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*Review Article*

# IoT Smart Jar: A Study on Consumer Willingness, Price Sensitivity and Adoption Potential

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***ABSTRACT:*** ***In today's technology-driven era, the IoT Smart Jar has transformed kitchen inventory and dietary management through advanced IoT technologies for real-time food monitoring. This innovation enhanced efficiency, supported healthier eating, and streamlined grocery management. This study aimed to assess consumer willingness to use the IoT Smart Jar for diet and nutrition management, as well as kitchen inventory management. Additionally, it evaluated price sensitivity and consumers' willingness to pay for the product. A structured survey gathered 202 valid responses from a diverse demographic. The data was analyzed using SPSS and Statista. Findings suggested a strong interest in inventory management features, with a smaller segment focused on health-related functionalities. Price sensitivity indicated that most consumers were willing to pay ₹10,000 to ₹15,000 for a set of 10 jars. The results suggested that the IoT Smart Jar should balance affordability with advanced features to appeal to a broad consumer base. Overall, the IoT Smart Jar showed strong potential, particularly among younger, busy individuals seeking convenience and efficiency in managing both their kitchen and health. The findings provided valuable implications for product development, marketing strategies, and pricing models, ensuring the IoT Smart Jar met consumer needs and maximized market potential.***

***KEYWORDS:*** ***Internet of Things, IoT Smart Jar, Smart Kitchen, Diet and Nutrition Management, Kitchen Inventory Management.***

## INTRODUCTION

In today's fast-paced world, technology has become an essential tool for enhancing convenience, efficiency, and connectivity in our daily lives. The IT industry, a dynamic and expansive field that offers services and products related to computing, networking, software, and hardware. Known for its rapid growth and constant innovation, this sector drives many of the technological advancements shaping our world today. Companies in the IT industry provide a wide range of services, from consulting and technical support to software development and infrastructure solutions.

The Internet of Things (IoT) industry in India is expanding rapidly, driven by advances in connectivity and the increasing adoption of smart devices. IoT technology, which connects devices, senses, analyzes data, and allows them to communicate and exchange data over the internet, is now making a significant impact across sectors like healthcare, agriculture, transportation, and manufacturing. This trend is driving demand for IoT solutions as industries

recognize the value of IoT in streamlining operations, cutting costs, improving customer experiences, and using resources efficiently. In India, home automation is experiencing robust growth as more homeowners embrace technology to bring convenience and efficiency to their living spaces. This sector offers products like smart lighting, automated security, energy management systems, and entertainment solutions that enable homeowners to control and monitor their homes remotely via IoT using smartphones, tablets, sensors, or voice commands, enhancing both comfort and security (Rao, 2021).

In today's busy world, people are often so absorbed in work and packed schedules that managing household tasks can become challenging. Working individuals, especially women balancing multiple responsibilities struggle to keep track of essential kitchen items, as the kitchen has become one of the least visited rooms in the home (Rao, 2021; Balaji *et al*., 2020). For those who already find it difficult to make time to cook, keeping tabs on grocery supplies can feel even more overwhelming. This often leads to wasted time on ordering and checking what's left in the kitchen, adding unnecessary hassle to their day (Rao, 2021). Manually tracking household inventory, like groceries, is often time-consuming, inconvenient, and prone to inaccuracies (Khan, 2024). Traditional methods, such as keeping lists or relying on memory, can lead to errors, missed items, and the inefficiencies of repeated trips to the store. The issue arises from the inefficient use of time and the tendency to forget to restock groceries (Agarwal *et al*., 2018; Balaji *et al*., 2020). One innovative product is the IoT Smart Jar, which aims to revolutionize kitchen management by automating inventory tracking and supporting dietary and nutrition monitoring. The IoT Smart Jar aims to solve this by introducing a "Smart Jar" concept, which significantly reduces the time people spend managing their grocery supplies (Agarwal *et al*., 2018). This emerging tool can enhance daily life by making household tasks easier and more efficient.

IoT Smart containers offer an efficient way to monitor food consumption in households. With mobile phones and tablets now common in homes, these devices can easily connect to smart containers, helping families manage food budgets and track dietary habits (Pila *et al*., 2017). This concept extends well beyond the kitchen, with versatile applications in areas such as smart garbage bins for smart cities and smart drips in healthcare. It also holds potential for broader use in smart homes, the chemical industry, and businesses like grocery shops, supermarkets, malls, and food chains, including family-owned restaurants, which could benefit from the technology to track inventory efficiently, improve restocking, and streamline operations (Agarwal *et al*., 2018; Balaji *et al*., 2020; Chopade & Nighot, 2019; Palanisamy & N, 2021; Pila *et al*., 2017; Sundaravadivel *et al*., 2018).

The IoT-based Smart Jar system utilizes a range of innovative technologies to monitor and manage contents in real time. The researcher employed the "NodeMCU ESP8266 module and an ultrasonic sensor" to track the exact percentage of contents in a jar. This sensor emits Ultrasonic waves that travel to the contents' surface, reflect, and are received by the sensor to calculate the jar's fill level using a speed and time-based formula, comparing this with the jar's total length to provide an accurate fill percentage (Rao, 2021). Another researcher utilized an AI model. By integrating "piezoelectric and ultrasonic sensors with a Microcontroller Unit (MCU) and a GPRS-based communication module A single MCU and GPRS interface can monitor multiple jars, effectively lowering both system complexity and cost (Agarwal *et al*., 2018). Further, proximity sensors can connect to an MCU that transmits data remotely to a PC or mobile device using Bluetooth technology or sub-1 GHz (Pila *et al*., 2017). In some systems, a live video analysis technique captures real-time images of contents, providing an additional

layer of accuracy and detail (Balaji *et al*., 2020; Sundaravadivel *et al*., 2018). Moreover, the system is designed to be environmentally friendly, operating on low power and using rechargeable batteries to minimize energy consumption and environmental impact (Rezwan *et al*., 2018).

The IoT-enabled Smart Jar offers multiple advantages, including reduced time and human effort in managing kitchen inventory, which is especially valuable in today's busy lifestyles. By utilizing IoT technologies to track food levels, the Smart Jar system promotes efficient resource usage and enables better capital budgeting, benefiting households and businesses (Agarwal *et al*., 2018; Rao, 2021). The IoT Smart Jar serves as an innovative dietary management tool for tracking food levels and consumption. It helps users monitor their nutritional intake, making it easier to adhere to healthy eating habits and manage dietary needs. Through real-time data and alerts, it supports better food budgeting, ensuring balanced nutrition and efficient use of resources. This is particularly beneficial for individuals managing chronic conditions or aiming to improve cardiovascular health (Javadi *et al*., 2018; Khan, 2024; Pila *et al*., 2017; Sundaravadivel *et al*., 2018).

This study aims to explore the potential of the IoT Smart Jar as both a dietary management tool and a kitchen inventory management product, assessing consumer interest, price sensitivity, and overall willingness to adopt such technology. In the near future, homes will be increasingly integrated with sensing and interactive technologies, creating new multimedia experiences that extend beyond traditional devices like smartphones, computers, tablets, or TVs. These experiences will seamlessly blend into our daily lives, making it easier to interact with our surroundings (Shiny Christobel *et al*., 2021).

Therefore, this research will help define target segments and refine marketing strategies, emphasizing relevant features such as nutrient tracking and inventory notifications. The insights gained will guide feature prioritization, product positioning, and identifying user education needs to facilitate adoption. Additionally, examining price sensitivity and willingness to pay will inform the pricing strategy, potentially employing tiered options or subscription models to balance affordability with premium functionality. Together these insights will drive strategic decisions, ensuring the product meets consumer needs and aligns with their value perceptions.

## LITERATURE REVIEW

Pila *et al*. (2017) suggested that smart containers offered an effective way to monitor household food consumption, promoting better food budgeting and dietary habits. With widespread access to mobile devices, these containers can easily connect to track inventory levels and automatically notify users of low stock. By utilizing proximity and ultrasonic sensors, food type and quantity data were relayed to an MCU and then transmitted information via Bluetooth or sub-1 GHz signals to mobile devices or PCs. This technology found applications not only in smart kitchens for managing food stocks but also in broader contexts such as supply chain monitoring in supermarkets and grocery stores, inventory tracking in chemical industries, and governmental oversight of food stocks.

Agarwal *et al*. (2018) addressed the time-consuming task of grocery replenishment by introducing a "Smart Jar" concept aimed at optimizing routine grocery management. By leveraging an AI model integrated with piezoelectric and ultrasonic sensors, as well as an MCU with a GPRS communication module, multiple jars were able to efficiently connect to a single

interface through a multiplexer, minimizing both cost and complexity. This system benefited consumers by saving valuable time and aided shopkeepers in material planning and capital budgeting.

Javadi *et al*. (2018) addressed the challenges of poor nutrition and its link to chronic diseases, which could be better managed with effective dietary monitoring, thus highlighting the limitations of existing dietary tracking methods, which relied on self-reporting and were often inaccurate. This paper explored the uses of Internet of Things (IoT) technologies to gather accurate nutrition intake data. While wearable sensors offered a potential solution, their limitations in real-life settings made them less effective. Therefore, the study focused on environmental sensors as a more practical approach to monitoring nutrition intake.

Rezwan *et al*. (2018) stated that the Smart Kitchen Inventory Management System was an IoT-based solution designed to streamline the management of kitchen, restaurant, and medicine inventories. It notified users when stock levels were low and could automatically reorder items or allow users to place orders manually through the SIMS app. Additionally, users could track spending, order status, and order history via a website. Despite its advanced features, SIMS was cost-effective and eco-friendly, using minimal power and rechargeable batteries. This system not only simplified grocery shopping but also functioned as a reminder for users to reorder items before running out.

Sundaravadivel *et al*. (2018) introduced "Smart-Log," an IoT-based automated nutrition tracking system aimed at enhancing diet monitoring as part of smart healthcare. The rise of IoT has enabled the development of intelligent systems across various sectors, contributing to advancements in smart cities, healthcare, and lifestyle management. In healthcare, IoT facilitated remote assistance and improved quality of life through innovations in nutrition monitoring and diet management. By building on prior research, Smart-Log advanced methods for designing, implementing, and evaluating solutions in diet and nutrition management, supporting a healthier lifestyle through continuous ingestive monitoring.

S. D. Chopade and M. K. Nighot (2019) presented an IoT-based prototype designed to monitor grocery levels in homes and supermarkets using a wireless device network. The system tracked food consumption patterns by sensing the weight of kitchen storage containers, providing valuable data on pantry ingredient availability. This data provided valuable insights into consumption trends, helping chefs and households predict inventory needs and replenish stock promplty. The system also alerted users when ingredients were running low and suggested recipes based on the available items, facilitating better grocery management and efficient meal planning.

Balaji *et al*. (2020) traced the concept of smart devices back to 1982, noting that effective food inventory management remained a critical challenge for restaurants, families, and food chains. Smart kitchen solutions allowed daily tracking of container levels and notified users when products were low, helping prevent oversights in grocery shopping. This approach was especially beneficial for busy individuals, such as working women, who needed reliable grocery management. Additionally, data collected from users assisted sellers and manufacturers in analyzing sales and product flow. By leveraging live video analysis to capture real-time container levels, the system automatically compiled a shopping list when items reached a set threshold, sending alerts to users through a mobile application.

S. Palanisamy and N. Saranya (2021) focused on a smart monitoring system for managing groceries in large kitchens and retail stores, such as restaurants and stores, using IoT

technology. The system was cost-effective and user-friendly, helping users organize grocery shopping, save time, and reduce costs. It monitored grocery storage, detected spoilage early, and sent notifications when stock was low. Future enhancements could have allowed users to place orders directly through the system. Additionally, this model could be applied to grocery stores, supermarkets, fruit & vegetable shops, monitoring waste bins and water tank levels.

Rao (2021) addressed the challenges of managing kitchen inventory in today's busy lifestyle, where people often struggle to track grocery items due to limited time and attention. IoT technology offers a solution by enabling smart devices to monitor and manage kitchen contents, reducing human effort & costs, and improving data collection and resource utilization. IoT ecosystem connected devices like smartphones, sensors, and tablets to monitor data and send alerts. However, a disadvantage was the need for a frequent internet connection to function properly. A notable example was the IoT-based Smart Jar, which used a NodeMCU ESP8266 module and an ultrasonic sensor to track the exact quantity of contents in a jar. The sensor calculated the distance based on emitted sound waves, providing real-time information on the jar's fill level, accessible remotely via the internet.

Khan (2024) examined the design, implementation, and impact of IoT-enabled Smart Nutrition Monitoring Systems for dietary management, focusing on improving adherence to healthy eating and supporting individuals with chronic conditions. Traditional dietary monitoring, such as food diaries, was often inaccurate and tedious, whereas IoT-driven systems offered a streamlined, precise alternative. These systems empowered individuals to better understand their nutritional needs by tracking sodium intake and blood pressure, especially those managing cardiovascular health. Despite challenges like data security and device interoperability, IoT-enabled nutrition systems showed strong potential to transform dietary management, promoting healthier, happier lifestyles.

## OBJECTIVES

1. To assess consumer willingness to use the IoT Smart Jar as a tool for diet and nutrition management or as a kitchen inventory management product.
2. To evaluate price sensitivity and consumer willingness to pay for the IoT Smart Jar.

## METHODOLOGY

The study employed a primary data collection approach to explore consumer interests and willingness to pay for the IoT Smart Jar. A structured survey questionnaire was designed, focusing on consumer awareness, perceived utility, and price sensitivity. The survey was distributed online via social media platforms, targeting a diverse group of potential consumers aged between 18 and 65. The respondents represented a broad demographic range, including individuals with varying income levels, employment statuses, and lifestyles, to ensure comprehensive feedback from potential users of the IoT Smart Jar. Data was collected from March 15, 2023, to June 30, 2023. By the end of the collection period, a total of 202 valid responses were obtained.

The collected data was analyzed using SPSS and Statista software to perform statistical analyses and derive insights into consumer preferences, price sensitivity, and overall interest in the IoT Smart Jar. SPSS (Statistical Package for the Social Sciences) was used to conduct descriptive statistics, while Statista was employed to complement the SPSS analysis by providing industry-specific benchmarks and visualizing data through charts and graphs.

## RESULTS AND DISCUSSION

1. Consumer willingness to use the IoT Smart Jar as a tool for diet and nutrition management or as a kitchen inventory management product.

The market research results provided valuable insights into consumer preferences regarding the IoT Smart Jar's potential applications as shown in figure 1. A significant portion of respondents (42%) showed interest in using the IoT Smart Jar product primarily as a kitchen inventory management app, suggesting strong demand for features that helped track and manage food supplies. In contrast, 14.85% of participants were more inclined to use the IoT Smart Jar as a diet and nutrition management tool, indicating a smaller but notable interest in health and wellness-related functionalities.

Additionally, 21.29% of participants expressed interest in leveraging the IoT Smart Jar for both inventory and diet management purposes, highlighting the appeal of a multifunctional device that addresses both practical and health-conscious needs. However, 21.78% of respondents indicated no interest in using the IoT Smart Jar for either of these purposes, reflecting a segment of the market that may require further engagement or different product features to drive interest.

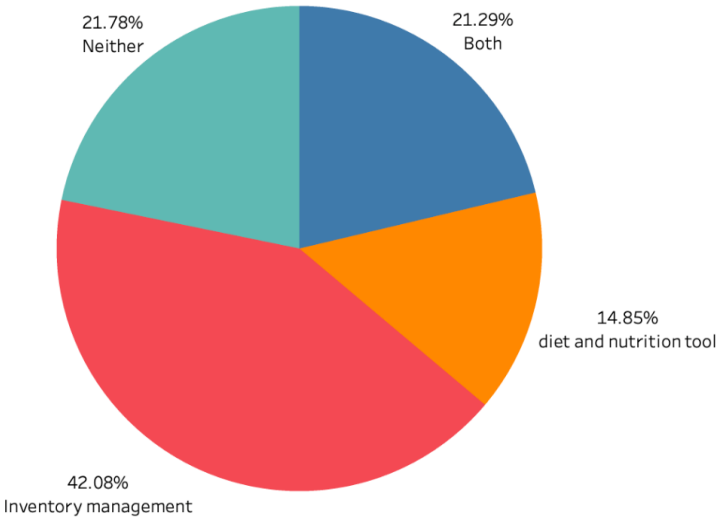


**Figure 1: Represents consumer interest in iot smart jar applications**

2. Price sensitivity and consumer willingness to pay for the IoT Smart Jar.

As shown in Figure 2, a significant majority of respondents (64.85%) indicated a willingness to pay between ₹10,000 and ₹15,000 for a set of 10 jars, including the accompanying application. This suggests that this price range is acceptable and aligns with consumer expectations for value.

In contrast, 15.35% of the sample expressed a willingness to pay between ₹16,000 and ₹20,000 for the same set of jars, indicating a smaller segment of consumers open to a higher price point for additional features or perceived value. Meanwhile, a minority of respondents expressed interest in a price lower than ₹10,000, reflecting a segment of the market that may be more price-sensitive or looking for budget-friendly options. Overall, these findings illustrate varying levels of price tolerance among consumers, highlighting the importance of pricing strategy in the successful marketing of the IoT Smart Jar.

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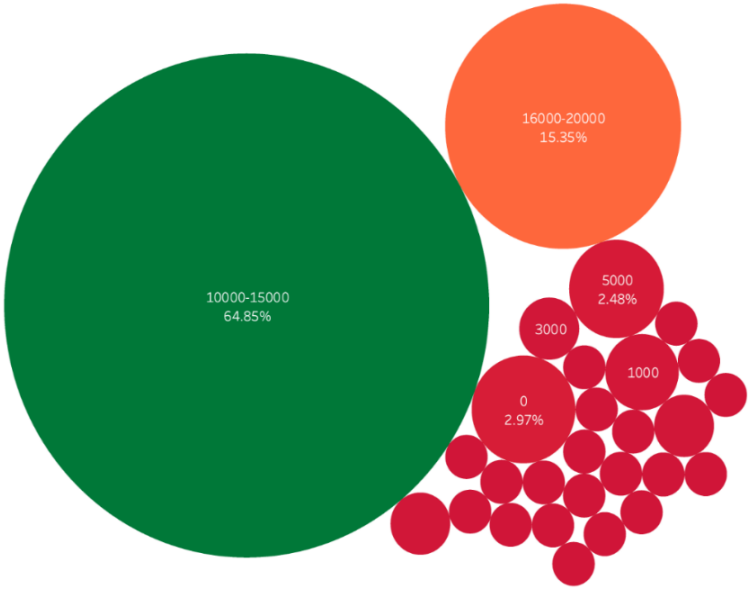


**Figure 2: Price sensitivity and consumer willingness to pay for the IoT smart jar**

*Demographic Profile of Respondents*

The demographic profile of the respondents provides critical insights into the characteristics of the study sample, which can influence consumer preferences and behaviors regarding the IoT Smart Jar. The analysis reveals a diverse range of characteristics among participants, reflecting various genders, age groups, grocery purchasing habits, employment statuses, and Annual Income.

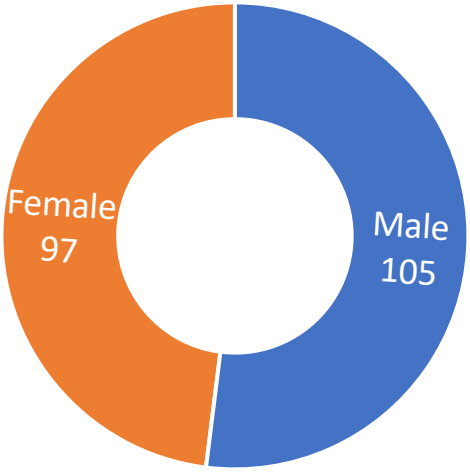


**Figure 3: Gender distribution**

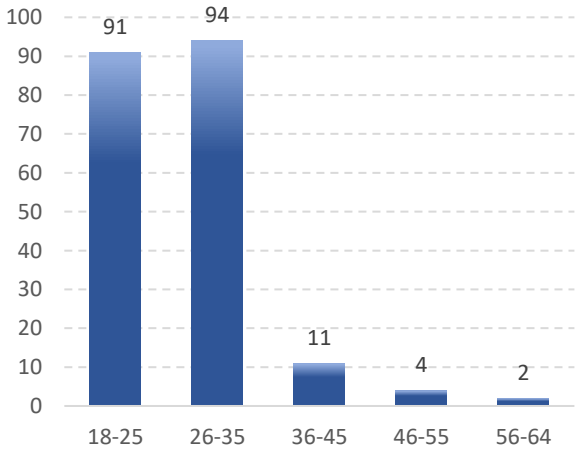


**Figure 4: Age distribution**

Gender Distribution: The sample consisted of 105 males and 97 females (Fig. 3), providing a balanced representation that allows for a comprehensive analysis of consumer preferences across genders.

Age Distribution: The age distribution of respondents revealed that most participants were relatively young, with 91 individuals aged 18-25 and 94 aged 26-35. In contrast, fewer respondents were in the older age brackets (Fig. 4). This predominantly young demographic suggests a potential market for innovative kitchen solutions that appeal to tech-savvy and health-conscious consumers.

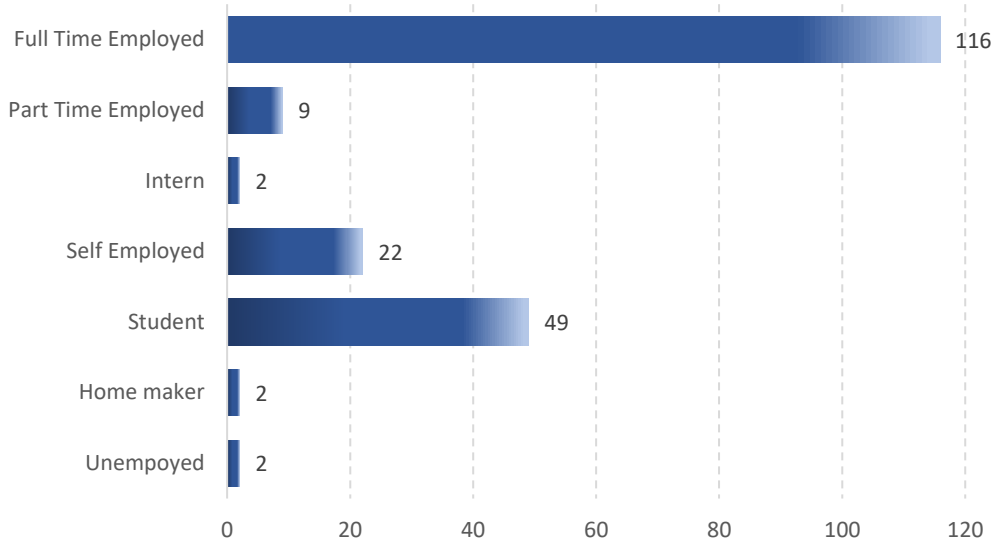


**Figure 5: Employment Status**

Employment Status: The employment status of the participants indicates a diverse workforce. The majority of respondents were full-time employed, with a variety of other employment statuses represented in (Fig. 5). This distribution highlights a predominance of working individuals, which may impact their purchasing decisions.

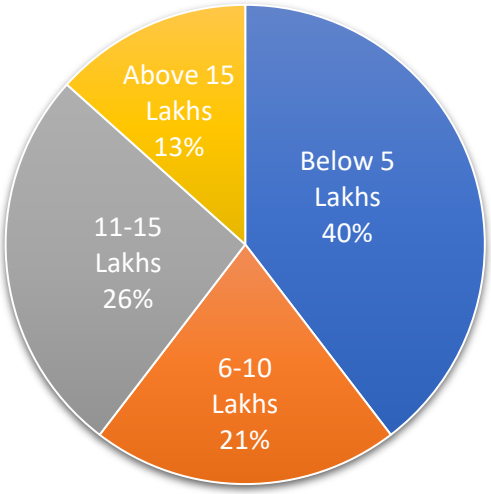


**Figure 6: Annual income**

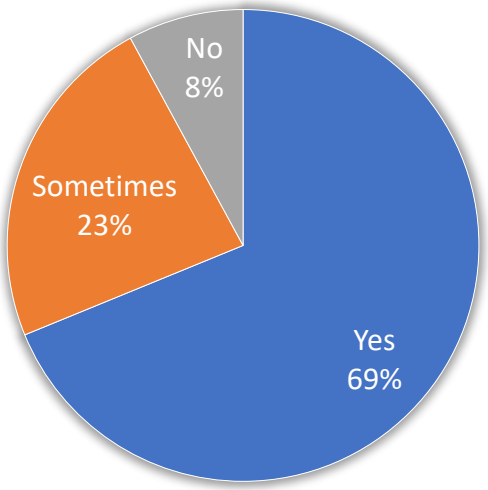


**Figure 7: Grocery purchase habits**

Annual Income: The annual income distribution of the respondents further contextualizes their purchasing power. The majority of participants reported an income below five lakhs (80 individuals), followed by those earning between 11 and 15 lakhs (53) and a diverse economic background among other participants, which may influence their willingness to pay for products like the IoT Smart Jar (Fig. 6).

Grocery Purchasing Habits: A significant number of respondents regularly buy groceries, with a small percentage indicating they do not (Fig. 7). This strong inclination suggests that the IoT Smart Jar may appeal to a substantial consumer base.

## CONCLUSION

In a nutshell, the study highlighted diverse preferences and price sensitivities of potential consumers for the IoT Smart Jar, revealing insights into its dual-purpose appeal for kitchen inventory and diet management. The findings indicate a strong interest in inventory management features, with 42% of respondents prioritizing this application, while a smaller yet significant segment (14.85%) is inclined toward health focused functionalities. Price sensitivity results reveal that the majority of consumers are willing to pay between ₹10,000 and ₹15,000 for a set of 10 jars, aligning with mid-range pricing expectations, while a smaller segment is open to paying more for additional features.

The demographic analysis further revealed valuable insights into the target market for the IoT Smart Jar. With a predominantly young and tech-savvy consumer base, the product is well-positioned to appeal to individuals who are both health-conscious and comfortable with technology. Most respondents are employed full-time, highlighting the potential appeal of the IoT Smart Jar for busy professionals looking for time-saving solutions in their daily routines. Additionally, the varied income distribution suggests that the product should cater to a range of price points, balancing affordability with advanced features. This diverse demographic is also characterized by regular grocery purchasing habits, which aligns with the product's utility in kitchen management. Collectively, these factors indicate that the IoT Smart Jar has strong potential to meet the needs of a broad consumer base, particularly among younger, working individuals who value convenience, health, and efficiency in managing their households.

The study's findings provide strategic guidance for market positioning, emphasizing the need for a balanced pricing strategy and targeted features to maximize adoption among varied consumer groups. However, the study has several limitations. First, online surveys distributed via social media may have introduced sample bias, as it primarily captured responses from younger, tech-savvy individuals, potentially excluding older or less digitally engaged demographics, which may affect the generalizability of the findings to rural or less tech-enabled areas. Additionally, the reliance on self-reported data could lead to response bias, as participants might have given socially desirable answers. Moreover, factors such as cultural differences and brand loyalty were not explored in depth.

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