

AR NutriMoms

A Mobile-based Augmented Reality Application for Enhancing Prenatal Nutrition in Urban India.

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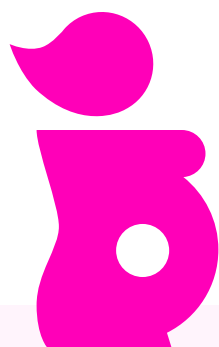
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Module: Specialist Project

Module No. DESN5183M



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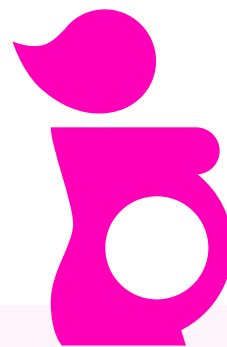


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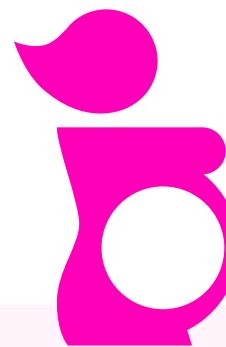


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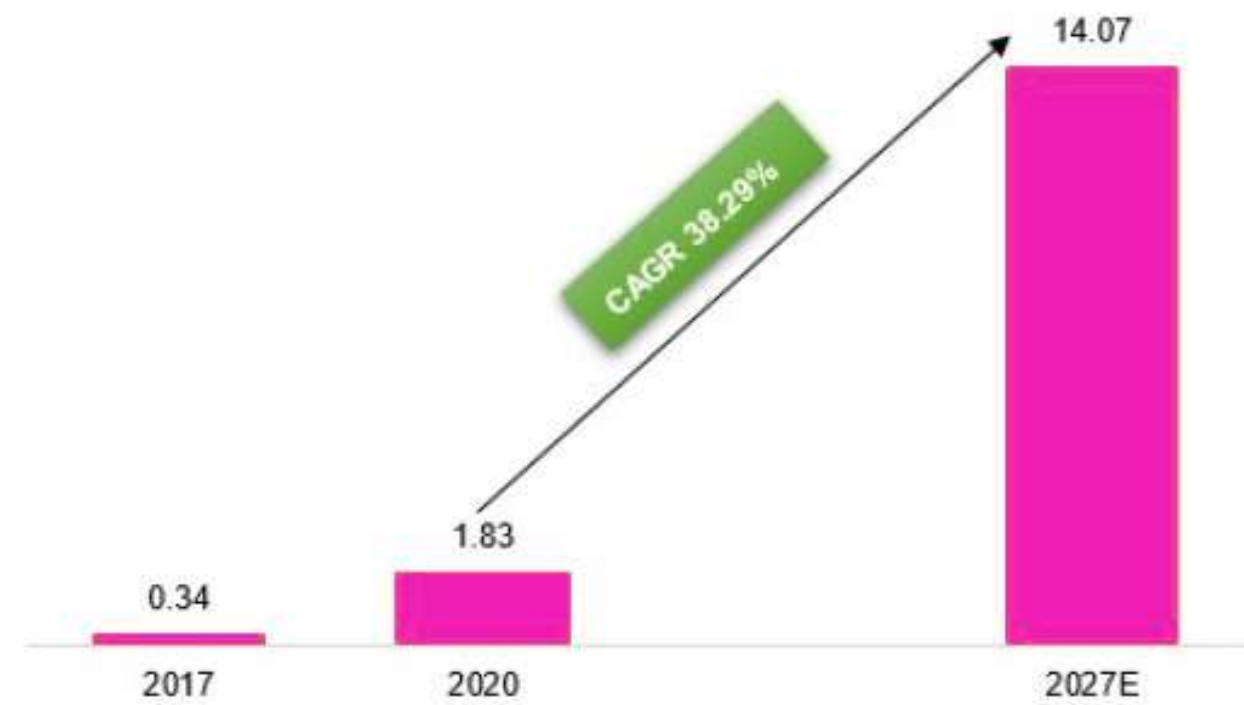
AR Nutrimoms is a mobile AR learning intervention specifically tailored for expectant women in urban areas of India. The primary focus of this app is to improve prenatal nourishment for both the mother and the fetus. By utilizing handheld devices, the AR app enables users to engage with food items within relevant environments, allowing them to access real-time nutritional information, recommendations and its potential impact on their prenatal health. This is achieved through the implementation of image recognition and AR frameworks, which enhances the user experience and provides insights for making healthier dietary decisions.

- **Prenatal Health Challenges:** Pregnancy is a critical phase for women, especially during the prenatal period, where poor health outcomes like anemia, gestational diabetes, and excessive weight gain are prevalent in India (Patel et al., 2018; Collaboration NCDRF, 2016; Rasmussen and Yaktine, 2009; Han et al., 2011; World Health Organization, 2016; 2008; Haider et al., 2013).
- **Nutritional Needs:** Lack of nutritional knowledge, changing food environment with processed foods, and limited access to nutritious foods are growing concerns in urban India (Bhushan et al., 2019; Alves-Santos et al., 2020; Kumar et al., 2022; Ministry of Food Processing Industries, 2021; Shetty, 2013).
- **Cultural and Social Constraints:** Cultural beliefs and social norms limit access to healthy foods, compounding nutritional challenges for pregnant women (Bailey et al., 2018; Catherin et al., 2015; Sarkar et al., 2020; Nguyen et al., 2019; Alive & Thrive, 2016).
- **Widespread Smartphone Use:** Urban India has widespread smartphone ownership, making mobile-based AR intervention feasible and cost-effective (Indian Cellular & Electronics Association, 2020; The Mobile Gender Gap Report, 2021).
- **Augmented Reality (AR) Solution:** Evaluation of existing apps like FoodLens (Azumio, 2021), Calorie Mama (Azumio, 2017), ARFood (Chanlin and Chan, 2018), and RedLaser (McMohan et al., 2013) demonstrates the potential of AR apps to improve dietary habits and knowledge in various contexts. No existing AR apps in nutrition closely resemble the proposed intervention, making it a novel and valuable addition to the field.
- **Unique Tailored AR Experience:** No existing AR apps in nutrition are tailored for pregnant women in urban India, delivering essential dietary knowledge aligned with WHO's global guidelines for maternal nutrition, making it a novel and valuable addition to the field.

By addressing the specific challenges of poor prenatal health outcomes, limited nutritional knowledge, and cultural factors, AR Nutrimoms has the potential to significantly enhance the dietary choices and overall health of pregnant women in urban India.

Market Survey

With the increasing penetration of smartphones and widespread internet connectivity (Indian Cellular & Electronics Association, 2020), the Indian market for AR is expected to reach US\$ 14.07 billion by 2027, with a compound annual growth rate of 38.29% (India Brand Equity Foundation, 2022).



Indian AR Market Size (US\$ Billion) presented by Indian Brand Equity Foundation (2022).

Augmented reality (AR) technology, when integrated with handheld systems, has gained recognition for its role in facilitating nutrition education and behavioral shifts (Juan et al., 2019; Calle-Bustos et al., 2017; Domhardt et al., 2005; Rollo et al., 2017).

Some existing mobile applications offering innovative ways to access and interact with nutrition information, empowering individuals to make more informed food choices and manage their dietary intake effectively have been reviewed to inform current work.

FoodLens
(Aumio, 2021)



ARFood
(Chanlin and Chan, 2018)



Calorie Mama
(Aumio, 2017)



Red Laser
(McMohan et al., 2013)



Market Survey

Apps	FoodLens	Calorie Mama	ARFood	Red Laser
Technology	FoodLens utilizes image recognition algorithms to analyze food items and provide real-time nutrition information.	Calorie Mama employs image recognition and machine learning algorithms to estimate the calorie content of scanned food items.	ARFood uses AR technology to scan real food images and deliver real-time nutrition information.	Red Laser utilises AR technology to overlay virtual information on physical product labels, providing details about nutritional content and potential allergens.
Features	FoodLens offers real-time nutritional analysis, including calorie content, macronutrient composition, and allergen warnings.	Calorie Mama estimates calorie content and provides a quick way to track calorie intake.	ARFood allows users to scan food images, receive nutrition information, and maintain a log of daily nutrient intake.	RedLaser enables AR interpretation of nutrition labels on packaged food items, helping users identify allergens and understand nutritional content.
Differentiator	Comprehensive nutritional analysis and allergen warnings.	Quick and convenient calorie estimation feature.	Real-time nutrition information and nutrient intake tracking.	Assistance for intellectually challenged users in identifying food allergens.
OS Platform	iOS	iOS	Android	Not Specified
Pricing	Free	Offers a free version with limited features, along with a premium subscription for additional features.	Free	Not Specified

SWOT Analysis

Strength

- **Unique and Targeted:** The application specifically caters to the needs of pregnant women in urban India, providing them with tailored dietary knowledge and nutritional information.
- **Enhanced User Experience:** The integration of AR technology enhances the user experience by offering real-time information and interactive engagement with food items.
- **Convenience and Accessibility:** The mobile-based platform ensures easy accessibility for users, as smartphones are widely owned in urban India.
- **Health Impact:** The application has the potential to positively impact maternal health outcomes by promoting informed food choices and prenatal nourishment.

Weakness

- **Technical Requirements:** The effective functioning of the AR application requires smartphones with compatible hardware and software capabilities, which may limit access for users with older or less advanced devices.
- **User Adoption:** Some pregnant women may not be familiar with or comfortable using AR technology, leading to potential challenges in user adoption and acceptance.
- **Language and Cultural Sensitivity:** Adapting the application to accommodate different languages, cultural practices, and regional dietary preferences may be a challenge.

Opportunity

- **Collaborations:** Collaborating with healthcare professionals, nutritionists, and relevant stakeholders can enhance the credibility and effectiveness of the application.
- **Expansion Potential:** The success of the application in urban India can pave the way for future expansion to other regions and target audiences.

Threat

- **Technological Advancements:** Rapid advancements in AR technology may necessitate frequent updates and improvements to stay relevant and competitive.
- **Privacy and Data Security:** Handling sensitive user data related to health and nutrition requires robust security measures to protect user privacy and ensure data integrity.

Business Model Canvas

KEY PARTNERS - Collaborating with pregnant women or new mothers in urban India to develop relevant content and user experience. - Collaborating with healthcare professionals such as doctors, gynecologists, nutritionists and dieticians in India to provide credible and accurate information and guidelines. - Partnering with local food suppliers to ensure accurate information about food products.	KEY ACTIVITIES - Curating a database for pregnancy-specific dietary knowledge and nutritional information. - Designing the mobile-based AR application for seamless user experience using image recognition and AI frameworks. - User evaluation to ensure the required design outcomes are achieved.	VALUE PROPOSITIONS Relevant Nutrition Information: Providing relevant and nutritional information, dietary impact and recommendations for pregnant women. Real-time AR Experience: Offering an engaging and real time interactive experience through the use of AR technology. Improved Maternal Health: Supporting pregnant women in making informed food choices to enhance maternal health outcomes.	CUSTOMER RELATIONSHIPS Encouraging active user participation through interactive features, notifications, and regular updates.	CUSTOMER SEGMENTS Pregnant Women: Targeting urban Indian women in their prenatal phase who are seeking reliable dietary information.
	KEY RESOURCES Research & Development: Evaluation of knowledge and insights from secondary research. Technical Infrastructure: AR technology, AI, ML and software development to support the application. Partnerships: Collaborations with healthcare professionals, nutritionists, and food suppliers.		CHANNELS Mobile App Stores: Distributing the application through popular app stores, such as Google Play Store and Apple App Store. Online Marketing: Promoting the application through digital marketing channels, social media platforms, and targeted online advertisements. Healthcare Professionals: Offering their patients as a resource to support their dietary education.	
COST STRUCTURE - Development and Maintenance Costs - Marketing expenses			REVENUE STREAMS - Offering a basic version of the application for free, with additional premium features available through in-app purchases or subscription plans. - Partnerships and Sponsorships	
ENVIRONMENTAL COSTS The use of mobile devices and AR technology may contribute to increased energy consumption, potentially impacting carbon emissions.	SOCIETAL COSTS Addressing any potential biases in the content or design of the application to ensure inclusivity and cultural sensitivity for all users.		SOCIETAL BENEFITS Improved maternal health of the Nation by contributing to the well-being of women and their babies promoting healthier food choices.	ENVIRONMENTAL BENEFITS By promoting informed food choices, the application may contribute to reducing food waste.

Project Scope & Limitations

The project aims to design a mobile Augmented Reality (AR) application tailored for pregnant women in urban India. This innovative app intends to provide real-time nutritional information, dietary impacts and recommendations to empower pregnant women to make informed food choices.

The scope includes the following key components:

- **Educational Content:** Curating educational content related to prenatal health, nutritional requirements, and dietary guidelines to enhance the users' understanding of their dietary needs during pregnancy.
- **AR Technology Integration:** Implementing AR frameworks to overlay real-time nutritional data on actual food items captured by the smartphone's camera, allowing users to visualise and understand the nutritional value of their meals.
- **User-Friendly Interface:** Designing an intuitive and user-friendly interface that accommodates the unique needs of pregnant women, ensuring easy navigation and interaction with the app's features.

While the project aims to address key challenges faced by pregnant women in urban India regarding nutrition during pregnancy, there are certain limitations to consider:

- **Content Creation:** Creating an extensive database encompassing nutritional details, recommendations, and dietary effects for a diverse array of foods, spanning local cuisine and packaged items, in alignment with WHO's maternal nutrition guidelines (World Health Organization, 2016), is undoubtedly feasible with sufficient time and expertise. Nonetheless, considering the project's time and skill limitations, this particular goal lies beyond the project's scope.
- **Accuracy of Nutritional Information:** The accuracy of real-time nutritional information provided by the app and the extent of personalization depends on the quality and completeness of the database, which may not cover every local dish or product.
- **Language and Literacy:** The app's impact may be constrained by language barriers and low literacy rates in certain regions, necessitating clear and accessible communication.
- **Cultural Diversity:** India's diverse culture and cuisine may pose challenges in providing universally applicable dietary recommendations, requiring careful consideration of cultural variations.
- **Healthcare Professional Advice:** The app does not replace personalized medical advice from healthcare professionals, and users should be encouraged to consult with them for specific health concerns.
- **User Engagement:** Ensuring sustained user engagement and behavior change in dietary habits might be a challenge, requiring effective strategies for motivation and reinforcement.

User Personas

The target audience for this project is pregnant women residing in urban India. These women, typically between the ages of 25 and 35, come from diverse socio-economic backgrounds and cultural contexts. They belong to urban settings, where access to healthcare facilities and food resources is relatively higher compared to rural areas. They are seeking support and guidance during their prenatal journey to make informed decisions about their nutrition and overall well-being. These women are mostly working professionals, tech-savvy, using smartphones as a primary means of communication and information access. The project aims to cater specifically to the needs and challenges faced by this audience, empowering them with valuable resources and assistance to enhance their maternal health and the health of their unborn child.

User Persona Profile #1



"Its been hard for us to get pregnant and I am so worried I will lose this baby .."

CURRENTLY FEELING...

- Happy
- Concerned
- Stressed
- Busy

GOALS

- Wants to have a healthy baby free from any complications.
- Wants to stay healthy during pregnancy and maintain optimal weight for a positive pregnancy outcome.
- Wants to make healthy and safe food choices to keep the pregnancy risk free.
- Wants to prioritise her health and nourishment

Neha

NEW EXPECTING MOTHER

Age: 34 years
Education: Some College
Occupation: Executive Assistant
Status: Married
Children: None
Location: New Delhi, India

Frustrations

Neha is very happy to be expecting but is also very worried at the same time because of her experience with miscarriage in her previous pregnancy. She understands that that are more risks of complications for women who have babies at her age and she will need to work very hard to keep this baby from coming prematurely. She is expecting to be put on bed rest later in her pregnancy.

User Persona Profile #2



"I want to enjoy a healthy pregnancy experience and hope my baby is born healthy too.."

CURRENTLY FEELING...

- Excited
- Little worried
- Anxious
- At times confused

GOALS

- Wants to give birth to her baby safely and wants her baby to be born healthy.
- To have access to the right information for making the best dietary and nutriton choices for herself and her unborn baby.
- Wants to have a trusted guide for her nourishment during pregnancy that of free of any myths.

Amrita

NEW EXPECTING MOTHER

Age: 26 years
Education: Some College
Occupation: Accountant
Status: Married
Children: None
Location: Mumbai, India

Frustrations

This is Amrita's first time experience with pregnancy. Since she has never been pregnant before she feels excited but at the same time a little worried, anxious and confused as she is experiencing alot of things going on in her mind and body for the first time. She feels there are many myths about the kind of food or drinks that should be avoided during pregnancy and she cannot tell which holds true or not. She feels overwhelmed with all the information.

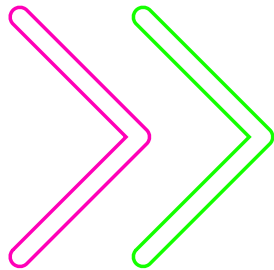
User Scenarios & Design Mapping

User Persona #1

Neha, a 34-year-old executive assistant living in New Delhi, is thrilled to be expecting a baby. However, her previous experience with a miscarriage has made her anxious about the health and well-being of her baby. Neha's goal is to have a healthy baby free from any complications and maintain her own optimal weight for a positive pregnancy outcome. She is aware of the increased risks associated with her age and wants to take every precaution to prevent premature birth. Neha's frustration stems from her worries and the possibility of being put on bed rest later in her pregnancy. She seeks a solution that can provide her with reliable guidance, personalised nutritional recommendations, and support to prioritise her health and nourishment during this period.

User Persona #2

Amrita, a 26-year-old accountant in Mumbai, is thrilled to be expecting her first baby. However, being a first-time mother, she feels overwhelmed, worried, and confused. She wants to ensure a safe delivery and a healthy baby, but she lacks access to accurate information regarding the best dietary and nutrition choices during pregnancy. Amrita is frustrated by the numerous myths and misconceptions surrounding pregnancy nutrition, making it challenging for her to differentiate between reliable advice and unfounded beliefs. She desires a trustworthy guide that can provide her with evidence-based information and help her make informed decisions about her diet and nutrition throughout her pregnancy journey. Amrita is eager to find a solution that can dispel myths, provide accurate information, and support her in making the best choices for herself and her unborn baby.

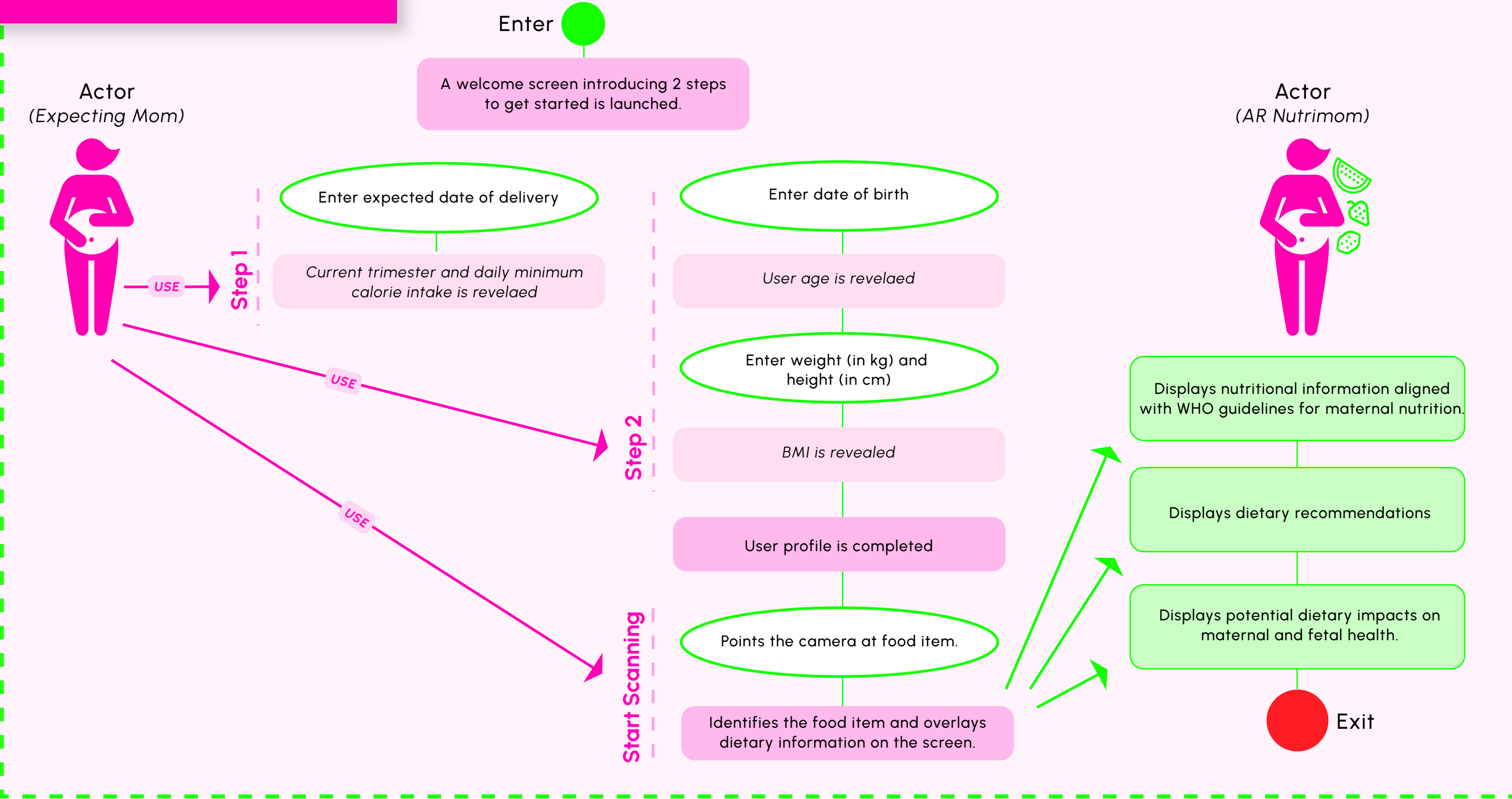


Design Scenario

Both users are excited about their journey into motherhood but also feels overwhelmed by the dietary changes and nutritional requirements during pregnancy. They want to ensure that their baby and themselves receive the best possible nourishment but finds it challenging to navigate through the abundance of information available.

- *The user downloads the app and starts exploring its features.*
- *With the app, the user can now easily access personalized dietary recommendations based on her specific stage of pregnancy and nutritional needs.*
- *The user visits a local supermarket and activates the app's scanning feature using AR technology.*
- *As she scans different food products, the app instantly displays real-time nutritional information, highlighting the benefits and potential risks to her prenatal health.*
- *User feels empowered as she can now make well-informed choices while shopping for groceries.*

Scenario: Use Case Diagram



Synthesis: Use Case Specification Table

Use Case Name	AR Nutrimoms	Actors	Pregnant Women
Goal	To provide real-time nutritional information and dietary knowledge to empower pregnant women to make informed		
Preconditions	User has a compatible device to run the AR application. User has an internet connection. User has installed and launched the app.		
Main Flow	User opens the app after installation. App displays a welcome screen introducing 2 steps to get started. App prompts the user to enter basic information: Due date, DOB, Weight, and Height. User submits the information. App verifies the input and populates user's current trimester, minimum caloric intake, age, and BMI. Apps successfully creates user profile and prompts user to start scanning food items. User grants camera access. User points the camera at a food item. App identifies the food item and overlays nutritional information on the screen. App displays nutritional information, recommendations and potential dietary impacts aligned with WHO guidelines for maternal nutrition.		
Alternate Flow	Once a user has established a profile, the app will retain the most recent information as the default profile setting. The user has the option to either update the profile details or initiate scanning directly. If the app cannot identify the food item, it informs the user that recognition failed.		
Postconditions	User completes onboarding process required to start scanning food items. Dietary knowledge and recommendations are displayed on the screen.		
Assumptions	The user provides accurate information during profile setup. The user captures clear images of food items for accurate recognition.		

Ideation: Mind Map

User Experience

- Intuitive and user-friendly interface
- Seamless scanning of food products
- Clear and concise nutritional information
- Personalized recommendations based on user's profile
- Interactive and engaging AR overlays

Health and Safety

- Offering tips for maintaining a healthy pregnancy diet
- Educating about the importance of prenatal nutrition

Cultural Relevance

- Incorporating regional food practices and preferences
- Addressing cultural dietary restrictions and preferences
- Offering customizable settings based on cultural background
- Considering local food availability

Features and Functionality

- Real-time scanning and analysis of food products
- Highlighting nutritional value and ingredients
- Identifying potential allergens and risks for pregnant women
- Providing portion sizes and recommended daily intake
- Offering alternative and healthier food options

Mobile AR App for Prenatal Nutrition Education

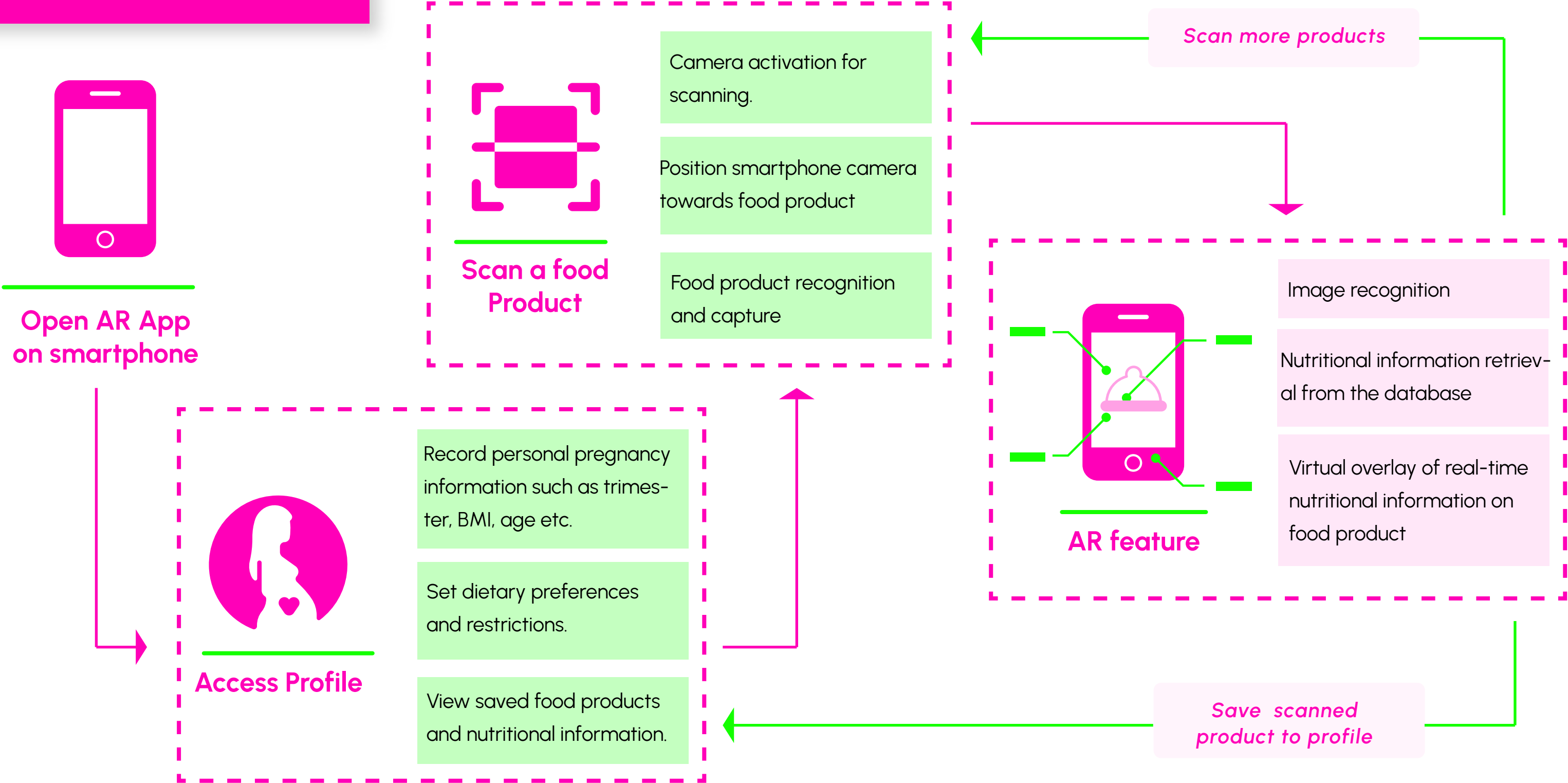
Data and Information

- Comprehensive and accurate food database
- Nutritional databases specific to Indian cuisine
- Regular updates and additions to the database
- Sources and references for nutritional information
- Integration with trusted health organization's guidelines

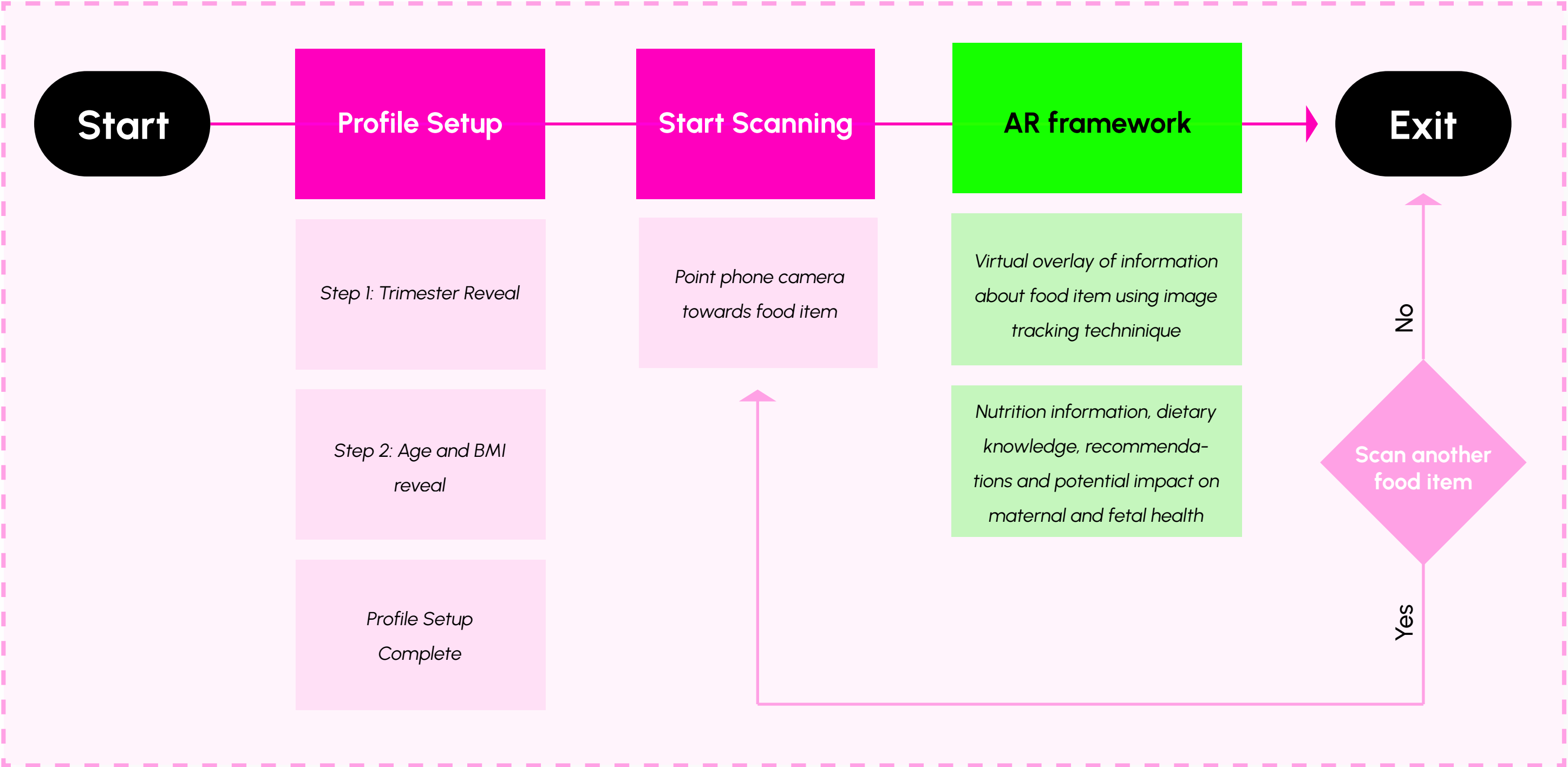
Design and Interface

- Clean and visually appealing design
- Feminine pregnancy-related visual elements and icons
- Consistent color scheme and typography
- Clear and readable text for easy comprehension
- Intuitive navigation and interaction patterns

Ideation: Concept Map

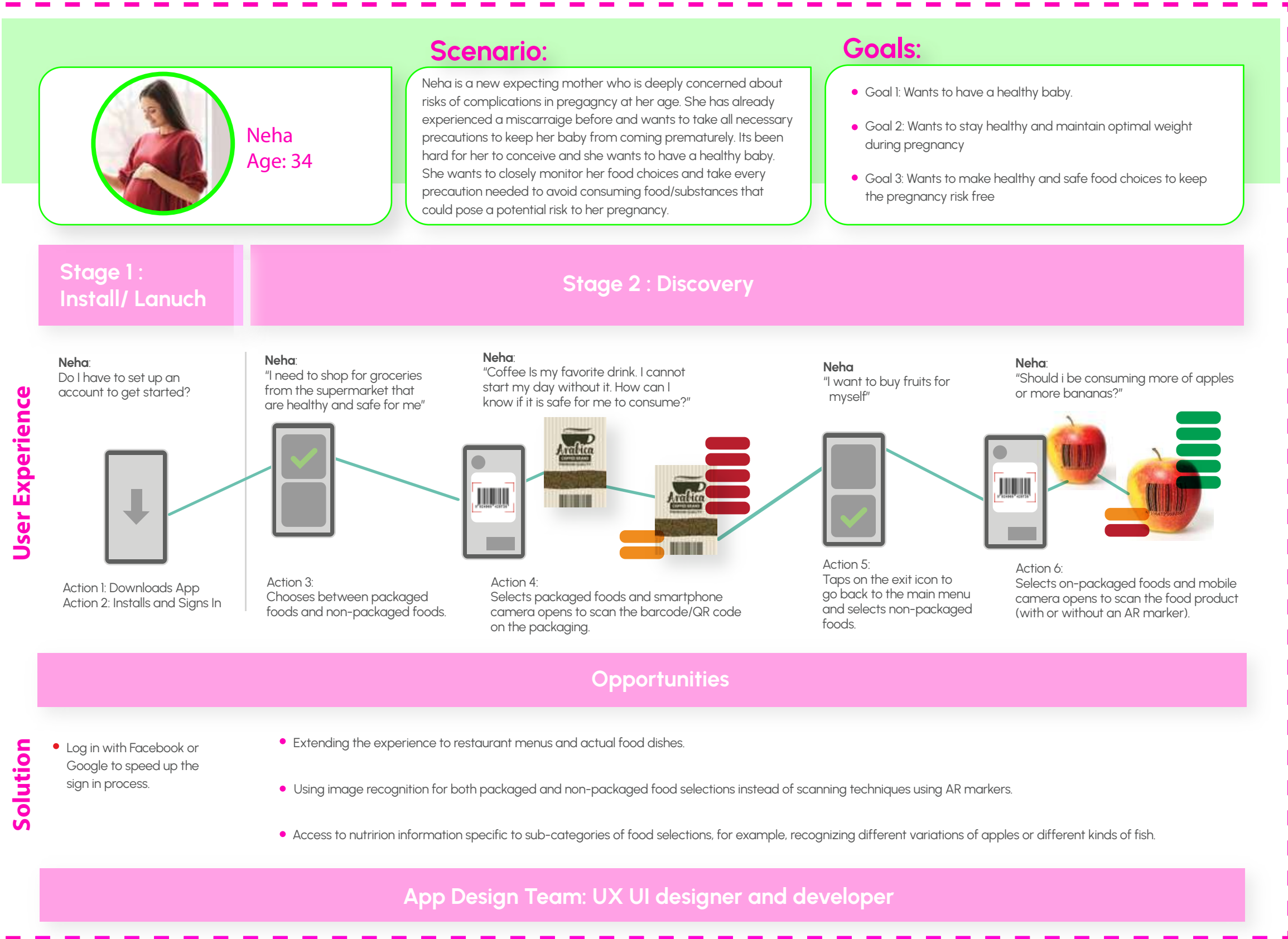


Workflow



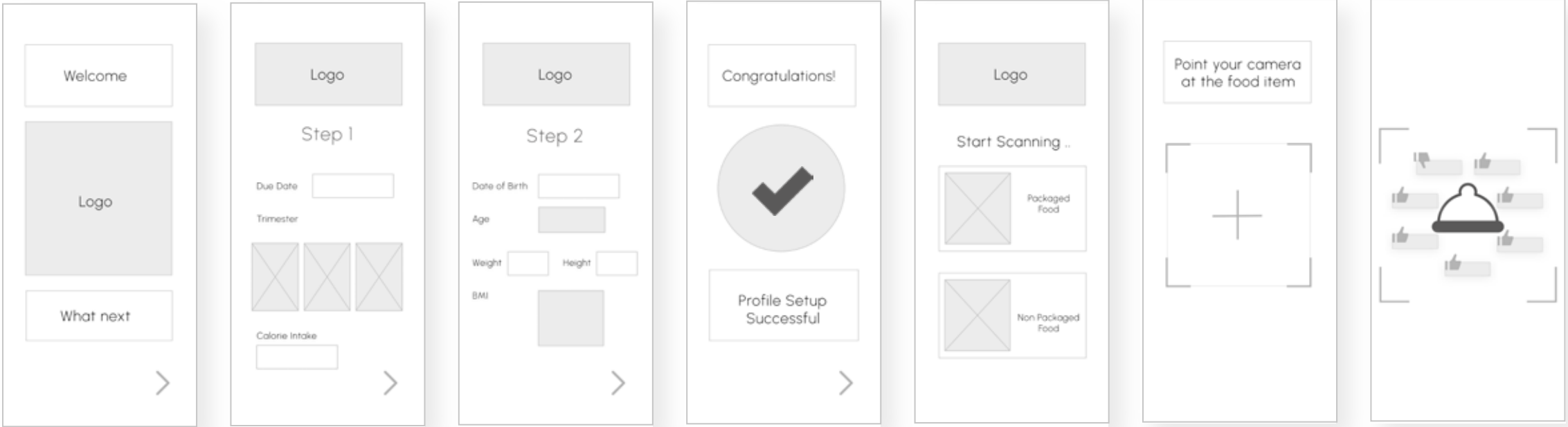
User Journey Map

The ideation process for this work follows a user-centred design approach. The process embraces an iterative approach for continuous refinement and improvement to address the specific needs and preferences of the target audience. The design iteration process involved valuable inputs from pregnant women and experienced mothers on design concepts, sketches and low fidelity wireframes that were sought informally engaging with personal network of friends and family. The feedback was employed to enhance the design concepts and modify the user experience throughout the transition from low-fidelity to high-fidelity wireframes during the design process.



Low Fidelity Wireframes

Hand-drawn sketches played a pivotal role in kickstarting the ideation process for the UX/UI of the AR app. These initial sketches served as the creative seed, allowing ideas to flow freely and concepts to take shape organically. They were instrumental in capturing the essence of the user experience and visualizing the app's potential.

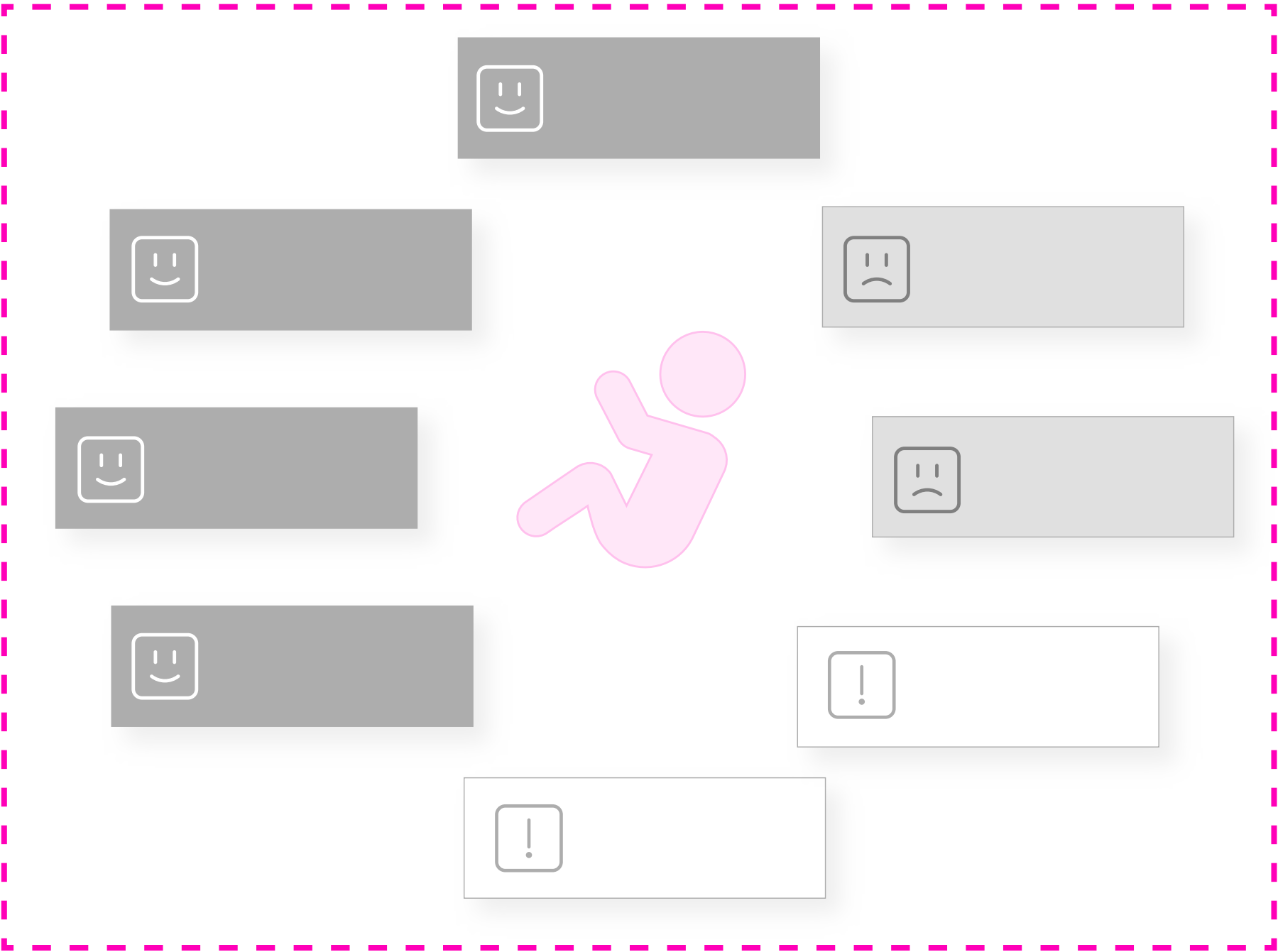


While the hand-drawn sketches were filled with creative ideas that flowed naturally and weren't overthought, they paved the way for the refinement of digitally crafted wireframes. These refinements were made based on valuable insights gathered from informally engaging with potential users, ensuring that the app design would align closely with user needs and expectations. This seamless transition from hand-drawn inspiration to digital refinement ultimately shaped the foundation of the app's design, ensuring a user-centric and visually engaging experience.

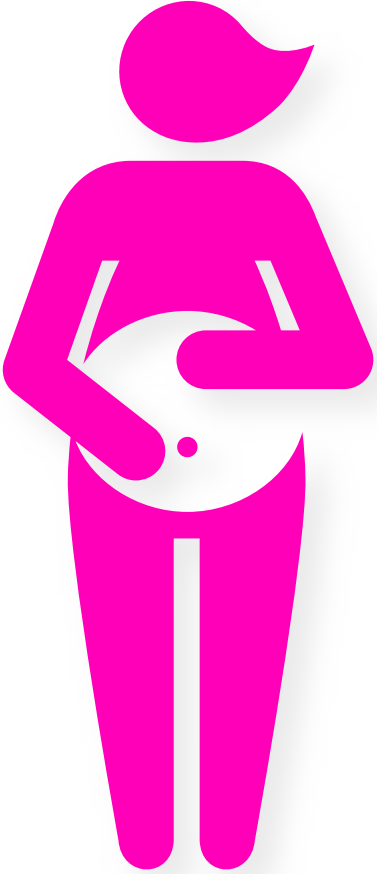
Low Fidelity Wireframes

This wireframe is a blueprint for the AR app's core function aimed at providing users with vital nutrition and dietary information when they scan a food item with their phone's camera. This overlay will display details about the food's nutritional composition, dietary impacts and provide recommendations including food safety tips relevant to the prenatal phase of pregnancy of the users. What makes it unique is its tailored advice for expectant mothers, in line with both global guidelines from the World Health Organization (2016) for maternal health and local nutritional practices in urban India.

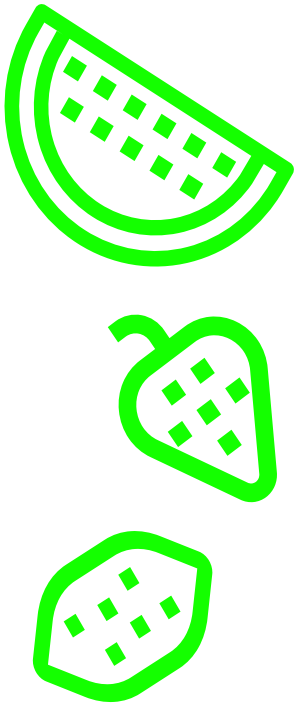
The visual overlay of our AR content is designed to be both engaging and user-friendly. Imagine the baby speaking directly to their mom, creating a delightful and interactive experience. This first-person perspective adds an exciting and fun element to the interaction, making it feel more personal and engaging. To enhance usability, the content will be color-coded, using distinct colors to represent different types of information. This color scheme allows users to quickly and easily associate content with its purpose, distinguishing between reasons to avoid, reasons to consume, and other helpful recommendations. This combination of engaging narrative and intuitive design ensures that users can effortlessly access and understand the valuable nutritional guidance provided by our AR app.



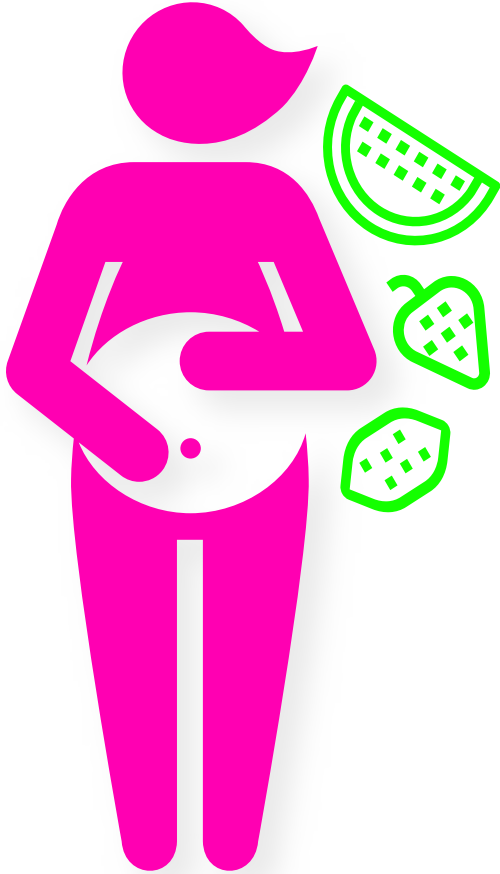
Branding: Logo Concept



Core Logo



Supporting
Logo Asset



AR Nutrimom
Logo Variant

The logo design for our AR app, created for expectant mothers, embodies a thoughtful and versatile concept. At its core, the main logo features a simple and feminine icon of a woman with a baby bump, symbolizing pregnancy and maternal care. This iconic representation serves as the foundation of the brand identity. In addition to the main logo, a set of three line-style icons has been developed to depict various fruits and vegetables, symbolizing nutrition and food choices. These supporting assets seamlessly pair with the main logo to convey a powerful message: the expectant mom transforms into the AR-powered "NutriMom," as represented by the brand name. This transformation signifies her ability to make informed and positive food choices for both her health and the well-being of her baby. Together, these elements encapsulate the essence of our app, offering a visual representation of the journey towards healthier choices during the prenatal phase. The application of logo design technique is inspired from a book by Airey (2015) and the logo assets are vector art created with Adobe Illustrator.

Branding: Colour Psychology and Typeface



Brand Name

Sansita Swashed

Extra Bold

App Interface

Urbanist

Bold

Bold Italic

Medium

Medium Italic

Regular

Italic

ExtraLight

ExtraLight Italic

Colour Palette

The chosen color palette for the brand, featuring shades of pink and green, is deeply rooted in color psychology (Heller and Anderson, 2019) to evoke specific emotions and associations. Pink, a soft and nurturing hue, embodies feelings of warmth, care, and affection, aligning perfectly with the nurturing aspect of motherhood and the bond between an expectant mom and her baby. On the other hand, green represents growth, vitality, and renewal, reflecting the idea of health and well-being, which is paramount during pregnancy. These colors work harmoniously to create a sense of balance, tranquility, and positivity within the brand, fostering trust and a sense of security for the users as they embark on their journey to making healthier food choices for themselves and their babies.

Typeface

The typography choices for the brand have been carefully selected to convey the messaging and brand identity effectively (Airey, 2015). In the logo, the Sansita Swashed typeface is employed for the brand name, adding a touch of elegance and femininity with its graceful, swirled details. In contrast, for the app interface, the Urbanist typeface is utilized. Its clean and modern lines ensure readability and user-friendliness, making it ideal for conveying the informative and educational content found within the application. These typefaces, in their respective contexts, create a harmonious blend of style and functionality, embodying the essence of the brand and its commitment to providing a seamless and informative experience for expectant mothers.

High Fidelity Wireframes



Upon launching the app, a splash screen extends a warm welcome to the user.

In Step 1 of profile setup, entering the expected delivery date of the baby unveils the user's current trimester and their daily minimum calorie goal.



In Step 2 of profile setup, entering the date of birth reveals user's age, while inputting the weight and height reveals user's Body Mass Index level.

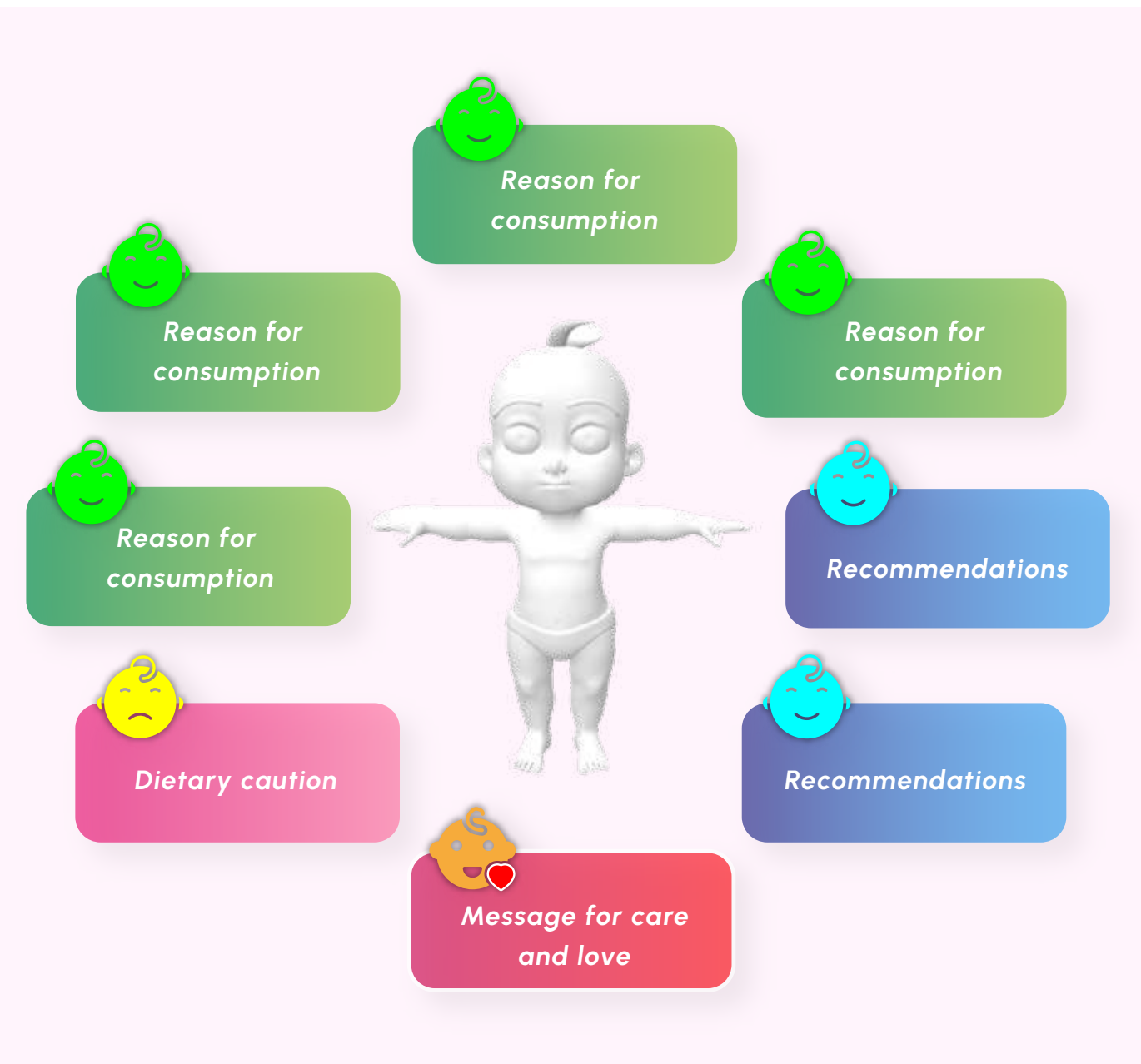


Confirmation of the successful completion of profile setup to start scanning food items.

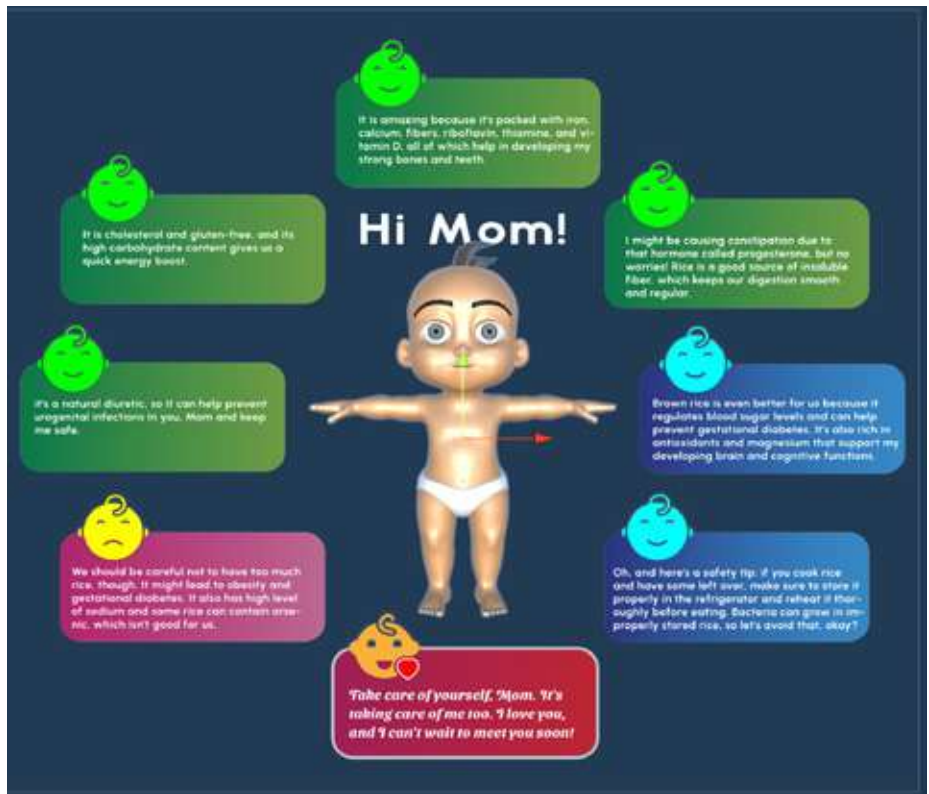


The AR camera activates, providing guidance to the user on scanning food items.

High Fidelity Wireframes



The development of high-fidelity wireframes for the AR content overlay has been an exciting journey. To convey information effectively, a vibrant color scheme is paired with emoticons of a baby to represent the nature of the information. Pink, complemented by a somber baby visage, signifies reasons for dietary caution. In contrast, green, accompanied by a jovial baby expression, designates reasons for food consumption. Meanwhile, additional recommendations are denoted in blue, along with a cheerful, content baby emoticon. A 3D baby model has been integrated to personalize the experience. The information is conveyed in a first-person perspective, with the future baby "speaking" to the mother through the overlaid content.



The high fidelity wireframes are brought to life in unity. The 3D baby model is textured with materials to enhance realism. As users scan food items, this AR content seamlessly integrates with the real world, creating an imaginative dialogue between the future baby and the mother. This visual narrative not only informs mothers to make informed and healthy food choices during pregnancy, fostering a unique and meaningful connection between them and their little ones.

Functionalities

OBJECTIVE: App Launch

FUNCTION: The app displays a welcome screen with clear instructions on how to get started. Through the app's navigation flow users are allowed to seamlessly transition from profile setup to food scanning.

OBJECTIVE: User Profile Creation

FUNCTION: The app's step-by-step onboarding process guides users through the necessary setup to initiate food scanning. This includes providing clear instructions and feedback at each step.

OBJECTIVE: User Data Collection

FUNCTION: The app features a user-friendly interface with input fields to collect user's information. It prompts users to input their due date, date of birth, weight, and height and employs algorithms to verify user input and calculates their current trimester, minimum caloric intake, age, and BMI based on the data provided.

OBJECTIVE: User Profile Retention

FUNCTION: A data storage mechanism within the app stores user profiles, ensuring they are successfully generated upon verification and retains user's information as the default setting. This allows the app to recall and use this information for subsequent interactions.

OBJECTIVE: Initiate Food Scanning

FUNCTION: The app uses the smartphone camera to turn on the AR camera and guides the user's with clear instructions on how to start scanning of food items.

OBJECTIVE: Food Item Recognition

FUNCTION: The integration of image recognition technology in AR serves as the initial trigger that identifies the food item. This identification, in turn, activates the app's database, information system, and algorithm. These components work collaboratively to dynamically retrieve, process, and present personalized dietary knowledge and recommendations based on the user's specific profile and the recognized food item.

Image Recognition Technology

When a user points the app's camera at a food item, the image recognition technology comes into play. This technology analyzes the visual data from the camera in real-time and identifies the food item through a process of pattern recognition and comparison with a database of food images. Once the food item is recognized, it triggers a data retrieval process.

Database Integration

The recognized food item serves as a key to access the app's internal database. The database contains a vast repository of nutritional data for various foods, including dietary impacts and recommendations. The recognized food item serves as a query parameter, prompting the database to retrieve the specific nutritional information associated with that food item.

Information System and Algorithm

Simultaneously, the recognized food item and user-specific data (such as age, trimester, and BMI) are fed into the app's information system. The information system continuously runs an algorithm that considers the user's profile and scanning history. This algorithm processes the nutritional information retrieved from the database in conjunction with the user's data. The algorithm then generates personalized dietary recommendations and dietary impact assessments based on the user's current health status and pregnancy stage.

Overlay Nutrition Information

Finally, the app's interface is designed to dynamically present this information to the user. The nutritional data, recommendations, and dietary impact assessments are overlaid onto the camera view using augmented reality. Users see this information superimposed on the live image of the food item through their device's screen. It takes into account the user's profile and scanning history, utilizing an algorithm to personalize the guidance based on user-specific data. The nutritional guidelines for maternal care in urban India, emphasizes on key nutrients such as iron, vitamin C f, folic acid, calcium, vitamin D, protein and fiber while limiting sugar, monosodium glutamate, caffiene and mercury in seafood, ensuring the health and well-being of both mother and baby during pregnancy.

3D Resources

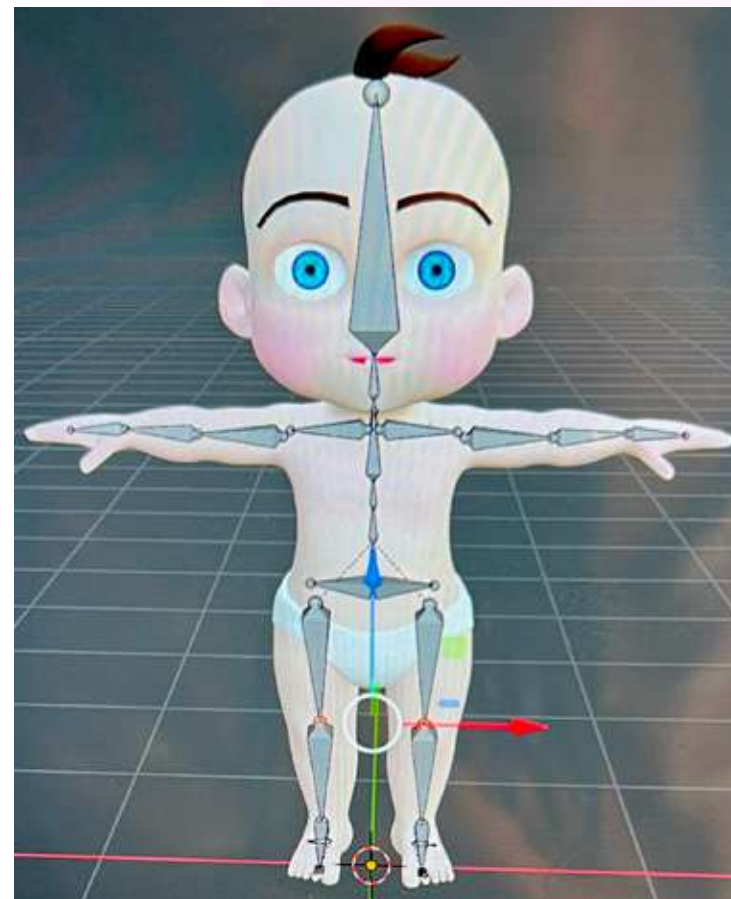
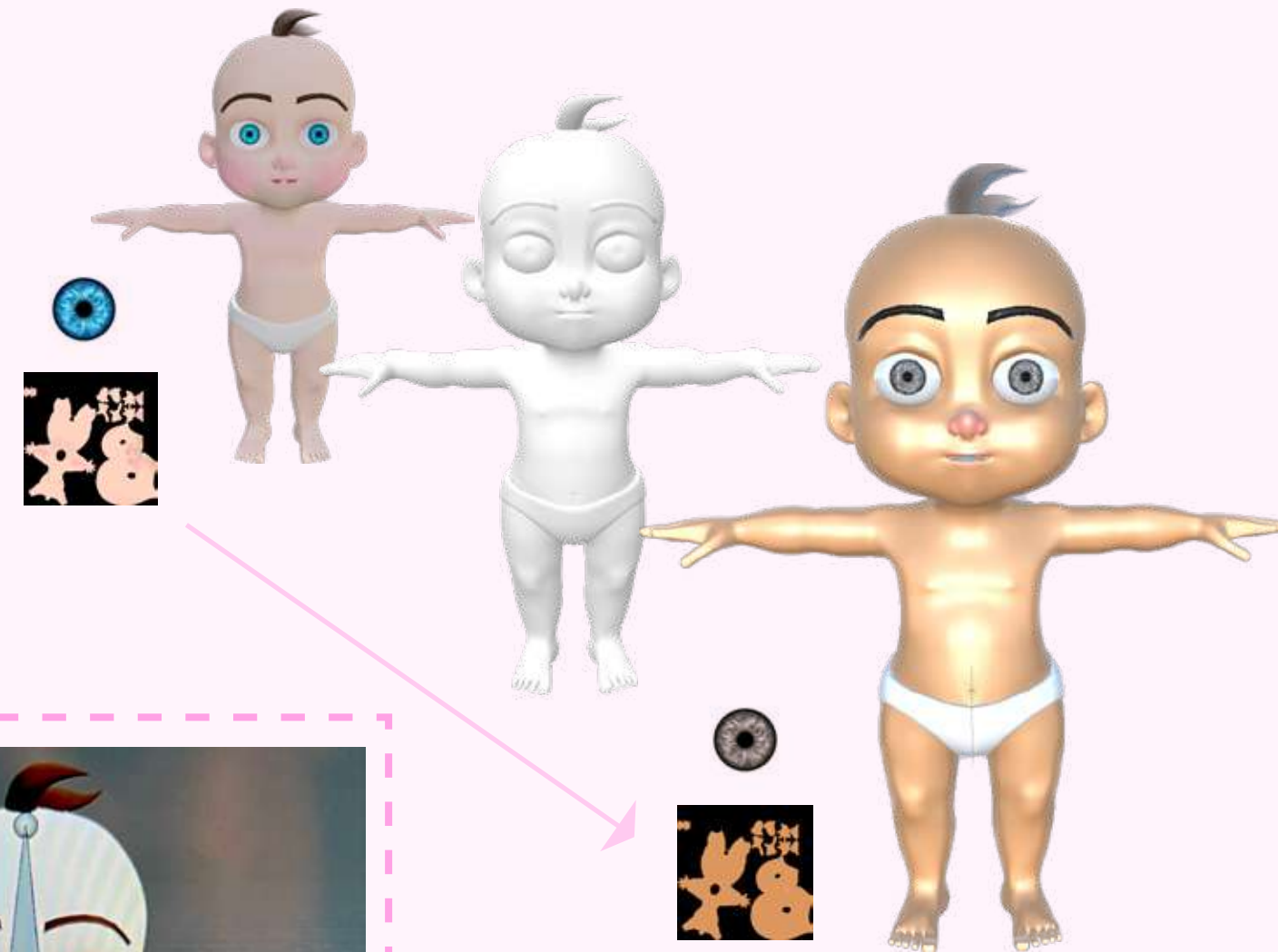
Character Model (Baby): The baby model by Giyasudeen (2022) sourced from CGTrader and then tailored to align with the cultural context of the experience. Textures and materials were modified using Photoshop to create a baby model that harmonized with the project's theme.

Character Animation (Baby Sitting): The 3D model of the baby underwent rigging in Blender, and animation was sourced from Mixamo (Adobe, 2023). This process allowed the baby to be animated in a sitting position within the AR environment.

Icons (Emoticons and Interface): Emoticons featuring baby faces by Daksina (2023) and Vector Market [no date] to convey emotions related to the AR overlay, along with various icons utilized in the app's interface, were sourced from The Noun Project, enhancing the app's visual communication.

Fonts: The typefaces used in the project were obtained from Google Fonts, ensuring a visually appealing and readable text presentation throughout the app.

Other Assets (Sound Effects): Sound effects for user interactions within the app were procured from the royalty-free music repository, Pixabay. These include announcement sound effects by Chetvertnykh (2022), beautiful piano logo sound effects by Luzan (2023), brass fanfare trumpet sound effects by u_ss015dykrt (2023), mouse click sound effects by Jurij (2023), and music box sound effects by Pixabay (2022), all contributing to the immersive user experience.



Design Techniques

Graphics and Sound

Branding: Maintained a uniform visual style, including colors, typography, and iconography, to ensure a cohesive user experience (Heller and Anderson, 2019), collectively conveying a feminine, nurturing, and informative visual identity. The logo concept and brand name was designed to echo with project's identity representing the target audience and thier needs (Airey, 2015).

Audio feedback: Incorporated sound effects judiciously to provide audio feedback for user interactions (Hartson and Pyla, 2012).

Interactions and Navigation

User-Centered Approach: Prioritized user needs and preferences, ensuring that interactions were engaging and navigations were clear (Norman, 2013).

Feedback Loops: Incorporated feedback mechanisms in the form of subtle animations and transitions, to provide users with a responsive and informative experience (Norman, 2013; Hartson and Pyla, 2012).

3D Character and Modelling

Cultural Sensitivity: Modified 3D character models to respect cultural contexts, ensuring they were relatable to the target audience.

Realism: Strived for realism in 3D modeling and textures to make the virtual character appear life like and engaging.

Emotion and Cognition

Emotive Design: Used emoticons and scripted an emotional expression of information overlay to connect with users on a deeper level, conveying messages of care and love (Norman, 2004).

Cognitive Load Management: Ensured a balanced cognitive load by presenting information in a clear and digestible manner, facilitating comprehension and decision-making for users (Sweller et al., no date).

AR Environment

Efficient Image Recognition: Optimized image recognition algorithms for quick and accurate food item identification.

Real-time Data Retrieval: Efficient retrieval of nutritional data from the database for seamless AR overlays is needed.

Personalization Algorithms: Algorithms to personalize dietary recommendations based on user profiles and scanning history are needed.

Seamless AR Overlay: Ensured the AR overlay consistently aligned with the recognized food item for a visually cohesive experience (Hartson and Pyla, 2012).

Clear and Readable Presentation: Designed the AR overlay for clear presentation of nutritional information, ensuring readability in various lighting conditions (Hartson and Pyla, 2012).

Development: Tools, Software and Plugins

Platform Selection

- **Unity:** Unity served as the primary development platform, enabling cross-platform compatibility for both Android and iOS devices. Initially, the project was developed for iOS devices.
- **Visual Studio:** Integrated with Unity for scene development, in-app interactions, sound design, and creating the virtual AR environment.
- **Xcode:** Utilized to run the build on iOS devices.

User Interface Design

- **Figma:** Used for designing the user interface of the AR app, with the designs then imported into Unity for creating a functional prototype.
- **Adobe Illustrator:** Employed for designing the AR overlay user interface, ensuring information was presented in an easy-to-understand and engaging manner, facilitating informed food choices.

AR Integration

- **AR Foundation:** Integrated into Unity, AR Foundation enabled image recognition and tracking capabilities crucial for recognizing various food products and providing real-time nutritional information.
- **ARKit:** iOS-specific SDKs were installed to ensure proper development and deployment on iOS devices.

3D Modelling & Animation

- **Blender:** Utilized for rigging the 3D character integrated into the AR experience.
- **Photoshop:** Applied to modify the material and textures of the 3D character to align with the project's identity.
- **Mixamo:** Employed to source character animations and apply them to the rigged character model in Unity. These tools collectively facilitated the creation of realistic and visually appealing virtual objects, enhancing user interaction with the app.

Throughout the development process, rigorous testing, debugging, and iterative improvements were conducted. These steps were essential to ensure the prototype met the desired standards in terms of functionality, usability, and performance.



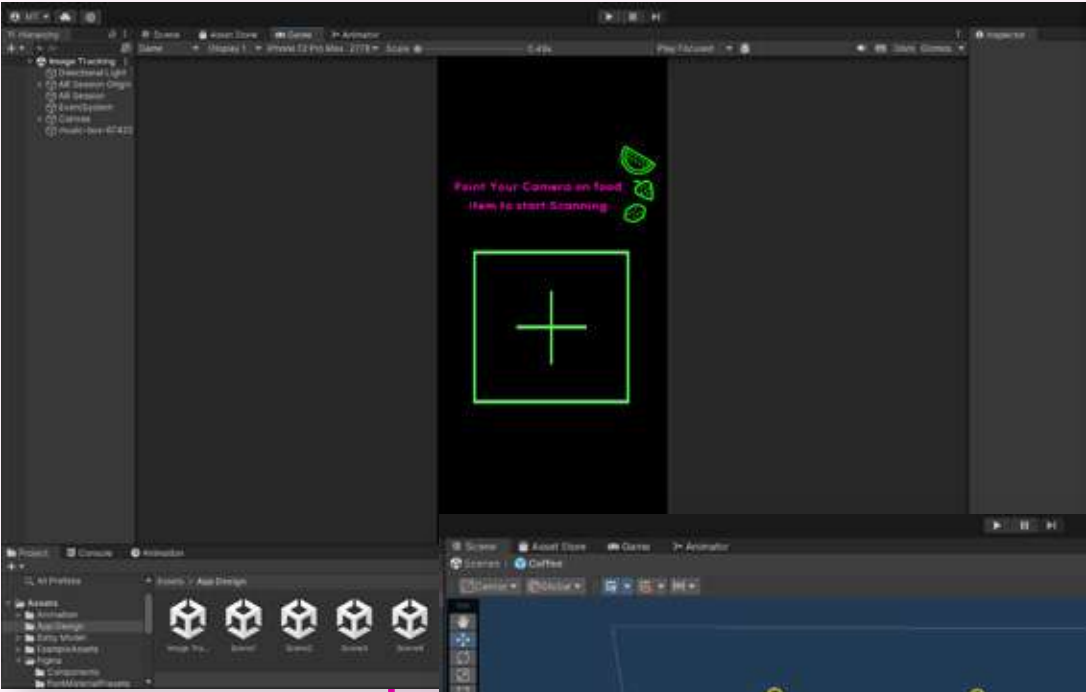
Development: Tools, Software and Plugins





The app interface was initially designed and prototyped in Figma during the ideation process and was subsequently transitioned to Unity for the development of a functional prototype.



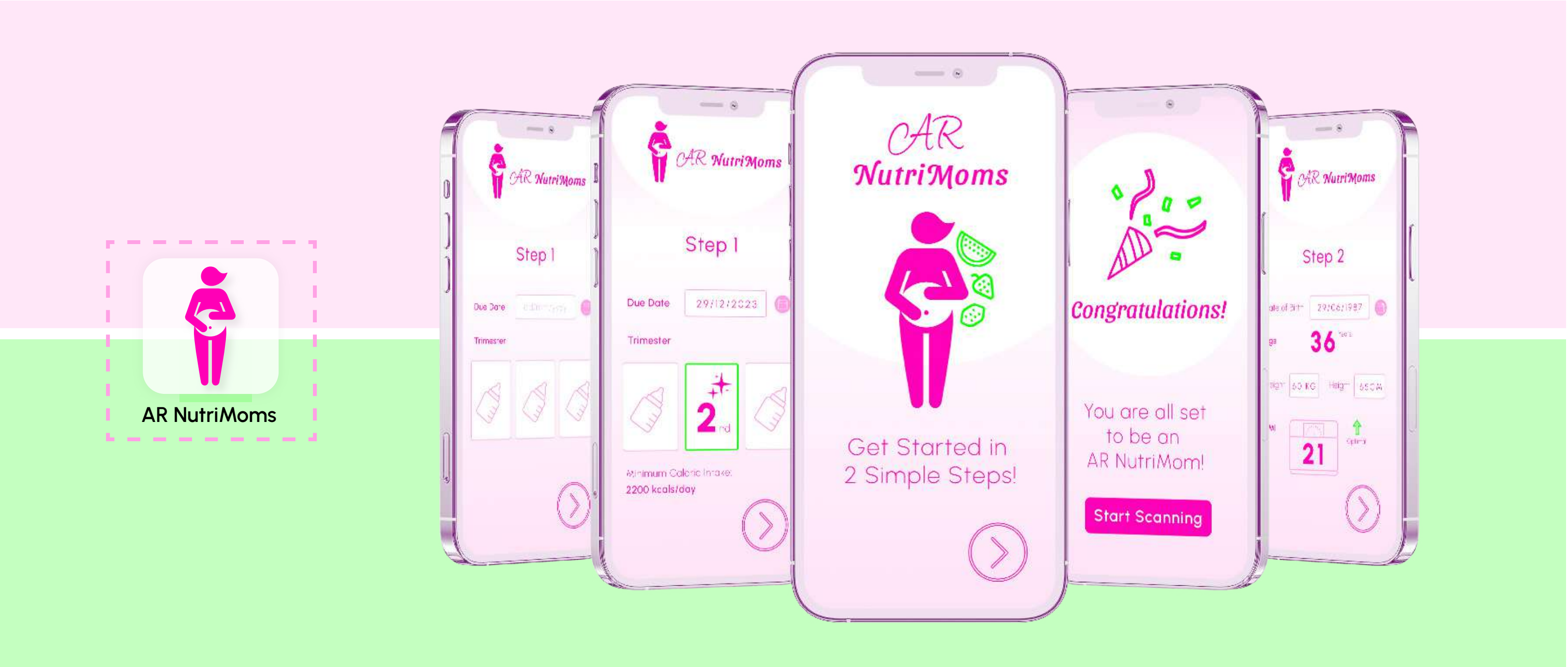


The AR feature of the app was developed in Unity using AR Foundation, incorporating advanced image recognition capabilities for real-time object detection and tracking.

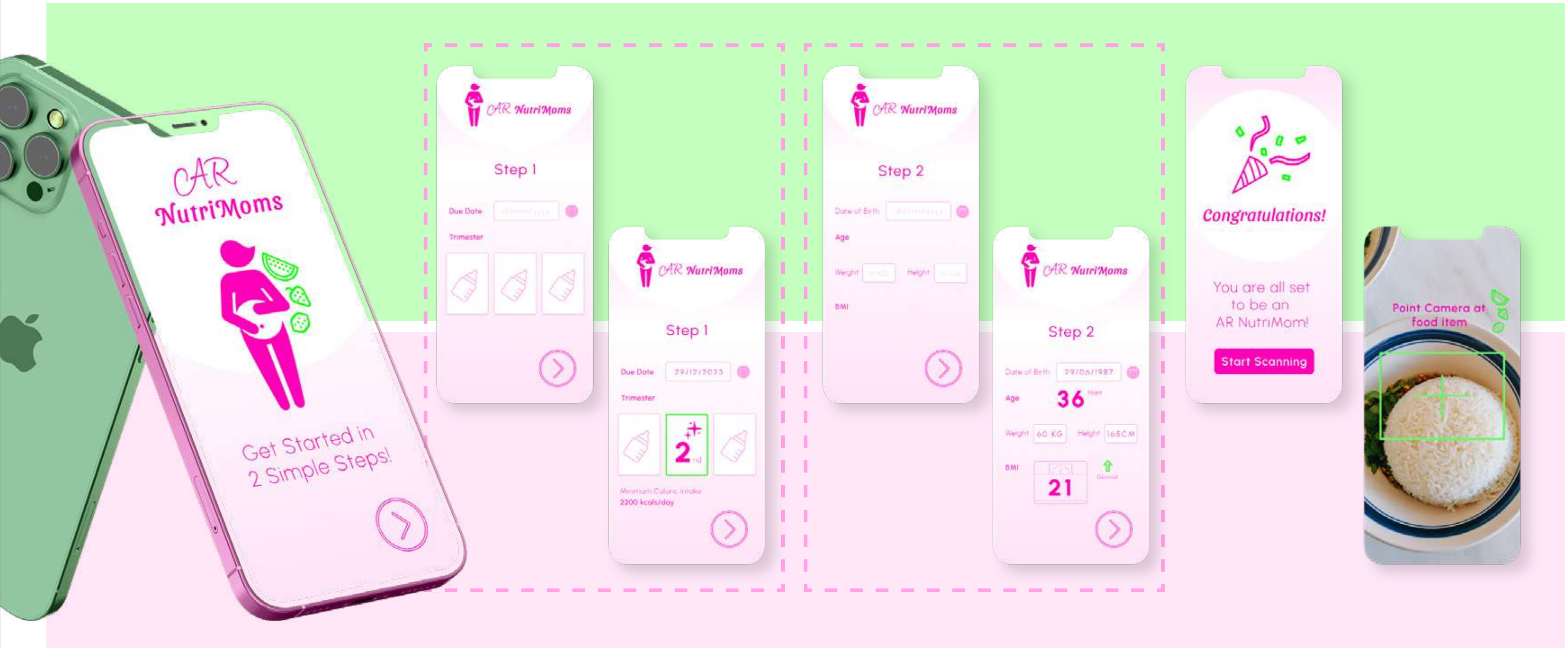


Several C# scripts played a pivotal role in ensuring the functionality and interactivity of the prototype. An intricate script was designed to facilitate image recognition for multiple objects concurrently, each associated with distinct prefabs for overlaying virtual content. This script also ensured that only one prefab remained visible at any given moment when its corresponding image was detected, preventing unwanted overlay persistence when transitioning to a different image. Additionally, separate scripts were employed to introduce sound effects seamlessly into animations and navigation, enhancing the immersive user experience. These scripts collectively contributed to the app's responsiveness and engagement.

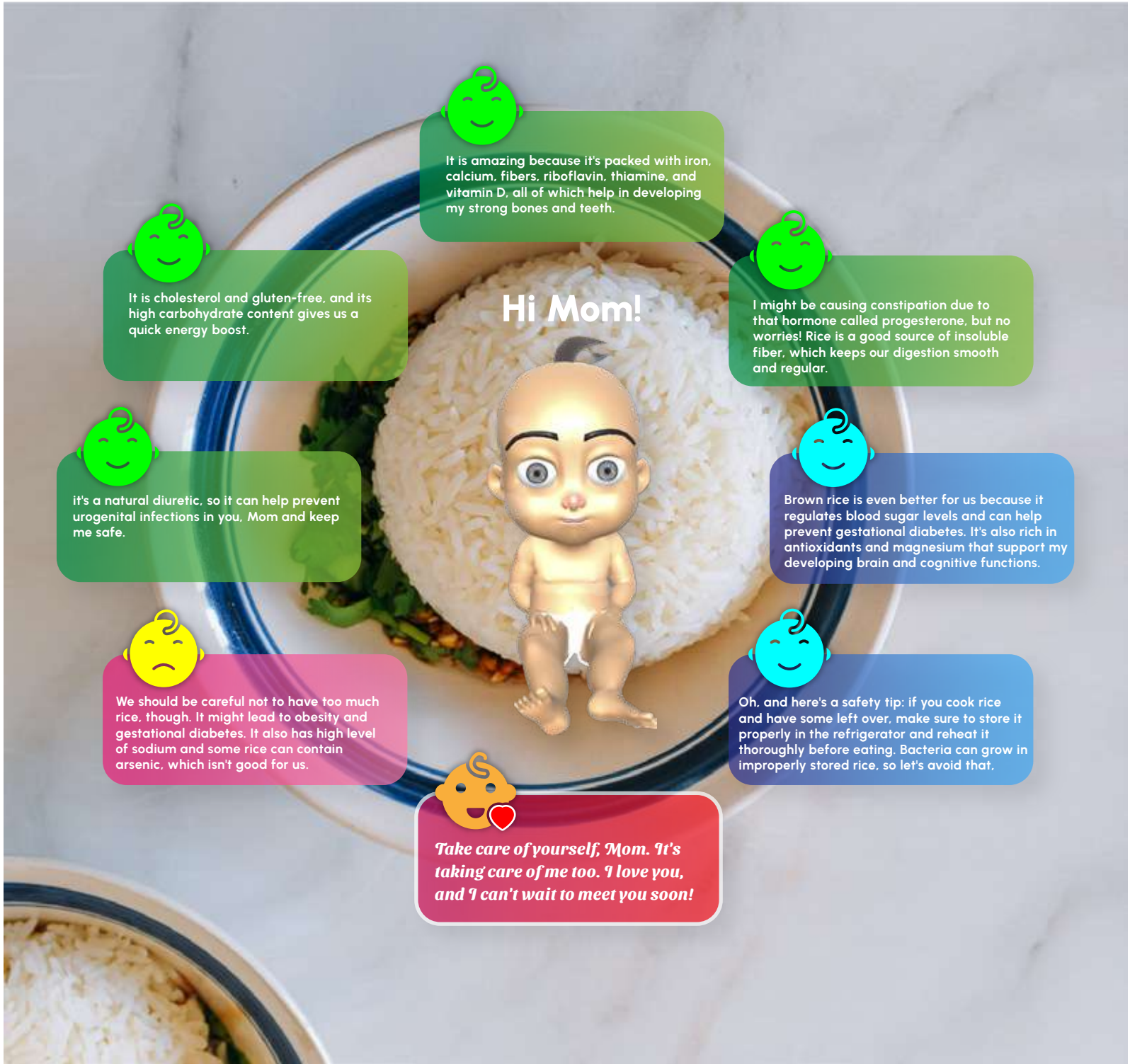
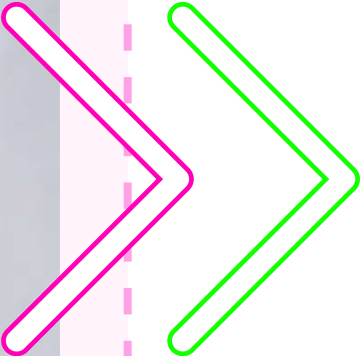
Final Outcome: Visual Design



Final Outcome: Visual Design



Final Outcome: Visual Design



Final Outcome: Visual Design



Final Outcome: Visual Design



Final Outcome: Technical Testing

During the technical evaluation process, a comprehensive testing approach was employed to ensure the quality and functionality of the AR app. Various types of testing, such as image recognition, user interactions, navigations, audio feedback, among others, were conducted. Each test was meticulously executed following predefined test cases, test conditions, and expected results.

The testing process involved multiple iterations and refinements, resulting in approximately 12 builds of the prototype. These builds incorporated enhancements and adjustments based on the findings and feedback from each round of testing. Through this iterative approach, the prototype was rigorously evaluated in all test categories.

The final prototype successfully passed all the tests on 7th August 2023, indicating its adherence to the desired standards and specifications. The technical evaluation process demonstrated the dedication and effort put into ensuring a quality AR experience.

TEST CASE PLANNING AND EXECUTION

TEST TITLE	PRIORITY	TEST CASE ID	TEST NUMBER	TEST DATE
Prototype Testing	High	TC012	012	6.08.2023

TEST DESCRIPTION	TEST DESIGNED BY	TEST EXECUTED BY	EXECUTION DATE
Execute the prototype as intended by the design.	Mallika	Mallika	6.08.2023

TEST DESCRIPTION	TEST DEPENDENCIES	TEST CONDITIONS	TEST CONTROL
This test case aims to validate the usability of AR NutriMoms prototype.	System Connectivity with Smartphone (iphone)	Prototype is installed and running properly.	Ensure no external factors affect the test environment.

STEP ID	STEP DESCRIPTION	TEST DATE	EXPECTED RESULTS	ACTUAL RESULTS	PASS / FAIL	ADDITIONAL NOTES
1	App Launch	6.08.2023	The application opens successfully and the welcome screen is displayed.	The application opens successfully and the welcome screen is displayed with sound and animation.	Pass	
2	Scene navigation	6.08.2023	Evaluate button interactions and audio feedback to navigate through the app screens	Confirm that users can smoothly navigate through the app screens with audio feedback on button taps	Pass	Navigation and button interaction check. A C# script was integrated to add a slight delay in loading next scene on button tap for the sound effect to play.
3	Transition Effects	6.08.2023	Ensure seamless transitions between UI elements	Verify smooth and accurate transitions accompanied by sound effects that provide meaningful feedback	Pass	Animationa and sound check
4	Food Recognition	6.08.2023	Verify that the app correctly recognizes food items	Food recognition for multiple food items in the same scene was not seamless.	Fail	Image recognition test. A C# script was added to enusre seamless tracking of multiple food items at a time.
5	AR Overlay Switch	6.08.2023	Ensure that virtual content overlays seamlessly between different food items	The virtual content overlays successfully between different food items.	Pass	
6	AR Overlay Quality	6.08.2023	Assess the clarity and alignment of AR overlays. objects are correctly positioned, dimensioned and scaled in the camera view.	AR overlay is clear. The objects are correctly positioned, however the dimensions and scales need to be reviewed.	Fail	Multiple iterations of testing were performed for the virtual overlays to attain the intended configurations.
7	3D model and character animation	6.08.2023	Material and textures of the baby model are well adopted and character's animation is smooth and timely.	The 3D model is overlaid accurately and character animation is smooth and timely.	Pass	
8	Sound effects and background music.	6.08.2023	The sound effects and background music play correctly.	All audio play correctly.	Pass	A C# script was used to enable animation event for the sound effects to play for animated transitions

User Evaluation

Sample Selection and Recruitment: The user evaluation process for testing the AR app prototype involved a carefully selected sample of pregnant women and experienced mothers from diverse backgrounds, age groups, educational levels, and occupations in urban India. The recruitment of participants was conducted through remote networking to ensure a representative sample.

Evaluation Method: Qualitative technique was employed for evaluation, using interview method (Muratovski, 2021). These interviews were designed to extract comprehensive feedback from participants, focusing on their experiences, challenges, and suggestions related to the AR application. Open-ended questions encouraged participants to express their thoughts openly, particularly regarding app effectiveness, information relevance, and augmented reality engagement.

Testing Procedure:To maintain ethical standards, informed consent was obtained from all participants, and their privacy and anonymity were safeguarded. The evaluation process involved sharing participant information sheet, participant consent form, video recording of the prototype, interview questions, interview format, and estimated duration of the interview, with the participants before scheduling online interview calls with them. Voice recordings of the sessions were transcribed to analyze key insights and outcomes. In total, 6 individual interviews were conducted, each lasting between 15-30 minutes.

Participants were thanked for their valuable inputs, contributing to the iterative refinement of the AR app prototype for improved effectiveness and relevance in enabling informed food choices during pregnancy.

Faculty of Arts Humanities and Cultures ,School of Design



UNIVERSITY OF LEEDS

Participant Information Sheet

Title: AR NutrMoms

Invitation paragraph

You are being invited to take part in a student project under the MA Programme of Digital Design Futures at the University of Leeds. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether you wish to take part.

What is the purpose of the project?

This project aims to design a mobile AR learning intervention specifically tailored for expectant women in urban areas of India. The primary focus is on improving prenatal nutrition for both the mother and the fetus. By utilising handheld devices, the AR app will enable users to engage with food items within relevant environments, allowing them to access real-time nutritional information, dietary knowledge and recommendations and understand its potential impact on their prenatal health.

Why have I been chosen?

You have been chosen for being part of the research context. This includes your experience, age group, gender, culture, and other demographic characteristics.

Do I have to take part?

It is up to you to decide whether to take part. If you do decide to take part, you will be given this information sheet to keep (and be asked to sign a consent form) and you can still withdraw at any time without it affecting any benefits that you are entitled to in any way. You do not have to give a reason.

What do I have to do? What will happen to me if I take part?

Your involvement in this research should last between 5 to 30 minutes, depending on the settings of this immersive project. Your participation will be for one time only, but you might be asked to respond to online interviews / observation.

The purpose of this evaluation will be around the usability, effectiveness, and relevance of an immersive design experience. The design will be in the form of Augmented Reality. The project will involve your engagement with the experience through learning, viewing, and hearing. Your participation will not consist of your direct interaction with the immersive experience due to location-based limitation. You will be asked to observe a video demonstration of a working prototype that is in line with the main focus of the project. You are not expected to use intensive physical activities or high mental load. You will be asked to assess your level of satisfaction, perception of the experience, usefulness, etc. after you have finished the experience.

The questioning style will encompass a series of open-ended questions, designed to elicit comprehensive feedback from participants regarding their experiences with the AR app. Participants will be encouraged to provide detailed and in-depth responses, particularly when discussing aspects related to app effectiveness, information relevance, and augmented reality engagement. Most of the questions will invite participants to share their thoughts, preferences, and suggestions openly, ensuring a holistic understanding of their perceptions and enabling them to discuss specific topics related to the app's impact on enabling informed food choices during the pregnancy experience.

A specific date will be identified to conduct the online interview by the main researcher. You are required to listen to the instructions provided by the main researcher for you to correctly engage with the immersive experience.

The research methods that will be used in this work will be qualitative method (interviews).

What are the possible disadvantages or risks of taking part?

There are no disadvantages or risks of taking part in this research evaluation.

What are the possible benefits of taking part?

Whilst there are no immediate benefits for those people participating in the project, it is hoped that this work will help the main researcher to achieve his/her research objectives that can help answer real-life problems.

Use, dissemination and storage of research data

Your identity will be kept anonymous. Other personal information, such as age, gender, and experience, will be used to characterise the background of the sample. No direct mention will be made to individual respondent. Your data will be used to help us understand the main factors contributing to your immersive experience. The data will be stored in a password protected folder in a university repository for a maximum period of 3 years.

What will happen to my personal information?

Contact information will not be collected during the course of the research, and if it will be collected, then it will be kept strictly confidential and will be stored separately from the research data. We will take steps whenever possible to anonymise the research data so that you will not be identified in any reports or publications.

What will happen to the results of the research project?

A series of questions will be asked about your familiarity with AR technology in a specific context. Some of the answers you will provide can be used to examine the direct and indirect impact of certain factors on your experience and use of the technology in the future.

The results might be stored in a university repository. There is also a possibility that the results from this work might be submitted for conferences, proceedings, and journal. Your identity or any personal information related to you will not be identified in any report or publication.

The data collected during this project might be used for additional or subsequent research.

What type of information will be sought from me and why is the collection of this information relevant for achieving the research project's objectives?

Information about your age, gender, experience, perceptions, etc. will be collected and used to achieve or answer specific research questions or objectives.

Who is organising/ funding the research?

This work is not sponsored or funded by any parties.

Contact for further information

You can contact the lead researcher if you have any concerns or questions related to this research.

Researcher
Malika Thakur
1.76 Clothworkers' Building Central, School of Design, University of Leeds
s.d22m@leeds.ac.uk

Supervisor
Vanessa Walker
1.76 Clothworkers' Building Central, School of Design, University of Leeds
v.walker@leeds.ac.uk

Note: You will be given a copy of the information sheet and, if appropriate, a signed consent form to keep.

Thank you very much for taking the time to read the information.

Project title	Document type	Version #	Date
AR NutrMoms	Participant information sheet for User Evaluation	1.1	11.08.2023
AR NutrMoms	Participant information sheet for User Evaluation	1.2	15.08.2023

Last updated 15/08/23

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Participant Information sheet and consent form

Faculty of Arts Humanities and Cultures ,School of Design



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Consent to take part in DESN5183M Specialist Project

Add your initials next to the statement if you agree

I confirm that I have read and understand the information sheet/ letter dated [insert date] explaining the above research project and I have had the opportunity to ask questions about the project.

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. In addition, should I not wish to answer any particular question or questions, I am free to decline.

Contact persons:
Malika Thakur
s.d22m@leeds.ac.uk
1.76 clothworkers' Building Central
School of Design, University of Leeds, Woodhouse, Leeds LS2 9JT
Vanessa Walker
v.walker@leeds.ac.uk
1.76 clothworkers' Building Central
School of Design, University of Leeds, Woodhouse, Leeds LS2 9JT
The data will be permanently removed upon withdrawal from the study.

I understand that members of the research team may have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report or reports that result from the research. I understand that my responses will be kept strictly confidential.

I understand that the data collected from me may be stored and used in relevant future research in an anonymised form.

I understand that relevant sections of the data collected during the study, may be looked at by individuals from the University of Leeds or from regulatory authorities where it is relevant to my taking part in this research.

I agree to take part in the above research project and will inform the lead researcher should my contact details change.

Name of participant

Participant's signature

Date

Name of lead researcher

Signature

Date*

*To be signed and dated in the presence of the participant.
Once this has been signed by all parties the participant should receive a copy of the signed and dated participant consent form, the letter/ pre-written consent information sheet and any other written information provided to the participants. A copy of the signed and dated consent form should be kept with the project's main documents which must be kept in a secure location.

Project title	Document type	Version #	Date
AR NutrMoms	Participant Consent form for User Evaluation	1.1	11.08.2023
AR NutrMoms	Participant Consent form for User Evaluation	1.2	15.08.2023

Last updated 11/08/23

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User Evaluation

Interview Instructions

"Hello and welcome! Thank you for participating in my research project. My name is Mallika, and I will be guiding you through this interview process. The purpose of this interview is to gather valuable insights and perspectives on an Augmented Reality (AR) mobile app designed to enhance prenatal nutrition for expectant women in urban India.

Before we begin, I want to assure you that your privacy and confidentiality are of utmost importance. Your responses and personal information will be kept strictly confidential, and any reports or publications will use pseudonyms to protect your identity.

Your participation in this interview is entirely voluntary. If, at any point, you feel uncomfortable or wish to withdraw, please let me know, and there will be no consequences for doing so. Do you understand and consent to participate in this interview?

This interview is expected to last approximately 30 minutes. We will be discussing topics related to app effectiveness, information relevance, and augmented reality engagement.

The questions will be open-ended, allowing you to provide detailed and in-depth responses. Please feel free to share your thoughts, preferences, and suggestions openly. Your insights are incredibly valuable in shaping the research outcomes.

The interview will be audio recorded for accuracy and analysis purposes. The recording will be kept confidential and used solely for research purposes. It will also be transcribed to help us analyze the interview responses. May I have your permission to record this interview?

If you have any questions or concerns after the interview, please don't hesitate to contact me. My Contact Information is available in the information sheet provided to you. I appreciate your willingness to share your experiences and perspectives and I am here to support you throughout this process.

Once again, thank you for your time and participation. Your input is highly valued, and I look forward to a productive and insightful conversation. If you are ready, we can begin the interview."

Interview Questions

1. What were your initial impressions of the AR app?
2. Can you describe the aspects of the app that you found most appealing or interesting?
3. How did you find the augmented reality feature in the app? Was it engaging and valuable for you?
4. How Did you find the information provided by the AR app?
5. How did you find the visuals in the app?
6. Do you believe that using this app would positively influence your food choices during pregnancy? Why or why not?
7. Can you envision the app being useful to other pregnant women in urban India? How likely are you to recommend this app to other pregnant women you know?
8. Would you feel motivated to continue using the app after the initial interaction? If yes, what aspects kept you engaged?
9. Were there any elements that you think could **further** enhance user engagement or enhance the app's value?

Ethical Considerations and limitations

In the evaluation process, ethical considerations play a crucial role in ensuring the well-being of participants and the integrity of the research. While the research aims to gather insights from a diverse group of pregnant women and mothers in urban India, there are certain challenges and limitations that need to be addressed.

The primary ethical concern pertains to cultural sensitivity. Given India's rich diversity with various social and cultural backgrounds, each with its own norms and beliefs, understanding and respecting cultural differences ensures that the evaluation process is inclusive and avoids any unintended offense. Aavoiding sensitive or triggering questions and providing support resources if needed for minimizing potential discomfort to participants

Specifically, we must be mindful not to include participants who may be vulnerable or unable to provide informed consent, such as minors, individuals with cognitive impairments or special needs, however, long-term considerations for app accessibility and inclusivity, especially for individuals with disabilities, would require ongoing improvements.

Due to the remote nature of the target audience, the users were unable to access and interact with the prototype directly on their devices. Instead, they were provided with a video demonstration of the working prototype, and their feedback was gathered through online F2F interviews. As a result, the evaluation primarily centered on assessing the app's effectiveness and relevance, with usability aspects being excluded.

While data privacy is often addressed during the evaluation, long-term data storage and security challenges may not be fully within the scope of testing. Ensuring that user data remains secure, even after the evaluation, requires ongoing attention.

User Evaluation: Analysis

The qualitative analysis of interview data began with the precise transcription of interview recordings, accomplished through the Microsoft Word Transcribe service. Subsequently, a thematic analysis approach was employed to discern recurring themes, involving the annotation of pertinent segments with codes and the creation of thematic categories. The ultimate results were presented in an impartial and objective manner, ensuring a comprehensive comprehension of the findings.

First Impressions

"Very interesting concept!"
"Fabulous, have never seen something like this before. It looks inviting for expectant mothers. It does make you feel like you're entering a high-quality app with a great user experience."
"It's cool! It is definitely a value-add to expectant mothers, whose decisions not only impact them but also the baby."
"I was definitely excited to see what the app has to offer and I think it is great."
"The concept of this app is brilliant. It is definitely something that will help expecting mothers make the right food choices."

Appeal

"Emotional engagement: the lovely message at the bottom of the AR pop up, expecting moms are highly emotional and therefore a sweet encouraging message goes a long way!"
"The fetus addressing the mother. It takes user engagement a step forward as it plays on the psychology of the mother by adding an emotional element."
"It's awesome to see the pop-ups as soon as the food item is recognized, there is a wow factor there for sure."
"The language was simplistic and easy to understand. Liked that there was not a lot of medical jargon used."

Engagement

"Ease of use - just enter basic information and get started by scanning the food item and seeing relevant info about it."
"I also liked that the sign-in was very smooth & it didn't require me to refer a lot to my doctor's notes."
"The AR feature in the app is definitely engaging considering how easy it is to use."
"The pop out of relevant information was very engaging."
"The information shared is so conversational that it doesn't feel like an app giving you cold hard facts, rather that it's guiding you like a friend would! Loved that it's written from the pov of the child!"
"I also liked the baby's expressions when moving from one food item to the next!"
"The nature of information, the way it articulated and the visual AR kept me engaged"

Relevance

"The information is helpful. One overarching takeaway is that ANY food item has both positives and negatives. The information shared is balanced and allows one to make an informed decision on whether or not to consume the food item and if so, how much"
"The information provided for the items was very comprehensive and easy to understand."
"It helps me gather all relevant data points wrt my food habits & helps me make informed choices."
"All the information that one could need is easily available. It saves the effort of having to look for specific information one at a time."
"In addition to information about the item in focus, the suggestion of a healthier alternative with basic information about it is something I think is very helpful when it comes to making choices."

Visuals

"The color-based recommendations are a great idea. However, the color of the baby's dialogue bubble at the bottom of the page should be marked in a different color/style to avoid confusing it with the rest of the content."
"The color markers for the positive and negative aspects are helpful too; at just one glance you can know whether the product in question is safe for consumption or not."
"The colour codes - green for the positives/advantages and red for the negatives/advantages were clear. perhaps all 'tips' with respect to how much to consume can be a different colour code. Similarly, the sweet message for moms would be a different call out to separate it from the food facts."
"The content needs to be more concise as it is quite verbose."

Effectiveness

"This app helps break some myths of food items that an urban Indian woman would already be eating as part of her diet."
"Pregnant woman has trust issues and has very less time, patience and energy. For her to be influenced, she would need to understand the basis of the research behind the information that is portrayed in the app."
"We tend to rely a lot on google/online information so if this is able to give the right kind of information, will be very helpful. If it is certified by a gynae, even better."

Usefulness

"Pregnancy is the time I was most mindful of what I eat and drink. I often had to research foods and ingredients online in the context of my pregnancy to gauge whether I should have it, why/why not and if so how much. This is a resourceful one-stop-shop for such information. The best part is that I can scan packaging and get the information instantly!"
"As a new mom - I have had to do multiple google searches on all food items - just to be sure that it was healthy for the baby & me. Sometimes - I wouldn't even know the name of the dish & that also caused anxiety in everything I ate. This app reduces that back & forth significantly & would add greatly aid any new/expectant mom. I wish I had this when I was expecting!"
"Expecting mothers usually have to search online for information that is not always very accurate, and different links often have contradictory information."
"I wish I had a similar app during my pregnancy. But now, this would also help me in my new mom journey. There's a ton of information out there, but this also helps me to understand what I can or can't eat, especially as my baby is dependent on me for breast milk."
"The app would be extremely useful to other pregnant women, as it is tedious to have to keep researching nutritional value of foods online. It isn't practical to keep checking every food/ingredient with your doctor. Often one has to rely on friends/family suggestions which may not be accurate or backed by facts, this app provides well researched data on nutrients and its effects."

Motivation

"User-friendly and interactive features. Some glimpse of personalization and reliability."
"The simplicity & the convenience of using this app would keep me motivated to continue using it. It would be great if we could extend this to not just pre-natal & new moms but also to people who are planning to lose weight."
"The app definitely builds curiosity in one's minds and motivates further engagement and interaction."
"Not only is the UI incredibly easy to navigate, the AR bit bring to life all our concerns & becomes a one-stop shop to answer all our queries."
"This saves me a ton of time & effort and makes my life really smooth. At least, I wouldn't have to do a 30-minute google search, only to finally eat half-heartedly!"
"Usually looking at labels and back of packs for such information entails reading complicated tables and straining to look for information amidst a lot of details shared by manufacturers. The AR feature makes it engaging and easy to comprehend."

User Evaluation: Key Insights



First Impressions

- Participants found the app's concept interesting and valuable for expectant mothers.
- The app's user experience and inviting design were appreciated.
- Users felt excited and impressed with the app's potential to aid food choices during pregnancy.



Relevance

- Users found the information helpful, emphasizing a balanced view of food items.
- Comprehensive and easily understandable information was appreciated.
- The app saved effort by providing all relevant data in one place.
- Suggesting healthier alternatives was deemed helpful.



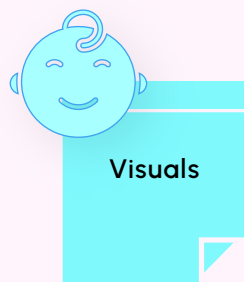
Usefulness

- The app was considered a resourceful tool for pregnant and new mothers, reducing the need for online research.
- Participants wished they had such an app during their pregnancies.
- The app's potential to provide accurate nutritional information was acknowledged.



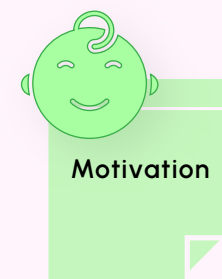
Appeal

- Emotional engagement through personalized messages, especially from the fetus, was a key highlight.
- The immediate pop-ups upon food recognition added a "wow factor."
- Simplistic language and the absence of medical jargon were liked.



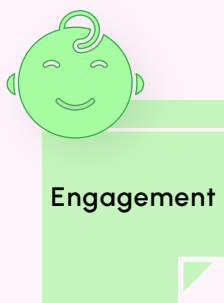
Visuals

- Color-based recommendations and markers for positive and negative aspects were deemed clear.
- Recommendations included marking the baby's dialogue bubble differently.
- A callout for sweet messages and concise content were suggested.



Motivation

- User-friendliness, convenience, and engagement motivated users to continue using the app.
- Extending the app's utility to individuals planning weight loss was suggested.
- The app's ability to make information easily comprehensible and accessible was highlighted.



Engagement

- Participants praised the app's ease of use and smooth sign-in process.
- The AR feature was engaging due to its simplicity.
- Conversational information delivery made users feel guided and engaged.
- The baby's expressions and visual AR elements contributed to engagement.



Effectiveness

- The app was effective in dispelling food myths and offering trustworthy information.
- Users emphasized the importance of understanding the research behind the app's information.
- Certification by healthcare professionals was seen as a valuable addition.



Future Work

- Address visual clarity issues for improved user experience.
- Maintain trustworthiness through certification by healthcare professionals.
- Explore personalization options and potential expansion into postnatal phase and other user segments.
- Leverage motivational aspects to encourage sustained engagement.

User Evaluation: Conclusion

The results from the interview evaluation highlight several key insights into the AR app's performance.

Participants found the concept of the app to be highly appealing, noting its potential to assist expecting mothers in making informed food choices. The emotional engagement and personalized messages from the fetus were particularly praised for their effectiveness. Users appreciated the app's ease of use and engagement factor, emphasizing the convenience of scanning food items for nutritional information. The app's relevance in providing comprehensive and balanced information, as well as suggesting healthier alternatives, was acknowledged.

Regarding visuals, participants commended the color-coded recommendations but suggested distinguishing the baby's dialogue bubble to prevent confusion. They found the color markers for positive and negative aspects helpful. However, they recommended different color codes for tips and sweet messages.

Participants highlighted the app's effectiveness in dispelling common food myths during pregnancy. Trustworthiness, certification by healthcare professionals, and the app's ability to provide accurate information were noted as crucial factors for user influence.

The app's usefulness was highly appreciated, especially as a resourceful one-stop-shop for nutritional information during pregnancy and new motherhood. Participants wished they had access to such an app during their pregnancy journeys, emphasizing its potential to ease the anxiety associated with food choices.

Motivation to use the app stemmed from its user-friendly and interactive features, convenience, and potential for personalization. Participants expressed a desire to extend the app's utility to individuals planning weight loss.

In conclusion, the evaluation results indicate a positive response to the AR app's concept, engagement, relevance, effectiveness, and usefulness. To enhance the app further, it is recommended to address visual clarity, maintain trustworthiness through healthcare professional certification, and explore opportunities for personalization and expansion into other user segments. Additionally, the app's motivational aspects should be leveraged to encourage continued engagement.

In the future, the AR app aims to elevate its functionality by expanding its food database to include images and comprehensive nutritional information. This expansion will involve a diverse range of food items from various cuisines and regions, ensuring relevance to a broad user base. Advanced algorithms and information systems will be developed to personalize the AR overlay, taking into account individual user profiles, such as due dates, weight, height, and trimester. This personalization will provide real-time, tailored recommendations for expectant mothers, making the app an invaluable resource for making informed dietary choices during pregnancy, thus benefiting both mother and baby.

Potential limitations and ethical concerns for future implications include the need for ongoing content updates to reflect evolving nutritional guidelines, ensuring unbiased information, and addressing cultural and regional variations in dietary practices. Ethical considerations involve protecting user privacy and data security, as well as addressing any potential commercial interests that may influence the app's content.

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To access Prototype

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