy. Being reproducible, gProfiler has all the database releases available since 2015, as well as programmable access with Python and R clients, which is beneficial to researchers.

Zhao (2021), in the research article published in E3S Web of Conferences, conducts a detailed analysis of the case of the Chinese variant of Tik Tok, the Douyin platform, giving an in-depth overview of the Douyin Mania phenomenon, stating that recommendation algorithms contribute to addictions of its users. Douyin, introduced by ByteDance in 2016, has more than 400 million daily active users in the Chinese market as of January 2020, mainly because its content distribution patterns rely on more advanced artificial intelligence capabilities. The paper theorizes how hierarchical interest label trees, user persona profiling, and collaborative filtering algorithms in Douyin present extremely personalization content to these users so that the effort to make users engage with contents is minimized. Such algorithms consider the taste of users as it identifies the content based on the personal tastes and actions of the user and uses cheap interaction patterns, like auto-playing videos, and swipe action, to retain the users. The study identifies the closed-loop interaction in which the more that the users engage the algorithm, the more accurate it will be, which can be treated as the expansion of addiction, commonly referred to as the Douyin Mania. Zhao also mentions presentation of partitioned data buckets and A/B testing to maximize content distribution and emotional appeal, as well as the fact that the platform is decentralized, making the process of content genesis democratic and raising user retention. Nevertheless, this customization gives way to the fear of overusing it, leading to the recommendation that developers should implement harsher anti-addiction policies, and users should become more media-literate in order to prevent over-using algorithmic suggestions.

Fayyaz et al. (2020) list all characteristics of recommendation systems (RSs) in the article written in the sphere of applied sciences, including algorithms, challenges, evaluation measures, and business purposes. To solve information overloading problem, RSs give personalized recommendations to users with respect to their likes and dislikes or preferences, and they employ such methods like collaborative filtering, content-based filtering, demographic-based, utility-based or knowledge-based recommendation techniques and the use of combinations of these methods known as hybrid filtering techniques. In collaborative filtering, the preferences of the users are rated and then able to identify similar users, however when dealing with content-based systems, features of the items and profiles of the user are utilized to make recommendations. Demographic RSs consider the user characteristics such as age and sex whereas utility systems emphasize on the product utility, and the knowledge based systems are based on explicit product-user knowledge. Hybrid systems are the combination of any of these approaches in order to reduce the shortcomings of the individual approaches with strategies such as weighted, switching or feature augmentation. The paper addresses such issues as cold-start problem, the lack of sufficient data about users or items when making recommendations, data sparseness when those ratings are limited, scalability problems when dealing with big data and diversity concerns that can constrain new suggestions. Precision, recall, accuracy, ROC curves, and F-measure are listed to evaluate an RS performance. The paper also points to the applications of RS in e-commerce (i.e. Amazon, Netflix), transportation (i.e. path and venue suggestions), healthcare (i.e. medical suggestions, diet regimens), agriculture (i.e. crop and fertilising suggestions), and media (i.e. cultural heritage, media contents). This book highlights the increased role of the RSs in various industries, requiring a strong algorithm to manage new

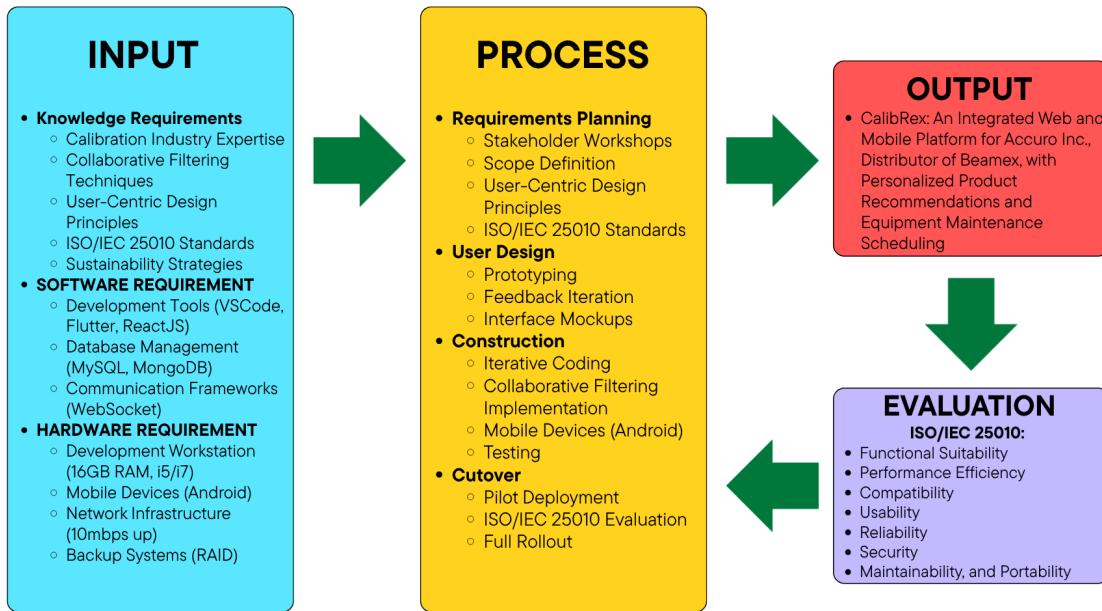
amounts of data and user requests, which means that it is a good source of information about RS dynamics and the influence of these systems in the real world.

## **Conceptual Framework**

The entire conceptual framework as shown in the picture answers the question as to how the customer outreach and the product personalization would be conflated with a digital platform of Accuro Inc. with a focus on the phases of Input, Process, Output and Impact. It started with the Input which consists of Customer Data, Beamex Product Information, Industry Requirements and Technological Resources that form the core components of the project.

The Process section includes Platform Development as the mechanism of operation. This will be done through Data Collection and Preprocessing, Algorithm Implementation, Testing and Evaluation, and Iteration and Refinement which will collaborate to support Platform Functionality, User Interaction as well as Personalized Recommendations. CalibrEx Platform, Enhanced Customer Engagement, Accurate Product Suggestions, and Industry Insights concepts developed during the Output stage are the direct product of this development period. These outcomes serve to achieve greater objectives of Better Customer Satisfaction and Increased Market Position.

Lastly, the Impact phase will include Global Customer Reach in which the scope of the platform will be brought to a wider international scope and would be advantageous to the activities of Accuro Inc. in advancing customer relations and shaping standards within the industry of calibration.

**Figure 1***Conceptual Framework of**or CalibrEx*

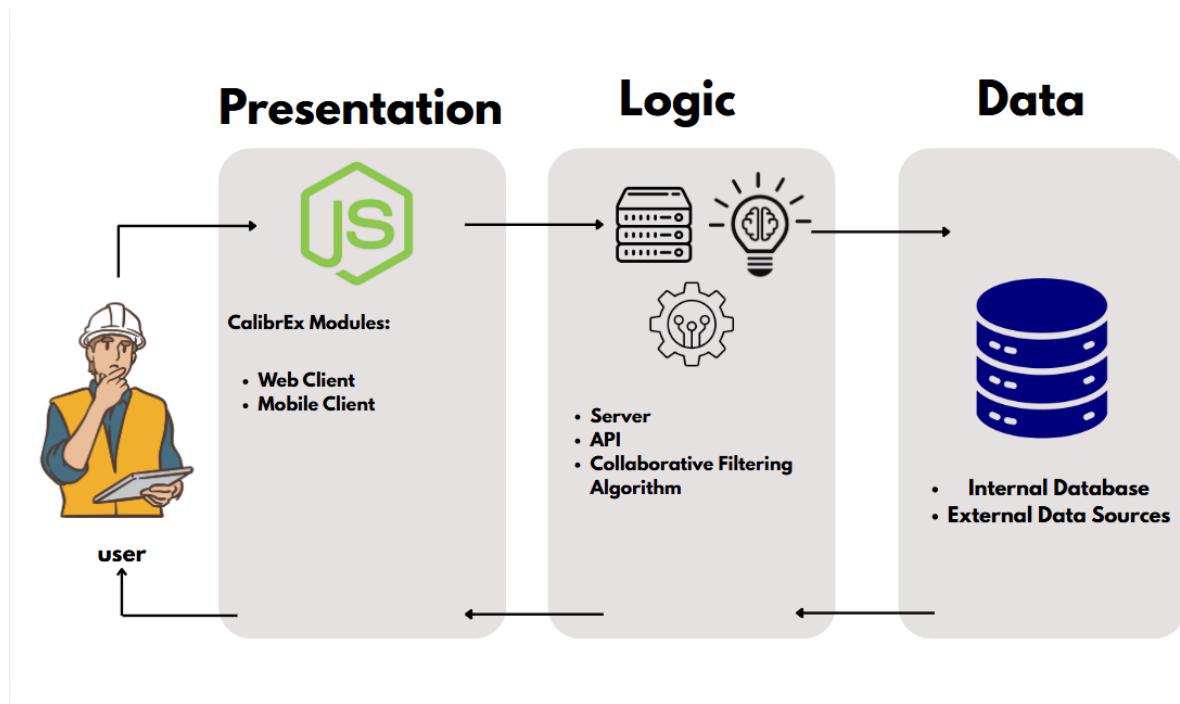
## System Architecture

The system architecture of CalibrEx intended to optimize customer reach, is developed under three tier-related structures such as: Presentation, Logic, and Data, providing its users with

an uninterrupted and productive use. As a top-down layer, the Presentation Tier serves as the interface to the customer, in which the feeds of the platform and their outputs are shown and interpreted to readable, handy forms to the customers, and in which it facilitates computer-assisted shares of data with the other layers. Some of the elements found in it include Web Client that is used in making browser-based inquiries and support tickets, and the Mobile Client that can be used to communicate and explore products using standard web browsers and in Android apps.

The Logic Tier runs on the server-side technologies such as Node.js and helps the platform sort out commands and sets them to action and make logical decisions. It has a Communication Processor that serves to handle ticket systems, a Recommendation Engine that allows optimizing customer relations and recommendations via the collaborative filtering algorithm, and an API Coordinator that will provide real-time data interchange among customers and servers, guaranteeing an effective customer activity and recommending changes.

Data Tier is linked to the practice of storing and retrieving data to the database and sending it to the Logic Tier to be processed in this case and sent back to the user, the Internal Database stores customer profiles, purchase history and data of Beamex products and the External Data Sources incorporate industry standards and market trends in a customer to make more accurate recommendations.

**Figure 2***System Architecture for CalibrEx***Definition of Terms:**

- **Accuro Inc.:** A distributor of Beamex calibration products, serving technicians, engineers, and industrial firms, facing challenges in providing efficient customer communication and product discovery.
- **Beamex Products:** High-quality calibration equipment distributed by Accuro Inc., including tools for measuring and adjusting industrial instruments, with diverse specifications tailored to customer needs.

- **CalibrEx:** A proposed web and mobile platform designed to facilitate direct customer contact with Accuro Inc. and provide personalized Beamex product recommendations using collaborative filtering.
- **Collaborative Filtering (CF):** A recommender system technique that analyzes user-item relationships (e.g., ratings, purchase histories) to predict and suggest products tailored to individual preferences, enhanced by methods like matrix factorization and deep neural networks.
- **Cold Start Problem:** A challenge in recommender systems where insufficient user data (e.g., for new users or items) hinders accurate recommendations, often addressed through techniques like hyperparameter tuning or additional data integration.
- **Customer Data:** Anonymized information, including interaction records, ratings, and purchase histories, collected from Accuro Inc.'s clients to support personalized recommendations.
- **Data Sparsity:** A common issue in recommender systems where user-item interaction data is incomplete or limited, impacting recommendation accuracy, often mitigated by techniques like matrix factorization or data preprocessing.
- **Deep Neural Collaborative Filtering (CbDNCF):** An advanced collaborative filtering approach combining deep neural networks with traditional CF methods to improve recommendation accuracy and scalability, particularly for large datasets.
- **Industry Requirements:** Standards and expectations within the calibration sector, influencing the design and functionality of CalibrEx to meet customer and regulatory needs.

- **Inquiry Forms:** Digital tools within CalibrEx allowing customers to submit questions or requests to Accuro Inc., enhancing communication efficiency.
- **K-Nearest Neighbor (KNN):** A collaborative filtering technique that identifies similar users or items based on proximity in a data space, often compared to matrix factorization methods like SVD for performance.
- **Latent Factor Models:** Recommender system models that uncover hidden patterns in user-item interactions, such as through singular value decomposition (SVD), to improve prediction accuracy.
- **Matrix Factorization:** A collaborative filtering technique that decomposes user-item interaction matrices into lower-dimensional representations, often using singular value decomposition (SVD), to predict preferences.
- **Personalized Recommendations:** Tailored Beamex product suggestions generated by CalibrEx's collaborative filtering algorithm, based on user preferences and product specifications.
- **Singular Value Decomposition (SVD):** A matrix factorization method used in collaborative filtering to reduce data dimensionality and improve recommendation accuracy, particularly effective for sparse datasets.
- **Support Tickets:** Structured requests or issues submitted by customers through CalibrEx, tracked for resolution to ensure timely support.
- **Technological Resources:** Tools and frameworks (e.g., Flutter, React) used to develop and deploy the CalibrEx web and mobile platform.

- **Technicians, Engineers, and Industrial Firms:** The primary target audience of CalibrEx, including Beamex customers in the Philippines and potentially international calibration experts.
- **Technical Hub:** A section of CalibrEx providing product guides, tutorials, and educational content about Beamex calibration equipment to support informed decision-making.

## Chapter 3

### Research Methodology

The researchers used an Agile strategy to develop CalibrEx: A Web and Mobile Platform for Accuro Inc., where the development part is based on iterative design, development, and evaluation in order to develop a good and user-friendly platform. The process focuses on iterative loops of small sprints and focuses on creation of communication tools and recommendation functionality, using the answers of Accuro Inc. employees, Beamex customers, and listens to both industry specialists so that it can meet the requirements of both the calibration industries and customers. With this style, the team will improve the platform on a step-by-step basis and provide a feasible solution that will maximize customer interaction and aid in personalized product recommendations of Beamex products.

### Project Design

CalibrEx is an e-commerce web and mobile app targeted at an end customer, meant to simplify both communication and product finding for Accuro, Inc., selling Beamex calibration products. The software is going to be developed with the React technology on the web side and Flutter on the mobile app, and the backend will be built on the Node.js framework and will be hosted at the cloud data center. There shall also be incorporated collaborative filtering algorithms based on matrix factorization and deep neural methods, which will deliver dynamic and personalized product recommendations of Beamex based on user rating and purchases. This aspect enables the customers to browse through a Technical Hub with guides of the products and tutorials, create inquiries or support tickets and interact where a customer is easily integrated

with the platform. The use of Figma will be employed to develop visuals that are related to the theme of calibration (e.g. device dashboards), which will increase the practicality of the platform and stimulate the confidence in the calibration sphere.

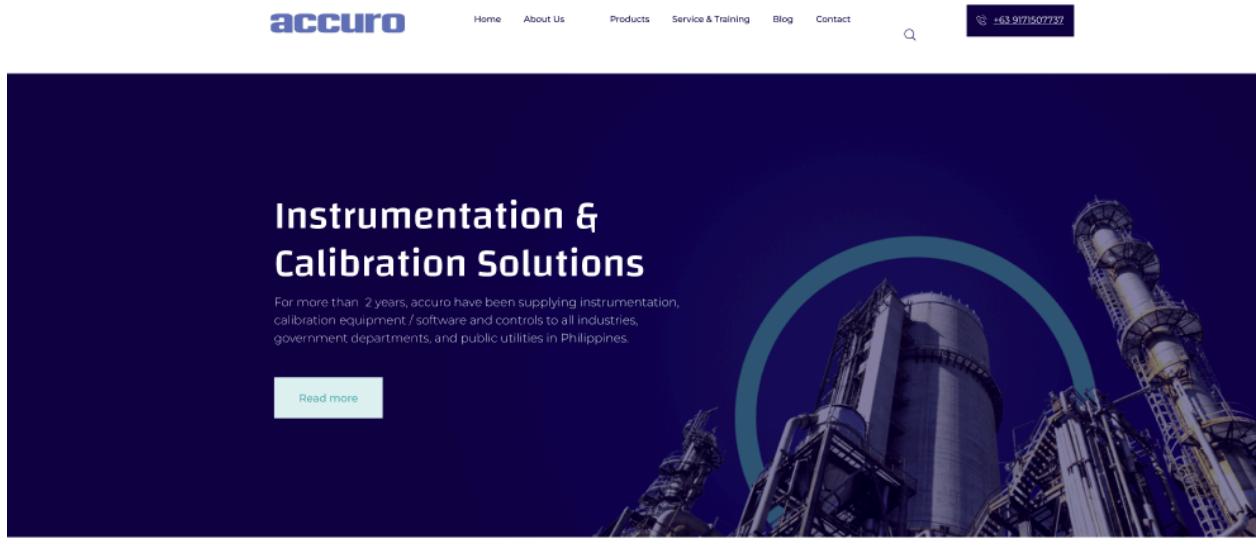
## **Design Discussion**

The design process of CalibrEx lays great emphasis on the development of functional, user-friendly, and scalable platforms capable of dealing with the issues of Accuro Inc. client communication and product discovery. The idea was to create a web/ mobile interface that is both self explanatory and easy to interact with and at the same time include the collaborative filtering algorithm to direct the recommendations of the Beamex products to the individual. The main factors were making the system highly responsive, securing customer profile data and fine-tuning the system to the niche of the calibration industry. The application is implemented on current frameworks, such as React and Node.js, to achieve the optimal balance between programming efficiency and performance levels, whereas the user interface features fantasy calibration-inspired elements (i.e., instrument dashboards) to improve trust and intuitiveness.

## Design Trade-Offs

**Figure 3**

*Design 1*



## Who we are at accuro

The company, originally established in 2023, has its head office in Unit 3C, 58A Scout Chuitoco corner Champaca Streets, Roxas District, Quezon City, 1103, Metro Manila, Philippines

- ✓ More than 2 years of combined technical knowledge.
- ✓ Represented Suppliers for over 35 years.
- ✓ Cost effective and professional service.
- ✓ We tailor solutions to your requirements.

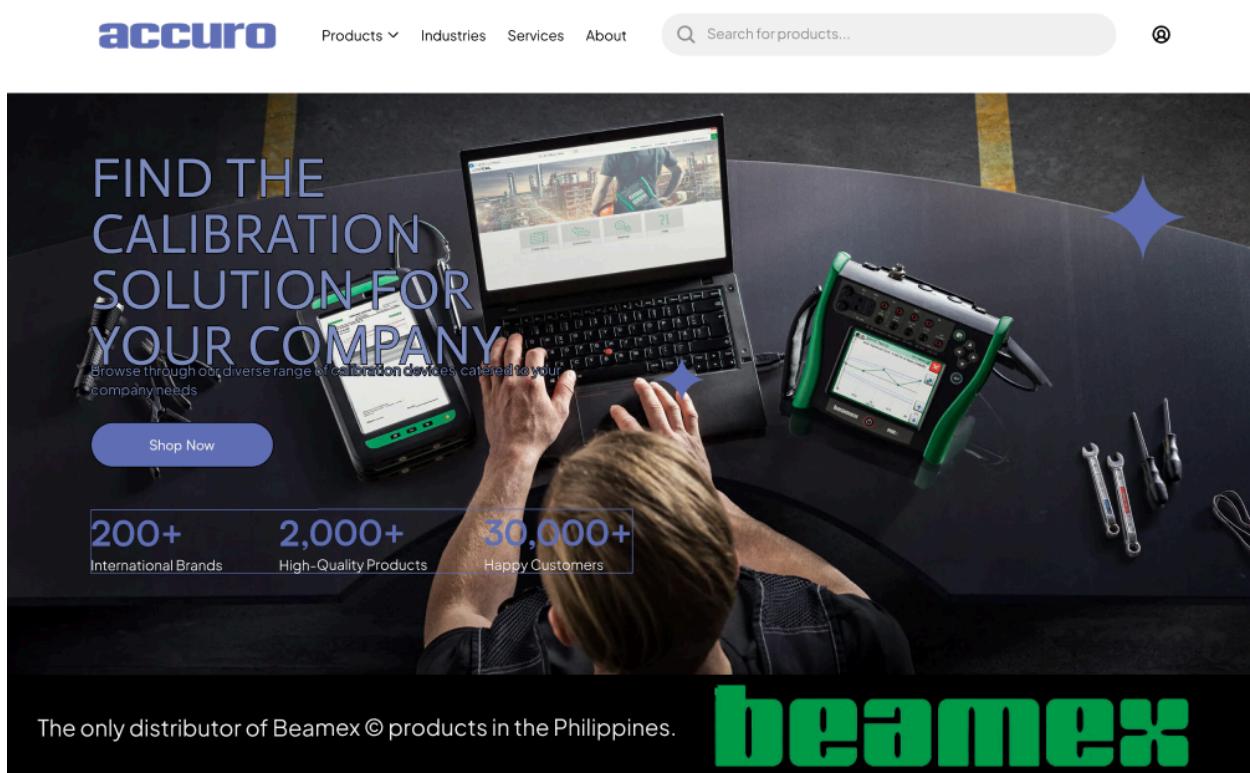
[Read more](#)

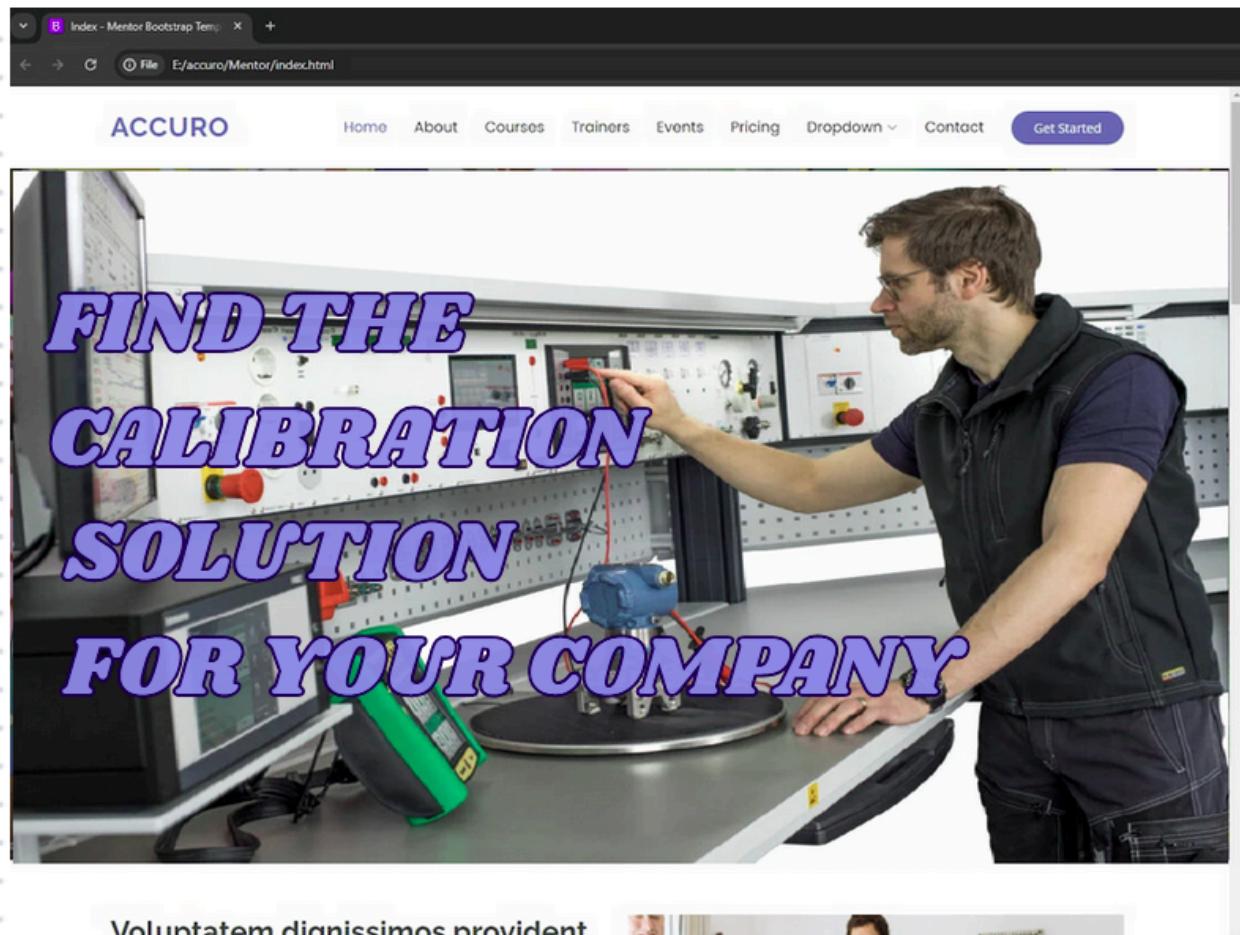


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Our Mission Statement:  
AMS will be the trusted  
partner by providing  
Unique Expertise in  
offering Engineering



**Figure 4***Design 2*

**Figure 5***Design 3*

**Table 1:***Frontend Framework Comparison*

<b>Criteria</b>	<b>React/Flutter (Chosen)</b>	<b>Angular</b>	<b>Vue.js</b>
<b>Development Speed</b>	Fast, reusable components	Moderate, steeper learning curve	Fast, lightweight
<b>UI Consistency</b>	High across web/mobile	Consistent, but verbose	High, but less mobile support
<b>Performance</b>	Near-native for mobile	Slightly slower due to size	Lightweight, fast
<b>Community &amp; Support</b>	Large, mature ecosystem	Strong, enterprise-focused	Growing, less mature
<b>Learning Curve</b>	Moderate	High	Low

The reasons to use React/Flutter were flexibility, the large ecosystem and consistency of UI across websites and mobile applications. Angular was also too verbose, and Vue had a poorer mobile support making it less viable to the cross-platform requirements of CalibrEx.

**Table 2:***Backend Framework Comparison*

<b>Criteria</b>	<b>Node.js (Chosen)</b>	<b>Django</b>	<b>Spring Boot</b>
<b>Real-time Updates</b>	Built-in via WebSockets	Limited, requires add-ons	Possible, complex setup
<b>Data Model</b>	Flexible (NoSQL/Relational)	ORM-based, relational	Relational, verbose
<b>Authentication</b>	Built-in libraries	Built-in, robust	Built-in, complex
<b>Complex Queries</b>	Flexible with MongoDB/PostgreSQL	Strong SQL support	Strong, but verbose

<b>Hosting &amp; Setup</b>	Easy, cloud-friendly	Moderate setup	Complex, server-heavy
----------------------------	----------------------	----------------	--------------------------

Node.js was chosen because it is real-time (needed on notifications), flexibly approachable to data models, and clouds can be deployed with little effort. Although robust, Django and Spring Boot are more complicated to set up and less optimized towards the real time features.

**Table 3:**

*Database Service Comparison*

Criteria	<b>MongoDB (Chosen)</b>	<b>PostgreSQL</b>	<b>Firebase</b>
<b>Real-time Updates</b>	Supported via change streams	Limited, requires extensions	Built-in, NoSQL-focused
<b>Data Model</b>	NoSQL, flexible schema	Relational, structured	NoSQL, document-based
<b>Scalability</b>	High, horizontal scaling	High, vertical scaling	High, fully managed

<b>Query</b>	Moderate, JSON-based	High, SQL-based	Limited, NoSQL
<b>Flexibility</b>			

<b>Cost</b>	Pay-as-you-go (cloud)	Higher for large datasets	Pay-as-you-go, restrictive
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MongoDB has been selected due to flexibility of schema, possibility of working with real-time updates and scalability, which coincides with the requirements of CalibrEx to work with various customer and product information. The relational model of PostgreSQL is complicated, and the type of query is changed by NoSQL limitations of Firebase.

**Table 4:**

*Recommendation Algorithm Comparison*

Criteria	Collaborative Filtering (Chosen)	Content-Based Filtering	Hybrid Filtering	Matrix Factorization	Knowledge-Based
<b>Data Dependency</b>	User-item interactions	Item metadata	Both	Large user-item matrix	Predefined rules

<b>Personalization</b>	High, user similarity-focused	Item-focused	Strong	Latent factors	Rule-dependent
<b>Cold Start</b>	Challenging for new users	Handles new items	Moderate	Logic-based	Handles both
<b>Accuracy</b>	High with sufficient data	Moderate	High	High, rating-focused	Rule-dependent
<b>Diversity</b>	Moderate, user-driven	Filter bubble risk	Better diversity	Moderate	Limited
<b>Suitability</b>	Ideal for Beamex product ratings	Suited for specs-focused	Comprehensive	Rating prediction	Niche rules

<b>Ease of Implementation</b>	Moderate (SVD, neural models)	Easy (TF-IDF, cosine)	Complex	Tools available	Hard, rule-based
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The collaborative filtering was selected due to its potential to use user feedback and buying records to provide customized Beamex products, which was consistent with CalibrEx objectives. Content-based filtering is impractical with regard to user interaction, hybrid models are simply too complicated on the time scale, matrix factorization is heavily rating-based, and knowledge-based filters are just too constrained in its recommendations.

## Design Prototype

**Figure 6**

*Landing Page Module*

**accuro**

Home About Us Products Service & Training Blog Contact

Instrumentation & Calibration Solutions

For more than 2 years, accuro have been supplying instrumentation, calibration equipment / software and controls to all industries, government departments, and public utilities in Philippines.

Read more

**Who we are at accuro**

The company, originally established in 2023, has its head office in Unit 3C, 56A Scout Churruco corner Champaca Streets, Roxas District, Quezon City, 1103, Metro Manila, Philippines.

- More than 2 years of combined technical knowledge.
- Represented Suppliers for over 35 years.
- Cost effective and professional service.
- We tailor solutions to your requirements.

Read more

**Figure 7***About Us Module for Web*
**Figure 8***Products Module for Web*

**Figure 9***Service and Training Module for Web*

**Calibration Service and Training**

When process control instrumentation and measurement equipment go offline, everything goes offline. At AMS Instrumentation & Calibration, we offer calibration services and repairs to resolve any problems that arise and keep your organisation up and running.

We perform these in our Melbourne Head Office facilities and on-site.

**Instrument Calibration Services**

Instrument calibration is the cornerstone of precision measurement. Our dedicated team excels in calibrating a wide array of equipment, including but not limited to:

- Pressure and Temperature Calibrators
- Liquid and Gas Flowmeters
- Analytical Instrumentation
- Analogue and Digital Meters
- Pressure Gauges
- Electronic Controllers and Indicators
- Fire Hydrant Flow Meter Calibrations
- Ultrasonic Flow Meter Calibrations

**Figure 10***Contact Us Module for Web*

**Get in touch with accuro**

Please contact us via phone, email or in person, or complete your details in the form on the right and we will be in touch very soon.

↓ Find nearest location

**Find your nearest accuro location**

**Quezon City - Head Office**

- Phone: +63 91707 8205
- Email: [ardeev@beamex.com.au](mailto:ardeev@beamex.com.au)
- Address: Quezon City 103, Metro Manila, Philippines

**Lane Cove, NSW**

- Phone: +61 8777 2625
- Email: [steve@beamex.com.au](mailto:steve@beamex.com.au)
- Address: Suite 108, 102 Longueville Rd,

**Figure 11***Login and Sign Up Module for Mobile App*

The Only Distributor of **beamex** in the Philippines

First Name  
Enter first Name

Last Name  
Enter last Name

Contact Number  
Enter contact Number

Email  
Enter email

Company Name  
Enter company Name

Company Address  
Enter company Address

Password  
Enter password

Confirm Password  
Enter confirm Password

**Create Account**

Already have an account? [Log in](#)

The Only Distributor of **beamex** in the Philippines

Email  
Enter email

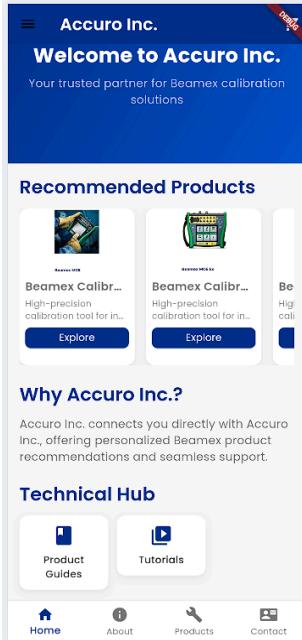
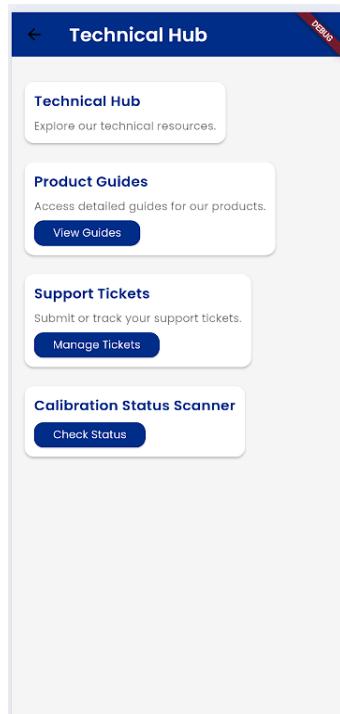
Company Name  
Enter company Name

Password  
Enter password

**Log In**

[Don't have an account? Sign up?](#)

[Forgot your password?](#)

**Figure 12***Landing Page for Mobile App***Figure 13***Service and Training Module for Mobile App*

**Figure 14**

*Contact Us Module for Mobile App*

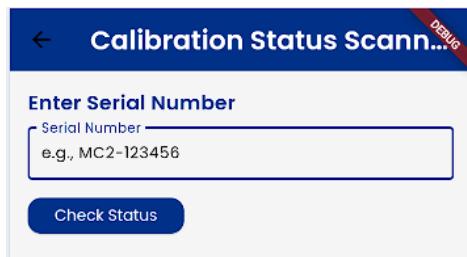
The figure displays two screenshots of a mobile application's "Contact Us" module.

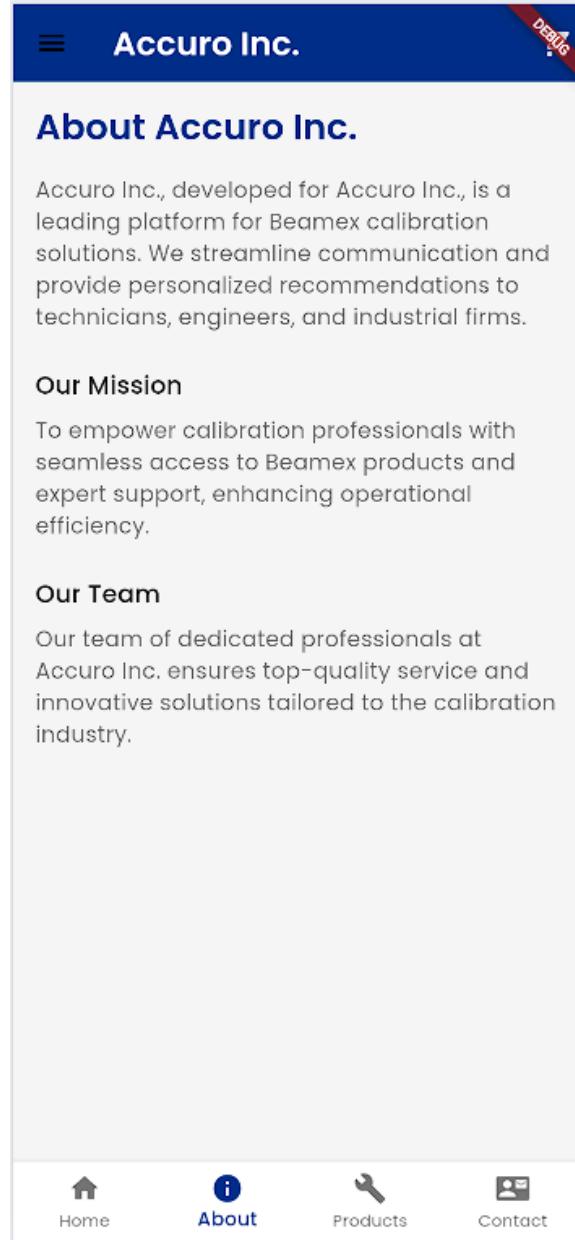
**Left Screen: Calibration Status Scan**

- Header:** Calibration Status Scann... (with a DEBUG badge)
- Form:** Enter Serial Number  
Serial Number: MC-123456
- Button:** Check Status
- Section:** Service History  
Service History:  
- 2025-06-01: Calibration completed  
- 2024-12-15: Initial setup  
- 2024-06-10: Factory calibration
- Section:** Calibration Status  
Status:  
- Last Calibration: 2025-06-01  
- Next Due: 2026-06-01  
- Condition: Fully Operational
- Section:** Warranty Information  
Warranty:  
- Expires: 2026-06-01  
- Terms: 2-year limited warranty  
- Coverage: Parts and labor

**Right Screen: Accuro Inc.**

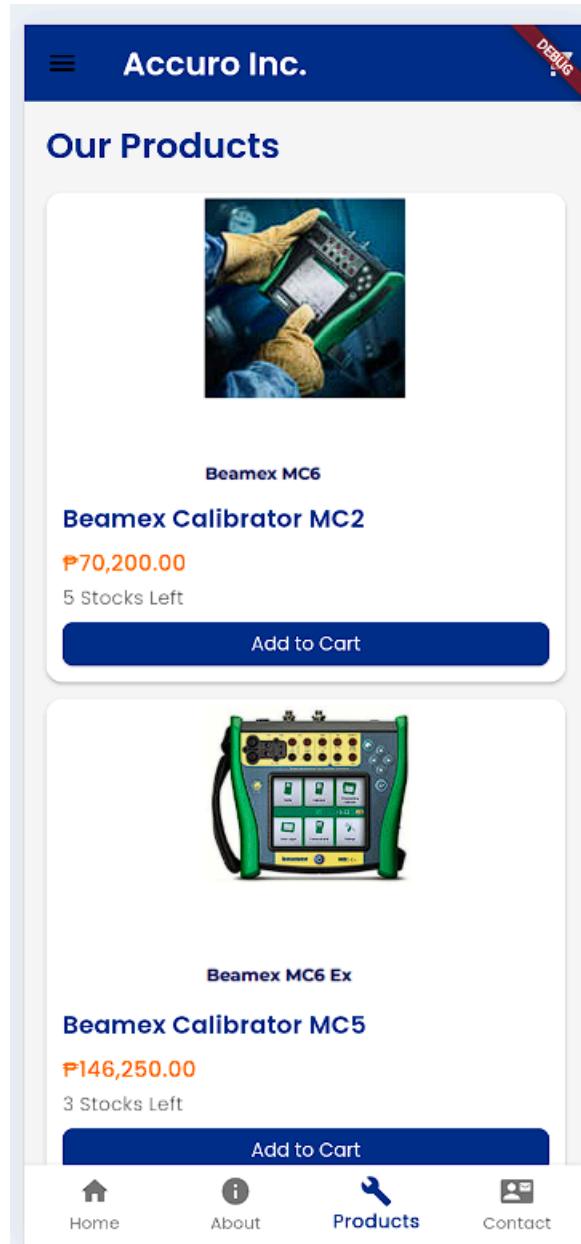
- Header:** Accuro Inc. (with a DEBUG badge)
- Text:** Reach out to Accuro Inc. for support or inquiries:
- Address:** 123 Calibration Ave, Manila, Philippines
- Phone:** (+63) 123-456-7890
- Email:** support@accuro.com
- Section:** Inquiry Form (with five input fields for Name, Email, Company Name, Phone Number, and Message)
- Button:** Submit Inquiry
- Bottom Navigation:** Home, About, Products, Contact

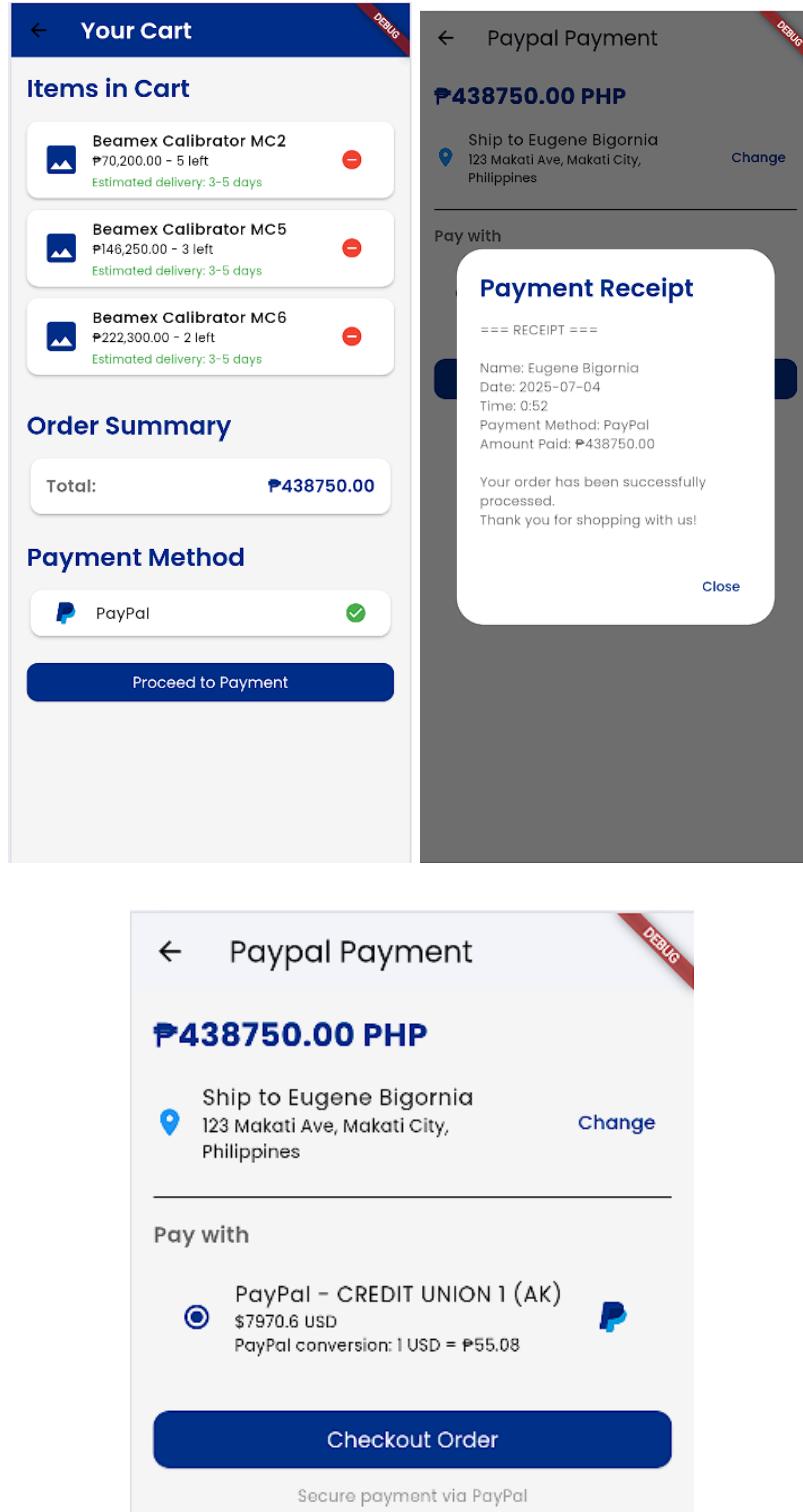


**Figure 15***About Us Page for Mobile App*

**Figure 16**

*Products Module for Mobile App*



**Figure 17***Cart and Checkout Module for Mobile App*

**Figure 19***Admin Module for Web*

The screenshot shows the Accuro Admin Dashboard with the following sections:

- Left Sidebar:** Admin\_dashboard, accuro logo, navigation menu with links: Dashboard, Purchase Orders, Inventory, Analytics, Maintenance, Warranty, Audit Trail, Technical Hub.
- Header:** Dashboard, Orders, Inventory, Analytics, Technical Hub, Notifications, User icon.
- Dashboard Section:**
  - Recent Orders:** Total Orders: 156 (+12% from last month). Order details:
    - PO-4532: TechCal Solutions, 2023-06-15, \$4,320.00, Processing
    - PO-4531: Industrial Metrics, 2023-06-14, \$1,250.00, Shipped
    - PO-4530: PrecisionTech, 2023-06-12, \$3,750.00, Delivered
    - PO-4529: CalibrationPro, 2023-06-10, \$2,800.00, Pending
  - Low Stock Alerts:** 4 items low on stock (Beamex MC6 Calibrator, Beamex PG Pressure Generator, Beamex CMX Professional). Beamex MC6 Calibrator: Current Stock 2, Threshold 5, Status Critical.
- Quick Actions:**
  - Create Purchase Order: Add a new order for Beamex products
  - Update Inventory: Adjust stock levels and thresholds
  - Schedule Maintenance: Plan maintenance for equipment
  - View Analytics: Check performance metrics and forecasts
  - Submit Warranty Claim: Process warranty claims for customers
  - Access Technical Hub: View guides and documentation
- Footer:** © 2023 Accuro Inc. All rights reserved. Authorized distributor of Beamex calibration products. Privacy Policy, Terms of Service, Contact Us.

Purchase Orders

**accuro**

Dashboard Orders Inventory Analytics Technical Hub

+ New Order

**Purchase Orders**

Manage and track all purchase orders for Beamex products

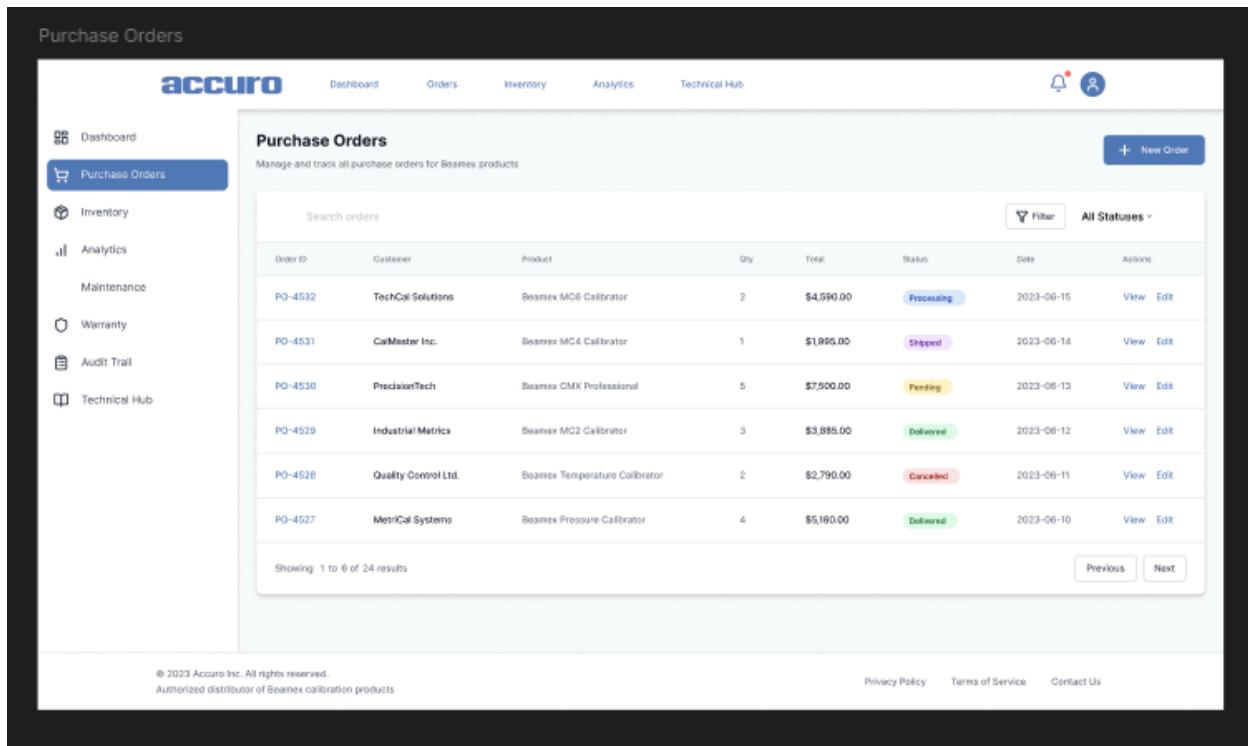
Search orders Filter All Statuses

Order ID	Customer	Product	Qty	Total	Status	Date	Actions
PO-4532	TechCal Solutions	Beamex MC6 Calibrator	2	\$4,590.00	Processing	2023-06-15	<a href="#">View</a> <a href="#">Edit</a>
PO-4531	CalMaster Inc.	Beamex MC4 Calibrator	1	\$1,995.00	Shipped	2023-06-14	<a href="#">View</a> <a href="#">Edit</a>
PO-4530	PrecisionTech	Beamex CMK Professional	5	\$7,500.00	Pending	2023-06-13	<a href="#">View</a> <a href="#">Edit</a>
PO-4529	Industrial Metrics	Beamex MC2 Calibrator	3	\$3,885.00	Delivered	2023-06-12	<a href="#">View</a> <a href="#">Edit</a>
PO-4528	Quality Control Ltd.	Beamex Temperature Calibrator	2	\$2,790.00	Canceled	2023-06-11	<a href="#">View</a> <a href="#">Edit</a>
PO-4527	MetricCal Systems	Beamex Pressure Calibrator	4	\$6,180.00	Delivered	2023-06-10	<a href="#">View</a> <a href="#">Edit</a>

Showing 1 to 6 of 24 results Previous Next

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Inventory

**accuro**

Dashboard Orders Inventory Analytics Technical Hub

Update Inventory

**Inventory Management**  
Monitor and manage Beamex product inventory and stock levels

Total Products 6 Low Stock Items 2 Out of Stock 1

Search products Filter All Categories

Product	Product ID	Product Name	Category	Current Stock	Threshold	Status	Movement	Actions
BX-MC6-01	Beamex MC6 Calibrator	Calibrators	2	5	Low Stock	Fast	Edit Reorder	
BX-MC4-01	Beamex MC4 Calibrator	Calibrators	8	5	In Stock	Medium	Edit Reorder	
BX-CMX-01	Beamex CMX Professional	Software	4	10	Low Stock	Fast	Edit Reorder	
BX-MC2-01	Beamex MC2 Calibrator	Calibrators	0	3	Out of Stock	Medium	Edit Reorder	
BX-TC-01	Beamex Temperature Calibrator	Calibrators	6	5	In Stock	Slow	Edit Reorder	
BX-PC-01	Beamex Pressure Calibrator	Calibrators	12	5	In Stock	Slow	Edit Reorder	

Showing 1 to 6 of 6 results Previous Next

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The screenshot displays the Accuro Inventory Management interface. On the left, a sidebar lists navigation options: Dashboard, Purchase Orders, Inventory (which is selected and highlighted in blue), Analytics, Maintenance, Warranty, Audit Trail, and Technical Hub. The main content area is titled 'Inventory Management' with the subtitle 'Monitor and manage Beamex product inventory and stock levels'. It features three summary boxes: 'Total Products' (6), 'Low Stock Items' (2), and 'Out of Stock' (1). Below this is a search bar and a filter section. The central part of the screen is a table listing six products: Beamex MC6 Calibrator, Beamex MC4 Calibrator, Beamex CMX Professional, Beamex MC2 Calibrator, Beamex Temperature Calibrator, and Beamex Pressure Calibrator. Each row includes columns for Product, Product ID, Product Name, Category, Current Stock, Threshold, Status (color-coded from green to red), Movement (Fast, Medium, or Slow), and Actions (Edit and Reorder buttons). At the bottom, a footer notes copyright information and links to Privacy Policy, Terms of Service, and Contact Us.

**Analytics**

**accuro**

Dashboard Orders Inventory Analytics Technical Hub

Last 30 days

**Analytics Dashboard**  
Track sales, inventory movement, and forecast demand

Total Sales: **\$24,560** +12% from previous period

Total Orders: **156** +8% from previous period

Average Order Value: **\$1,575** +6% from previous period

Stock Turnover Rate: **3.2x** +2% from previous period

**Sales Trend**

Month	Sales (\$)	Orders
Jan	3500	45
Feb	3000	35
Mar	4800	55
Apr	2800	30
May	2000	25
Jun	2500	28
Jul	3200	42

**Demand Forecast**

Month	Actual Sales	Forecast
Jan	4000	4000
Feb	3000	3000
Mar	5000	5000
Apr	2500	2500
May	1500	1500
Jun	2000	2000
Jul	3000	3000
Aug	3500	3500
Sep	4000	4000
Oct	4500	4500
Nov	5000	5000
Dec	5500	5500

**Product Movement Analysis**

Movement Type	Percentage
Fast Moving	35%
Medium Moving	45%
Slow Moving	20%

**Category Distribution**

Category	Percentage
Calibrators	65%
Software	25%
Accessories	10%

**Top Selling Products**

Product	Category	Units Sold	Revenue	Growth
Beamex MC6 Calibrator	Calibrators	24	\$35,000	+15%
Beamex CMX Professional	Software	18	\$27,000	+12%
Beamex MC4 Calibrator	Calibrators	15	\$20,000	+5%
Beamex Temperature Calibrator	Calibrators	12	\$18,740	-2%
Beamex Pressure Calibrator	Calibrators	10	\$12,950	+8%

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**Maintenance**

**Maintenance Tracker**  
Schedule and manage maintenance for Beamex calibration equipment

Scheduled	In Progress	Completed	Overdue
2	1	1	1

**Maintenance Tasks**

Task ID	Equipment	Serial Number	Task Type	Status	Due Date	Assigned To	Actions
MT-1001	Beamex MC6 Calibrator	BX-MC6-10045	Calibration	Scheduled	2023-07-15	John Smith	<a href="#">View</a> <a href="#">Update</a>
MT-1002	Beamex Temperature Calibrator	BX-TC-20078	Firmware Update	In Progress	2023-07-10	Maria Garcia	<a href="#">View</a> <a href="#">Update</a>
MT-1003	Beamex MC4 Calibrator	BX-MC4-30056	Inspection	Completed	2023-06-30	David Chen	<a href="#">View</a> <a href="#">Update</a>
MT-1004	Beamex Pressure Calibrator	BX-PC-40023	Repair	Overdue	2023-08-25	Sarah Johnson	<a href="#">View</a> <a href="#">Update</a>
MT-1005	Beamex CMX Workstation	BX-CMX-50012	Software Update	Scheduled	2023-07-20	James Wilson	<a href="#">View</a> <a href="#">Update</a>

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**Warranty**

**Warranty Management**  
Track and process warranty claims for Beamex products

Active Warranties	Pending Claims	Approved Claims	Rejected Claims	Expired Warranties
1	1	1	1	1

**Warranty Claims**

Claim ID	Product	Serial Number	Customer	Purchase Date	Expiry Date	Status	Actions
WC-2001	Beamex MC6 Calibrator	BX-MC6-10045	TechCal Solutions	2022-06-15	2024-06-15	Active	<a href="#">View</a>
WC-2002	Beamex Temperature Calibrator	BX-TC-20078	CalMaster Inc.	2021-03-10	2023-03-10	Expired	<a href="#">View</a>
WC-2003	Beamex MC4 Calibrator	BX-MC4-30056	PrecisionTech	2022-08-30	2024-09-30	Pending Claim	<a href="#">View</a> <a href="#">Approve</a> <a href="#">Reject</a>
WC-2004	Beamex Pressure Calibrator	BX-PC-40023	Industrial Metrics	2022-02-25	2024-02-25	Approved	<a href="#">View</a>
WC-2005	Beamex CMX Professional	BX-CMX-50012	Quality Control Ltd.	2022-11-20	2024-11-20	Rejected	<a href="#">View</a>

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**Technical Hub**

**accuro**

Dashboard Orders Inventory Analytics Technical Hub

Dashboard Purchase Orders Inventory Analytics Maintenance Warranty Audit Trail **Technical Hub**

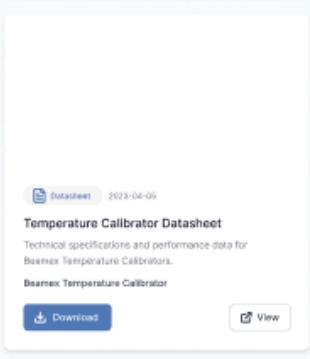
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 **Beamex MC6 User Manual** 2023-01-15  
Comprehensive user manual for the Beamex MC6 Advanced Field Calibrator and Communicator.  
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 **Calibration Best Practices Guide** 2023-02-20  
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Comprehensive guide to pressure calibration techniques and procedures.  
Beamex Pressure Calibrator  
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**Petrotech Industries**  
We're experiencing calibration drift with our Beamex M  
2023-06-28 Pending

**Sarah Williams**  
BioLab Research  
The CMX software we purchased last month keeps cra  
2023-07-02 High

**David Chen**  
Precision Instruments  
We recently received our order of temperature calibrat  
2023-07-05 Resolved

**Emily Rodriguez**  
Global Energy Corp  
We need training for our new technicians on the Beam  
2023-07-08 Low

**Robert Kim**  
Pharma Solutions  
We're considering upgrading our calibration manageme  
2023-07-10 Medium

**FB-1001 : Michael Johnson**  
Petrotech Industries • michael.johnson@petrotech.com Pending In Progress Resolved

Original Concern:  
We're experiencing calibration drift with our Beamex MC6 after only 3 months of use. This is causing issues with our compliance documentation. Can you advise on potential causes and solutions?  
Submitted on 2023-06-28

Type your reply here... Send Reply

## Project Development

CalibrEx implementation follows Agile Rapid Application Development (RAD) and adopts a rapid prototyping and recurrent feedback approach with brief development cycles to provide user-friendly web and mobile solutions to Accuro Inc. This is applicable in case of swift adaptation to stakeholder needs since it is necessary to respond to the needs of the calibration industry that treats communications as seamless and recommends personalized products. RAD process is organised into four phases as described below:

### Requirements Planning Phase

The team, in the first approach, worked on the definition of the main needs that CalibrEx should have so that it can ensure effective interaction with the customers and product discovery

to Accuro Inc., a distributor of the Beamex calibration products. To determine important features, stakeholder interviews and surveys with Beamex customers (technicians, engineers, and industrial companies), employees of Accuro Inc., and industry specialists were carried out. These were inquiry forms, support tickets, a recommendation system based on collaborative filtering and a Technical Hub providing product guides and tutorials. It was decided not to include the enhanced features such as video conferencing or social media, to concentrate on the core communication and recommendation-type features. Its technology stack was chosen prematurely, with React/Flutter as the frontend, Node.js as the backend, MongoDB database and collaborative filtering algorithms (suggested by SVD/deep neural methods) to make the recommendations.

## User Design Phase

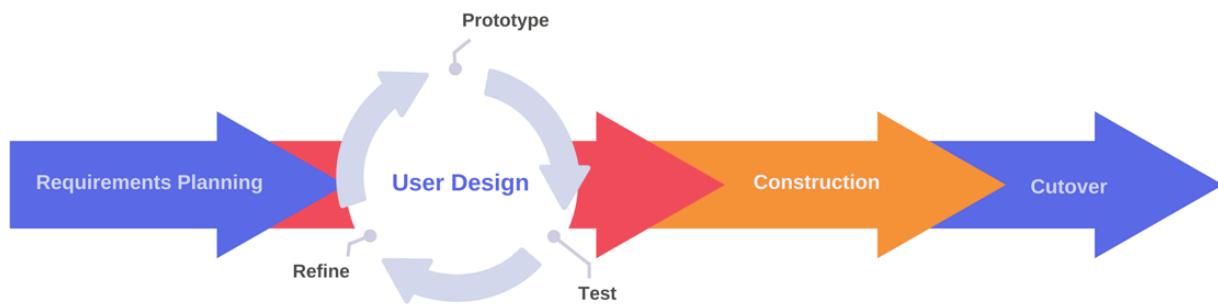
Several prototypes were built on Figma to present customers and Accuro Inc. administrators user interface. Designs developed with customers in mind focused on the ease of browsing Beamex products, making inquiries, obtaining the information available in the Technical Hub, and personalized recommendations. Support Tickets, query tracking, and product data update were the priorities of the administrator interfaces. It underwent an iterative process where user testing sessions with the customers of the Beamex Company and employees at Accuro Inc. have resulted in several refinements (e.g., simplification of the workflow of the inquiry form, increased visibility of recommendations, and the use of calibration-oriented visuals (e.g., dashboards) as a trust-building measure). The design process focused on usability and aesthetics of the industry so that it fits the professional standards of the calibration industry.

## **Construction Phase**

The platform is built on React (Observable web client) and Flutter (Remote mobile application) with Node.js as the serving logic and MongoDB as the information storage with API. The important features added were the real-time communication tools (support tickets), the recommendation engine based on collaborative filtering (using available user ratings and purchase histories) and the Technical Hub containing educational information. Frequent sprint test with stakeholders brought it back to the line of consistency with requirements so that quick corrections could be made. The real-time notifications API and customer authentication API integrations went smoothly and the user authentication was also able to be secure, with the admin interface only available to allow workers to provide customer interactions and manipulation of product information.

## **Cutover Phase**

Beta testing was done among a small number of Beamex customers units in the Greater Manila Area and Accuro Inc. employees. Feedback was returned to address smaller problems, e.g., time lags in providing clearing up on the recommendations, which were eliminated by the time of full deployment. The team gave training classes to the staff of Accuro Inc. and created both customer and administrator user manuals. CalibrEx was done with a follow up of maintenance, updates and conformance to the industry standards. The platform will allow later additions later, e.g. scalability of the platform to have international customers or an interface to other calibration devices.

**Figure 20***Rapid Application Development (RAD) Model***Work Plan**

The Work Plan for "**CalibrEx: A Web and Mobile Platform for Accuro Inc., Distributor of Beamex, Utilizing Collaborative Filtering for Personalized Product Recommendations**" outlines the development timeline from June 2025 to April 2026, divided into four phases:

**Table 5***Work plan*

Phase	Activities	Member	Schedule (2025 - 2026)											
			Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	
Requirements Planning Phase	Topic Proposal	Team	Done											
	Adviser Approval	Team	Done											
	Draft project requirements	Team	On-going											
	Finalize project requirements	Team	On-going											
User Design Phase	Build System Architecture	Team		On-going										
	Algorithms and Tools Used	Team		On-going										
	Prototype Design with Figma	Team		On-going										
Construction Phase	Develop Web and Mobile App	Team			On-going		On-going							
	Alpha and Beta Testing	Team			On-going		On-going							
Cutover Phase	Implementation	Team								On-going		On-going		
	Documentation completion	Team								On-going		On-going		
Legend:														
Done														
On-going														
To-do														

## Potential for commercialization

CalibrEx has significant potential for commercialization by addressing the need for efficient communication and personalized product discovery in the industrial calibration sector. While primarily designed to enhance Accuro Inc.'s customer engagement, the platform can adopt a sustainable cost recovery model. Possible ways to commercialize it include:

- **Engagement with Industry Associations:** Working with calibration industry groups to promote CalibrEx at trade shows or workshops, increasing visibility among technicians and industrial firms at minimal cost.
- **Strategic Marketing through Digital Channels:** Utilizing the CalibrEx website and app stores to distribute the platform, coupled with targeted digital campaigns on professional networks to reach calibration professionals.

## Market Model

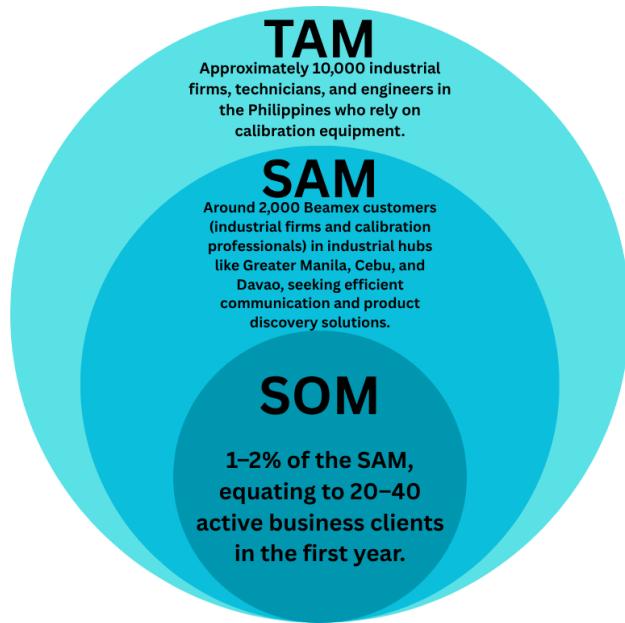
The Market Model for CalibrEx, illustrated in Figure 3, defines the Total Available Market (TAM), Served Available Market (SAM), and Share of Market (SOM) to evaluate the platform's commercial potential. This segmentation narrows the focus from the broad calibration industry to a realistic target clientele, ensuring a feasible market strategy. Based on industry data, approximately 10,000 industrial firms, technicians, and engineers in the Philippines rely on calibration equipment, constituting the TAM. Within this, the SAM comprises around 2,000 Beamex customers (industrial firms and calibration professionals) primarily located in industrial hubs like Greater Manila, Cebu, and Davao, who seek efficient communication and product discovery solutions. In its first year, CalibrEx aims to capture 1–2% of the SAM, equating to 20–40 active business clients.

This projection is driven by the increasing demand for digital platforms in the calibration sector, fueled by the need for streamlined distributor interactions and personalized equipment recommendations. As industrial firms prioritize operational efficiency and digital transformation,

CalibrEx provides a tailored solution, enhancing Accuro Inc.'s ability to meet customer needs in a competitive market.

**Figure 17**

*Market Model*



### **Measurable Benefits**

CalibrEx will also reduce human error and time consumption by approximately 5%, as the company has a lot of experience in the field. CalibrEx also has the potential to create an individual web and mobile interface of Accuro Inc., consisting of a collaborative filtering recommendation engine that would offer personalized Beamex products with specifications,

real-time communication channels such as inquiry forms, and a Technical Hub with product guides to train users. Its interface that is easy to use and colored in themes related to calibration can bridge the gap in customer interaction, lower decision-making and strengthen the trust quotient and customer satisfaction. Its scalable structure is capable of future growth, which would comply with SDG 9 (Industry, Innovation, and Infrastructure) and SDG 4 (Quality Education), providing the value to Accuro Inc. With its ability to enhance the business and make the interactions smoother.

**Table 6***Three-year product roadmap*

<b>Year</b>	<b>Focus Area</b>	<b>Key Features</b>
June 2025 - April 2026	Prototype Development	<ul style="list-style-type: none"> <li>● Develop web (React) and mobile (Flutter) interfaces with inquiry forms, and support tickets.</li> <li>● Implement basic collaborative filtering using SVD for initial product recommendations.</li> <li>● Conduct beta testing</li> </ul>

		with 50 Beamex customers in Greater Manila Area, targeting 80% usability satisfaction.
June 2026 - April 2027	Market Expansion	<ul style="list-style-type: none"> <li>● Enhance recommendation engine with deep neural methods, aiming for 90% accuracy in suggestions.</li> <li>● Launch a blog on the CalibrEx website with technical tips, targeting 200 monthly views.</li> </ul>
June 2027 - April 2028	Advanced Features	<ul style="list-style-type: none"> <li>● Introduce a mobile app push notification system for support</li> </ul>

		updates, targeting 70% user opt-in rate. <ul style="list-style-type: none"><li>• Add a feature for exporting recommendation reports, useful for industrial audits.</li></ul>
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### Go-to-Market Strategy

Outlines the offering (free platform), target customers (Beamex users and training institutions), and distribution channels (website, and app stores) to ensure rapid adoption of CalibrEx.

**Table 7***Go-to-Market Strategy*

Offerings	Customers	Channels
<ul style="list-style-type: none"> <li>● Free web/mobile platform with communication tools and basic recommendations.</li> </ul>	<ul style="list-style-type: none"> <li>● Technicians, engineers, and industrial firms (Beamex customers).</li> <li>● International calibration experts.</li> </ul>	<ul style="list-style-type: none"> <li>● CalibrEx website and app stores (Android).</li> </ul>

**Business Model**

The Business Model for "CalibrEx" emphasizes a sustainable approach to enhance customer engagement and product discovery for Accuro Inc. via a web and mobile platform.

**Table 8***Business model*

<b>Key Partners</b>	<b>Key Activities</b>	<b>Value Proposition</b>	<b>Customer Relationship</b>	<b>Customer Segments</b>
<ul style="list-style-type: none"> <li>• Calibration Industry Associations</li> <li>• Accuro Inc. Staff</li> </ul>	<ul style="list-style-type: none"> <li>• Platform Development (React, Flutter, Node.js)</li> <li>• Collaborative Filtering Implementation</li> <li>• Technical Hub Content Creation</li> </ul> <p><b>Key Resources</b></p> <ul style="list-style-type: none"> <li>• React/Flutter Tools</li> <li>• MongoDB Database</li> </ul>	<ul style="list-style-type: none"> <li>• Streamline communication with Accuro Inc.</li> <li>• Provide personalized Beamex recommendations</li> <li>• Educate users with product guides</li> </ul>	<ul style="list-style-type: none"> <li>• Feedback loops for feature enhancements</li> <li>• Regular updates and training sessions</li> </ul> <p><b>Channels</b></p> <ul style="list-style-type: none"> <li>• CalibrEx Website and App Stores</li> </ul>	<ul style="list-style-type: none"> <li>• Technicians and Engineers</li> <li>• Industrial Firms</li> <li>• Calibration Training Institutions</li> </ul>
<b>Cost Structure</b>		<b>Revenue Streams</b>		
<ul style="list-style-type: none"> <li>• Cloud Hosting Fees</li> <li>• Student Development Time</li> <li>• Research &amp; Training Materials</li> </ul>		<ul style="list-style-type: none"> <li>• Sales of Detailed Analytics Reports</li> </ul>		

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